PROJECT FILE

BRIDGE 34/B-T9
(BRIDGE STREET BRIDGE)

TOWNSHIP OF WILMOT

JANUARY 2022
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FILE NO. 20-145

K. SMART ASSOCIATES LIMITED
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PROJECT FILE

BRIDGE 34/B-T9
(BRIDGE STREET BRIDGE)

TOWNSHIP OF WILMOT

CONTENTS

1.

BACKGROUND, CATEGORY AND PROCESS OF THIS ENVIRONMENTAL ASSESSMENT

1.1 BACKGROUND

The Ontario Environmental Assessment Act (EA Act) is to provide for "*the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation and wise management in Ontario of the environment*" (Ontario Environmental Assessment Act, R.S.O 1990 Part I-Section 2). The EA Act further defines the "environment" as:

a) air, land or water;
b) plant and animal life, including human life;
c) the social, economic and cultural conditions that influence the life of humans or a community;
d) any building, structure, machine or other device or thing made by humans;
e) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities;
f) any part of combination of the foregoing and the interrelationships between any two or more of them

In applying the requirements of the EA Act to an undertaking (i.e. a project such as a road, bridge, etc.), the EA Act identifies two types of environmental assessment planning and approval processes:

- Individual Environmental Assessments
  Projects for which a Terms of Reference and an individual environmental assessment is carried out and submitted to the Minister of the Environment for review and approval.

- Class Environmental Assessments
  Projects which are approved subject to compliance with an approved class environmental assessment process with respect to a class of undertakings. Provided the approved process followed, a proponent has complied with the EA Act.

The Municipal Engineers Association (MEA) has produced a document titled "Municipal Class Environmental Assessment" which defines a five phase planning procedure that Municipalities (such as the Township of Wilmot) can use to plan, design, construct, operate, maintain, rehabilitate and retire the majority of infrastructure projects. The idea is to eliminate the need to seek individual approvals for every project a Municipality may undertake. The five phase planning procedure is as follows:

- Phase 1
  Identify the problem or opportunity

- Phase 2
  Identify, assess, and evaluate alternative solutions

- Phase 3
  Identify and evaluate alternative design concepts for the preferred solution

- Phase 4
  Prepare an Environmental Study Report

- Phase 5
  Implementation

As projects typically undertaken by municipalities vary in their environmental impact, the following types or schedules of projects have been defined. These schedules are as follows:

- Schedule A
  - May follow through to implementation without following the full Class EA planning process.
  - Activities include normal or emergency operational maintenance activities with minimal environmental impacts.

- Schedule A$^+$
  - The project has been previously approved and requires the public to be advised prior to project implementation.
  - Agency consultation may still be required.

- Schedule B
  - In general it includes improvements and minor expansions to existing facilities.
  - There is potential for some adverse environmental impacts.
  - The proponent is required to proceed through a screening process including public and agency consultation.

- Schedule C
  - Generally includes major expansions to existing facilities and construction of new facilities.
  - These projects proceed through the full municipal EA planning process.

Consultation is a major component of the EA process. Communication between the proponent and affected/interested stakeholders provides opportunities for the exchange of information and to allow those affected to influence decisions being made. As per Municipal Class Environmental Assessment, stakeholders include the general public, review agencies, other municipalities as well as First Nations and Aboriginal Peoples. The timing and quantity of consultation is also important, the following dictates the minimum level of consultation and with whom for Schedule A, A$^+$, B and C projects:

- Schedule A
  - No contact with the public, review agencies, other municipalities, First Nations and Aboriginal Peoples required.

- Schedule A$^+$
  - Formal advisory contact with the public required.

- Schedule B
  - Two points of contact with the public, review agencies, other municipalities, First Nations and Aboriginal Peoples required.

- Schedule C
  - Three points of contact with the public, review agencies, other municipalities, First Nations and Aboriginal Peoples required.

1.2 CATEGORY AND PROCESS OF THIS ENVIRONMENTAL ASSESSMENT

The potential works involved to reconstruct Bridge 34/B-T9 (Bridge Street Bridge), assuming the financial limit is $2.4 million, fall under a **Schedule B** project as per Item 25 - General Operation and Maintenance of Linear Paved Facilities and Related Facilities, Appendix 1 – Project Schedules of Municipal Class Environmental Assessment. Item 25 includes the reconstruction of a water crossing where the reconstructed facility will not be for the same purpose, use, capacity or at the same location (capacity refers to either hydraulic or road capacity).

As such, the following process will be used to satisfy the requirements of the EA Act.

- Phase 1
  - Identify the problem or opportunity
  - 1st point of mandatory public and agency consultation

- Phase 2
  - Identify possible alternative solutions
  - Evaluate alternatives and select a preferred alternative
  - 2nd point of mandatory public and agency consultation
  - Complete preliminary design
  - Complete Project File Report

- Phase 3
  - Not applicable for Schedule B projects

- Phase 4
  - Not applicable for Schedule B projects

- Phase 5
  - Complete detailed design (drawings, specifications and tender documents)
  - Proceed to construction and operation

2.

PROBLEM DEFINITION AND EXISTING CONDITIONS

2.1 PROBLEM DEFINITION

Bridge 34/B-T9 (Bridge Street Bridge) is an existing structure spanning the Nith River on Bridge Street between Tye Road and Puddicombe Road. The structure consists of a single-span one-lane steel truss bridge. The bridge was constructed in 1913± and is deficient in width and loading capacity in relation to current standards.

Given that the existing structure is deficient in terms of loading capacity and structure width, the Township of Wilmot is considering options to eliminate all deficiencies as well as to provide improved levels of traffic service and overall safety.

2.2 EXISTING CONDITIONS

Socio-Economic Environment

The study area is within the lower tier municipality of the Township of Wilmot in the Region of Waterloo. The immediate study area is comprised of a mixture of rural agricultural and rural residential properties. The surrounding area is rural agriculture. At the bridge site itself, people are known to fish in the river as well operate paddled vessels in the river. Noise and vibration is minimal because of the very low traffic counts on Bridge Street Bridge. Air quality can be said to be very good for the very same reason. This site could be considered "picturesque" because the river and associated flood plain is clearly visible from the roadway and the fact the crossing consists of a steel truss bridge.

Adjacent Landowners

There are seven (7) adjacent landowners located in the vicinity of the study area. Potential impacts to these residents include property acquisition, loss of access, delayed access to emergency services (when the bridge is closed), etc. Additional impacts to abutting property owners could be property acquisition.

Official Plans and Policies

Reference is made to the Township of Wilmot's Official Plan. The following is noted:

- The Official Plan sets out the land use policy directions for the Township's long-term growth and development;

- The Official Plan establishes the direction for development initiated by both the public and private sectors;

- The Township of Wilmot is one of seven Area Municipalities that comprise the Regional Municipality of Waterloo;

- While predominantly rural in character, the Township's 26,590 hectares also embrace a variety of urban communities, including the Baden and New Hamburg Urban Areas and twelve Rural Settlement Areas located throughout the surrounding Countryside.

- A few highlights of the Official Plan's goals are described below.

    - **Environment**:
      To maintain, enhance or wherever feasible restore the quality of the environment and the long-term health of the ecosystems represented in the Township while providing for the changing needs of the population. All other goals should attempt to satisfy the requirements of the environmental goal so as to improve the quality of life for residents.

    - **Transportation**:
      To promote the continued development and coordination of an integrated transportation network that is safe, efficient, environmentally sensitive, and which balances the needs of cyclists, pedestrians, motor vehicles and rail users.

    - **Services**:
      To provide and maintain a high level of municipal services for the various areas of the Township in accordance with economic, social, and environmental considerations.

  - **Cultural Heritage Resources**:
    To protect, conserve or wherever feasible, rehabilitate and/or reuse the cultural heritage resources of the township.

  - **Energy Conservation, Air Quality and Climate Change:**
    To promote land use and development patterns that support energy conservation and efficiency, and support actions that improve air quality, reduce greenhouse gas emissions and provide for adaptations to a changing climate, including through increasing resiliency.

- In terms of the Planned Township Structure, Bridge 34/B-T9 falls within the Countryside's Prime Agricultural area.

- The Township's Countryside is comprised of a diverse range of valuable natural resources, including agricultural lands, woodlands, mineral aggregate resources and groundwater recharge areas. The policies of this Plan seek to maintain and wisely maintain these valuable natural resources for both future and current generations.

- The Township's Countryside also supports a variety of privately owned and operated recreation and tourism uses, including campgrounds, trailer parks, golf courses and other activities. These uses provide significant economic benefits and offer recreational and tourism opportunities for both visitors and residents of the Township.

- The primary land uses permitted in the Prime Agricultural designation will be agricultural uses, agriculture-related uses and on-farm diversified uses. Within this area, all types, sizes and intensities of agricultural uses and normal farm practices will be promoted and protected in accordance with province standards.

- Council may pass a by-law to designate part of, or the entire township, as a Community Improvement Project Area in accordance with Section 28 of the Planning Act. Within a designated Community Improvement Project Area, Council may prepare and adopt a Community Improvement Plan to promote maintenance, rehabilitation, revitalization, remediation and/or conservation of selected lands, buildings and/or communities. Council will consider the characteristics of an area to be designated for community improvement. One of the characteristics of a Community Improvement Project Area is "A significant deterioration of infrastructure."

- The Township will plan and manage its road system to accommodate agricultural vehicles and equipment, as appropriate, and to provide for the safety of the Township road system's users.

- The Township will develop and maintain an on-going program of maintenance and improvement of the Township Road System taking into consideration both the function of the roadway and its impact on the surrounding environment.

- Bridge 34/B-T9 does not fall into any of the areas designated as a Mineral Aggregate Resource.

- Bridge 34/B-T9 falls into the Greenlands Network area designation, containing Core Environmental Features.

- Site alteration will be prohibited on lands where elements of the Greenland Network have not been adequately identified and evaluated through a watershed planning study or any other appropriate natural heritage review.

- Site Alteration will not be permitted within Core Environmental Features, except for infrastructure projects in accordance with the policies of the Regional Official Plan.

    - In accordance with Section 27 of the Planning Act, the Township's Official Plan must conform with the Regional Official Plan, however, the policies in this Official Plan may be more restrictive on the same subject, but may not be more permissive than the policy direction established by the Regional Official Plan.

- Site alteration will require the submission of an Environmental Impact Statement, to the satisfaction of the Township, the Region, the Grand River Conservation Authority and/or the Province as appropriate, to determine the mitigation measures to be implemented, as appropriate, through the development review process.

- Any requirements imposed through watershed planning studies, Environmental Impact Statements and other appropriate studies must be implemented by the proponent to the satisfaction of the Federal Ministry of Fisheries and Oceans or its delegate.

- The Township will require detailed hydrogeological and/or geotechnical studies to assess potential risks to persons, buildings, structures, or public infrastructure occasioned by groundwater discharge or high water tables prior to development. Such studies should demonstrate that engineering solutions designed to protect structures from the effects of groundwater discharge and high water tables will be effective, will not require significant on-going maintenance to remain effective, and will not divert or impede natural groundwater flows so as to create hazards or annoyances to adjacent lands and buildings.

- The Township recognizes the importance of cultural heritage resources to foster a sense of place and benefit the community.

- Cultural Heritage Impact Assessment will be required by the Township for any proposed development or site alteration that includes or is contiguous to a property designated under the Ontario Heritage Act or that includes a non-designated cultural heritage resource that is identified in the Heritage Registry.

- During the review of development applications and/or site plans, the Township and/or the Region will require the applicant to submit an archaeological assessment conducted by a licensed archaeologist in accordance with the provisions of the Regional Archaeological Implementation Guideline following the Ministry of Tourism, Culture and Sport Standards and Guidelines, to the satisfaction of the Province, where archaeological resources and/or areas of archaeological potential have been identified in the Region's Archaeological Master Plan.

- The Township will provide opportunities for public, agency and stakeholder input as stated in the Official Plan and during any planning process where the Township seeks public involvement.

Climate Change

Based on the scale and nature of this study, a qualitative approach was undertaken when assessing effects on and from climate change.

It can be said that the existing bridge, in its current configuration, contributes to climate change due to its frequent closures (vehicles need to detour around the site instead of crossing the bridge) and its inability to handle large vehicles (again, needing to detour around the site instead of crossing the bridge). Notwithstanding these issues, the existing bridge requires frequent repairs. This further contributes to climate change as workers routinely need to travel to the bridge to complete these repairs. If significant repairs were made to the structure, positive steps in reducing climate change would be made.

With respect to considering impacts resulting from climate change into the project, this will be addressed by means of appropriately sizing the structure hydraulically should replacement be deemed the preferred alternative. As part of the process to determine flow rates to size a replacement structure, the Single Station Frequency Analysis Method will be used. This flow estimation method relies heavily on historical records including records from the last few years; this takes into account large rainfall events that seem to be more prevalent as of late.

Source Water Protection

An online policy mapping tool (https://maps.grandriver.ca/swp-policymapping/) was utilized and Ontario Regulation 287/07 (under the Clean Water Act, 2006) was reviewed to determine whether this project is located in a vulnerable area and whether any project activities are a prescribed drinking water threat. The following is noted:

- Bridge 34/B-T9 is not located within a vulnerable area;
- Reconstruction of a bridge is not an activity identified as a “prescribed drinking water threat”;
- Some aspects of the work, such as refueling of equipment and dewatering, are activities identified as a “prescribed drinking water threat”, however any potential threats can be easily mitigated using best management practices described elsewhere in this Report.

Vehicular Traffic

Based on a Traffic Study conducted in 2018, the Average Annual Daily Traffic (AADT) for Bridge Street Bridge is estimated to be 816. The aforementioned AADT did not include truck traffic due to the bridge being load posted. After the construction of a new bridge, 10% of traffic is anticipated to consist of trucks. It is expected the AADT will increase 2% every year.

Waterway Traffic

The waterway at the crossing can be used for casual recreational purposes by paddled vessels.
A new bridge should provide a vertical navigational clearance at least equivalent to the old bridge. In addition, adequate signage should be installed upstream and downstream of the new crossing to warn boaters of the construction. Furthermore, the construction needs to be staged such that there are minimal obstacles placed near or in the water which might hinder movement of waterway traffic. Any such obstacles need to be marked with navigational signage.

First Nations/Aboriginal Peoples

As part of the Crown’s legal duty to consult, The Township of Wilmot was instructed by Infrastructure Canada (INFC) and Ministry of the Environment, Conservation and Parks (MECP) to contact the following Aboriginal communities:

- Haudenosaunee Confederacy Chiefs Council;
- Mississaugas of the Credit First Nation (MCFN);

- Six Nations of the Grand River (SNGR);

In addition to contacting the above, the Township also opted to contact:
- Métis Nation of Ontario

The land in which this project is situated is part of the '*Between the Lakes Treaty No. 3 (1792)*', a treaty which the Crown and MCFN entered into in 1792. As a result, MCFN expressed interest in this project. MCFN's Department of Consultation and Accommodation (DOCA) deployed their Field Liaison Representative (FLR) to monitor the Environmental and Archaeological field investigations and reviewed the subsequent reports. This stems from MCFN's stewardship responsibility over their Territory and the fact that their Aboriginal and treaty rights fundamentally entitle them to preserve their culture and heritage including archaeological materials and human remains.

Similarly, SNGR Elected Council (SNGREC) deployed their Monitor to ensure no indigenous archaeological potential was overlooked during the Archaeological field investigations and reviewed the subsequent reports.

During this process, the Township of Wilmot maintained full contact and cooperation with the above-mentioned First Nations groups and actively consulted with them.

Utilities

The following is in regards to the presence of utilities in the area:

- Gas:
  On October 14, 2020, G-Tel Engineering confirmed there are no Enbridge (formerly Union Gas) facilities in the project area.

- Hydro:
  Hydro is present overhead throughout the study area. The overhead lines are on the south side of Bridge Street.

- Bell:
  On October 29, 2020, Bell indicated two (2) existing buried cables, each starting at roughly 100m± from each end of the bridge and running to the direction opposite of the bridge. In other words, there are no buried cables within approximately 100m± of the bridge.

Based on the above, it is suspected that there will not be any conflicts arising from the proximity of any potential construction activities and existing utilities.

Cultural Heritage Environment

Cultural heritage resources include built heritage resources, cultural heritage landscapes and archaeological resources.

- Built Heritage Resources and Cultural Heritage Landscapes
  As part of this EA Study, a Cultural Heritage Evaluation Report (CHER) and Heritage Impact Assessment (HIA) were completed by CHC Limited for Bridge 34/B-T9 dated November 2021 (See Section 6).

  The bridge was found to be of cultural heritage value or interest (CHVI). Therefore, a Heritage Impact Assessment of the bridge was completed to assess the impacts of the structure's proposed replacement and recommend appropriate mitigation measures.

- <u>Archaeological Resources</u>
  Following the completion of the Municipal Heritage Bridges: Cultural, Heritage & Archaeological Resources Assessment Checklist, a Stage 1 and Stage 2 Archaeological Assessment (under Project Information Form (PIF) number P462-0036-2020) were completed by Detritus Consulting Ltd. (See Section 7). The archaeological recommendations have been made based on background historic research, property inspection, and indicators of archaeological potential as outlined in the Ministry of Heritage, Sport, Tourism and Culture Industries "2011 Standards and Guidelines for Consultant Archaeologists". Its purpose is to identify areas of archaeological potential and further archaeological assessment (e.g., Stage 3 and 4) as necessary.

  The Stage 1 background research indicated that the overgrown grass, scrub, and woodlot components of the Study Area exhibited moderate to high potential for the identification and recovery of archaeological resources and were recommended for Stage 2 archaeological assessment (Figure 3 in Section 7). The existing asphalt road with gravel shoulders and embankments, the gravel driveways, and field entrances were evaluated as having no potential based on the identification of extensive and deep land alteration that has severely damaged the integrity of archaeological resources, as per Section 2.1, Standard 2b of the Standards and Guidelines (Government of Ontario 2011). These areas of disturbance, as confirmed during the Stage 2 field survey, were mapped and photo documented in accordance with Section 2.1, Standard 6 and Section 7.8.1, Standard 1b of the Standards and Guidelines (Government of Ontario 2011).

  A portion of the Nith River is present within the Study Area. This area was evaluated as being permanently wet and therefore was determined to retain no potential, as per Section 2.1, Standard 2a of the Standards and Guidelines (Government of Ontario 2011). Additionally, a portion of the woodlots on either side of the Nith River, both north and south of the road, were steeply sloped. These areas were determined to retain no archaeological potential due to the identification of a physical feature of low archaeological potential, in this case a slope of greater than 20°, as per Section 2.1, Standard 2aiii of the Standards and Guidelines (Government of Ontario 2011). The permanently wet and steeply sloped areas, as confirmed during the Stage 2 field survey, were mapped and photo documented in accordance with Section 2.1, Standard 6 and Section 7.8.1, Standard 1a of the Standards and Guidelines (Government of Ontario 2011).

  The subsequent Stage 2 assessment was conducted between October 13, 2020 and October 20, 2021. This investigation consisted of a standard test pit survey at a 5m interval of the overgrown grass, scrub, and woodlot components of the Study Area. Furthermore, test pits in the southwestern portion of the Study Area were excavated to a depth of 120 centimetres ('cm') and proved to be disturbed with the presence of construction aggregates within the test pits, however, the subsoil was not able to be reached by means of hand excavation. Therefore, in consultation with Six Nations and MCFN, it was agreed that a mechanical excavator would be used to remove the disturbed overburden to the depth of 150cm for a maximum of a 10m interval and that excavation would cease when the topsoil or subsoil was reached. If the topsoil was found, then the interval would be increased to 5m and typical test pits would be excavated. In total, six test pits were mechanically excavated, to a maximum depth of 180cm, using a Bobcat E32 excavator with a straight edge ditching bucket. Disturbance in the form of mixed layers of construction aggregates as well as alluvial/fluvial sediments was observed in the profile of each mechanically excavated test pit. No evidence of intact topsoil or subsoil was observed. The Stage 2 assessment resulted in the identification and documentation of no archaeological resources. Therefore, no additional investigation is recommended for the Study Area.

The above highlights key points from the archaeological assessment report only; for complete information and findings, the reader should examine the complete report in Section 7.

Natural Environment

As part of this EA Study, a Scoped Environmental Screening Report was completed and can be found in the applicable section of this report.

The demolition of the existing structure and construction of the new structure should commence in Fall 2022, and by start of Winter 2023, in-water work should be completed and construction will then halt. The remainder of the work should resume in Spring 2023.

Hydrology/Hydraulics

As part of this EA Study, a Hydrology Report was completed and can be found in the applicable section of this Report.

The conclusion of this study was that the new structure has sufficient hydrology/hydraulic capacity.

Geotechnical

As part of this EA Study, a Geotechnical Investigation was completed and can be found in the applicable section of this Report.

Based on this report, the proposed structure will be founded on driven steel piles.

STRUCTURAL EVALUATION REPORT

FOR

BRIDGE NO. 15/B-NH
BRIDGE NO. 34/B-T9
BRIDGE NO. 37/B-OXF

Prepared For:

THE CORPORATION OF THE TOWNSHIP OF WILMOT

by

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FEBRUARY 2018

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February 2018

File No. 17-188

STRUCTURAL EVALUATION REPORT

FOR

BRIDGE NO. 15/B-NH
BRIDGE NO. 34/B-T9
BRIDGE NO. 37/B-OXF

TOWNSHIP OF WILMOT

1.0 INTRODUCTION

K. Smart Associates Limited (KSA) was retained by the Township of Wilmot to inspect, complete a structural analysis and provide recommendations for gross weight limits on each of the following bridges:

Bridge No. 15/B-NH located on Shade Street
Bridge No. 34/B-T9 located on Bridge Street
Bridge No. 37/B-OXF located on the Oxford-Waterloo Road

A visual inspection and examination of the four structures was carried out on September 26, 2017 and October 3, 2017 by Trevor Hoard, CET and Darryl Schwartzentruber, C.Tech.

The visual inspection was performed in accordance with the Ontario Structure Inspection Manual (OSIM) and included measurements of all structure members and a recording of all visual deterioration. For details of the visual inspection, refer to the OSIM Report.

The structural evaluation was made in accordance with Section 14 of the Canadian Highway Bridge Design Code 2014.

2.0 EVALUATION METHODOLOGY

The evaluator normally has access to original design drawings to obtain actual member sizes, connection details and specified steel strengths, however no drawings for this structure are available. This requires that individual members be measured in the field and records taken so that either a common section size can be assigned to the member or so that any required section properties can be calculated.

The ultimate limit state will be used in the determination of the load-carrying capacity and load posting of the bridges as outlined in the Canadian Highway Bridge Design Code 2014, Section 14.

The resistance of any member is based on the field measured cross-section less loss of material (5% min. unless otherwise stated) to allow for corrosion and deterioration.

The properties of the original existing materials are not known. Reference is made to Section 14 of the Canadian Highway Bridge Design Code 2014 to establish the grade of steel according to its vintage.

To keep the analysis simple, the structure was modeled assuming truss behavior of the superstructure i.e. only axial forces in each truss member. This is a valid assumption considering the structure was most likely designed as a truss given the date of construction and lack of modern analysis programs. When resistances of individual members were calculated, it was assumed that pin ended connections were present (k=1). It was soon evident that this assumption was not suitable for some members of the truss because unrealistic member resistances were found. As a result, different end conditions (partial fixidity, k=0.8) were assumed for these members and this resulted in satisfactory results. This is summarized in detail later in the report.

Three levels of Ontario truck or lane loading will be used in the load rating and posting of the structures.

This evaluation refers to the capacity of the superstructure only. Section 14 Evaluation does not make reference to the evaluation of the substructure.

The following drawings were made available by the Township of Wilmot:

a) Rehabilitation drawing for Bridge 15/B-NH - 2010
b) Rehabilitation drawing for Bridge 34/B-T9 – 1982 & 2010
c) Rehabilitation drawing for Bridge 37/B-OXF – 1990 & 2014

3.0 EVALUATION

3.1 General

Type of Structure:	Single span steel through truss
Material:	Steel and concrete or timber deck
Highway Classification:	Class C
Deck Finish:	Concrete
Number of Design lanes:	2 for Bridge No. 15/B-NH, 1 for rest
Design Criteria:	Canadian Highway Bridge Design Code 2014

3.2 Material Strengths

Original construction drawings are either not available or grade of materials are not called for. Reference is made to Section 14 of CHBDC.

Steel

Bridge No. 15/B-NH	Bridges No. 34 & 37
Fy = 230 MPa	Fy = 210 MPa
Fu = 420 MPa	Fu = 420 MPa
(for 1933 to 1975 vintage)	(for 1905 - 1932 vintage)

3.3 Dimensions, Thicknesses, Etc.

Sectional dimensions of all structural members were measured in the field. A reduction for deterioration and loss of materials was used in the analysis.

3.4 Analysis

The trusses are analyzed on the assumption that their members are interconnected through pin connections. The maximum axial load in each truss member was computed using Dr. Frame 2.0.2 software. The bending moments and shears in the floor beams and stringers were calculated from first principles (hand calculations) and verified using Dr. Beam software.

3.5 Evaluation Load Factor

The Canadian Highway Bridge Design Code 2014 relates the evaluation load factor to target reliability index of the structure.

3.6 Target Reliability Factor

"The life safety criterion that forms the basis for the reliability indices considers only loss of life resulting directly from the failure of the structure."

The philosophy behind the evaluation of existing bridges is to maintain a consistent level of risk to human life for each element of the bridge. The failure of bridge elements which receive regular inspection, show warning of failure and can redistribute load to other elements are less likely to result in loss of life than the failure of an element lacking one or all of these traits. Therefore, a consistent level of risk to human life is maintained, through the entire structure if a higher probability of failure is accepted in elements which are less likely to produce a loss of life if failure occurs." (CHBDC Commentary)

The risk to human life can be expressed as the probability of failure times the consequences of failure. For bridge evaluation, the annual (or notional) probability of failure (P_f) is used for the determination of a reliability index.

$$P_f = \frac{A\,k}{w\,\sqrt{n}}$$

For normal traffic evaluation

$A = 3.0$
$k = 10^{-4}$
$w = 1.0$ for no warning of failure expected
$n = 10$

$$P_f = \frac{3 \times 10^{-4}}{1 \ \sqrt{10}} = 9.5 \times 10^{-5}$$

This notional probability is then reduced in a systematic way to account for improved warning of failure which comes from the following:

a) System Behaviour
The target reliability index is reduced as the effect of failure of an element on the overall integrity of the structure is reduced.

b) Element Behaviour
The target reliability index is reduced for elements which fail in a ductile manner.

c) Inspection Level
The target reliability index is reduced as the level of inspection increases.

3.7 Determination of Load Factor and Dynamic Load Allowance (DLA)

The following table shows the Target Reliability Index (β), Load Factor (∝) and DLA.

		CATEGORY	
	Stringer	Floor Beam	Trusses
System Behaviour	S3	S2	S2
Element Behaviour	E3	E3	E2
Inspection Level	INSP3	INSP3	INSP3
β	2.50	2.75	3.00
∝D	1.05 & 1.10	1.10	1.07
∝L	1.35	1.42	1.49
DLA	1.30	1.30	1.25 or 1.3*

Reference is made to Section 14.11 of the CHBDC 2014.
* *Depending on number of axles. See CHBDC 2014.*

3.8 Live Load Capacity Factor (LLCF)

Live load capacity factor is a factor of the residual loading capacity of the element under consideration.

The CHBDC commentary describes the LLCF as follows:
"The live load capacity factor, F, is the factor by which the evaluation live load has to be multiplied so that the factored capacity of the bridge is not exceeded for the continuation of permanent and live loads under consideration."

For the bridge to carry full loading, i.e. no post load limit, the LLCF must not be less than 1.0. When the LLCF is less than 1.0, posting load limits on the bridge would be recommended. When the LLCF is less than 0.3, closing the bridge to vehicular traffic is recommended.

5.0 BRIDGE NO. 34/B-T9 – BRIDGE STREET

5.1 Description of Structure

The bridge is located on Bridge Street (Township Road 9) over the Nith River and is approximately 0.45 km east of Tye Road (Township Road 13). The bridge was constructed in 1913.

The structure consists of a 45.7m single span steel through truss with an exposed concrete deck road surface. The overall deck width at the bridge is 4.1m for one lane of traffic. The railing is a steel lattice type.

The structure underwent several rehabilitations since 1982. The 1982 rehabilitation included repairs to the abutments and the placement of new concrete deck. In 2006 and 2011 rehabilitation included the repairs of all floor beams, placement of new stringers on the outer edges and repairs to the truss bottom chords at the four ends.

The structure is posted for 11 t loading.

5.2 Field Findings

.1 Superstructure

Deck

- Concrete deck top has an exposed wearing surface and is in good condition with a few narrow transverse cracks in various locations, the deck is severely scoured approximately 1m wide down the middle.
- Steel corrugated deck forms present on underside except at east and west truss panels (good condition); severe rust staining typically evident on exterior edges of steel forms.

Trusses

- Bottom chords typically exhibit medium-to-severe rust with accumulation of debris and gravel. Bottom chords at ends were repaired in 2011.
- Top chords typically shows light to medium rusting. Southwest end diagonal member is severely corroded with loss of material and perforations over 50% of one web for 1.8m. Small perforations at bottom of southeast and northeast main truss diagonals. Northwest end diagonal severely corroded with loss of material and perforations for 2.7m. End diagonal/top chord has numerous perforations near bearing.
- End diagonals exhibit severe corrosion with loss of material and perforations over 50% of inside channel web.
- Connections generally in poor condition with medium to severe rusting of structural steel plates. Perforated stiffener plate between build-up channel of the west portal frame at all bearing locations. Bottom chord connection plates at eight locations are completely deteriorated with the remaining bottom connections in very poor condition due to severe loss of rivet material.
- First vertical chord from west at north side twisted at bottom

Joints

- Open gap joint at east and west abutment ends, abrasion marks from snowplow on joint steel. Uneven joint at northeast corner of structure

Beams

- All floor beams are severely rusted with perforations and loss of material. Remainder of floor beams exhibit medium to severe rusting with section loss. The severe corrosion at the ends of all beams were repaired in 2005 and 2011.
- Exterior stringers are severely rusted with perforations and loss of material. One outside stringer web has completely disintegrated at end for a distance of 600mm ± (2nd from east at south side). New stringers were placed next to the outside stringers (sistered) in 2011.
- Inside stringers exhibit medium surface rust.

Bracing

- Underside bracing typically severely rusted, perforation holes occur at some of the connections to the bottom truss chords. Three (3) bracings were replaced in 2005.
- End overhead portal bracing is severely damaged due to impact.

Barriers

- Steel lattice type railing is generally in poor condition with bent top and bottom rails, medium rusting, missing rivets, broken, bent and twisted lattice and numerous perforations in bottom rail.
- All end post at bridge corners are severely rusted and disconnected at bottom leaving rails unsupported at the end sections. The railing is generally in poor condition.

.2 *Substructure*

Abutments

- East and west abutments are in poor condition. Previous concrete patch repair (1982) has now mostly delaminated and spalled off exposing severe deterioration on original abutment (60% and 30% of total exposed areas delaminated on west and east abutments respectively). Concrete is missing at northeast corner under bearing.
- Debris accumulated on bearing location at all corners.
- East abutment roller bearing exhibits severe rust and has seized.

Wingwalls

- All wingwalls are in poor condition.

5.3 Summary of Structural Evaluation

CONCRETE DECK

As per Clause 14.14.1.3.1, the concrete deck is assumed to carry full vehicular loading since no structural cracking or punching failures were observed and all requirements surrounding the use of the empirical design method are satisfied. New reinforced concrete deck was placed in 1982.

DECK FRAMING

a) BENDING

					Load Capacity (t)		
Member	MDL	MLL	Mr	LLCF	Level 1	Level 2	Level 3
Floor Beam	94.0	286.0	273.0	0.46	27	20	11
Stringers	20.0	105.0	122.0	0.73	45	32	18

b) SHEAR

					Load Capacity (t)		
Member	SDL	SLL	Sr	LLCF	Level 1	Level 2	Level 3
Floor Beam	76.0	244.0	778.0	2.17	NPR	NPR	NPR
Stringers	14.0	74.0	296.0	2.89	NPR	NPR	NPR

Moments are in kN·m
Shears are in kN
NPR - No posting required
Dead and live loads are factored.
Ø = 0.95
U = 1.00
DLA = 0.25

TRUSSES

					Load Capacity (t)		
Member	DL-kn	LL-kn	R-kn	LLCF	Level 1	Level 2	Level 3
Top Chord							
U1U2	+438	+745	+1383	1.08	NPR	NPR	NPR
U2U3	+498	+833	+1383	0.91	56	40	22
U3U4	+519	+852	+1388	0.87	53	38	21
Bottom Chord							
L1L3	-285	-483	-720	0.84	52	37	20
L3L4	-434	-739	-1124	0.87	53	38	21
L4L5	-504	-828	-1124	0.69	42	31	17
Diags.							
L1U1	+413	+700	+1025	0.74	45	32	18
U1L3	-216	-444	-578	0.76	46	34	19
U2L4	-94	-310	-315	0.67	42	30	16
U3L5	-39	-305	-245	0.64	40	28	15
Verticals							
U1L2	-86	-305	-352	0.82	52	36	20
U2L3	+71	+249	+570	1.78	NPR	NPR	NPR
U3L4	-25	+169	+570	3.19	NPR	NPR	NPR
U4L5	0	-119	-570	4.30	NPR	NPR	NPR

\+ Compression
\- Tension
NPR - No posting required
Dead loads (DL) and live loads (LL) are factored
Live load includes DLA
See Drawing 3 (***Appendix A***) for joint identification and locations

5.4 Evaluation Findings and Recommendations

The evaluation analysis has indicated that the structure is not adequate to support full Ontario Highway Truck Loading. The loading capacity is limited by the continuous deterioration and loss of material in the floor beams (even after 2010 temporary repairs).

The bridge may be posted as follows:

a) Single posting - 11 t

b) Triple posting
  - 11 t single truck
  - 20 t single truck and trailer
  - 27 t single truck and more than one trailer

c) Axial weights posting
- 4 t single
- 8 t tandem
- 11 t tridem

It is recommended that this bridge remain posted for a single posting of 11 tonnes (maximum).

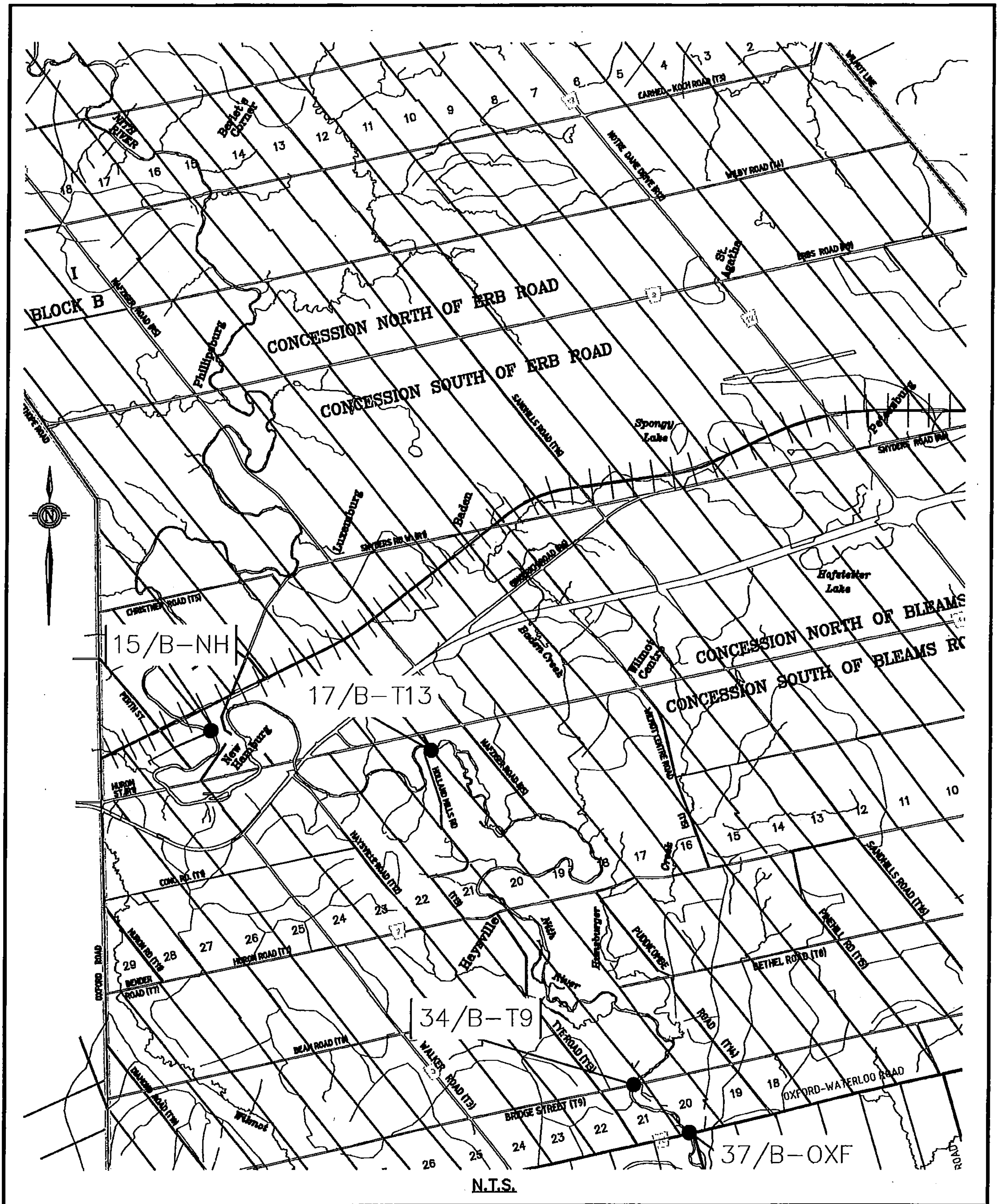
APPENDIX A

KEYPLAN – LOCATION OF STRUCTURES

DRAWING 1 – BRIDGE NO. 15/B-NH

DRAWING 2 – BRIDGE NO. 34/B-T9

DRAWING 3 – BRIDGE NO. 37/B-OXF



K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER NEW LISKEARD SUDBURY RAINY RIVER

KEY PLAN

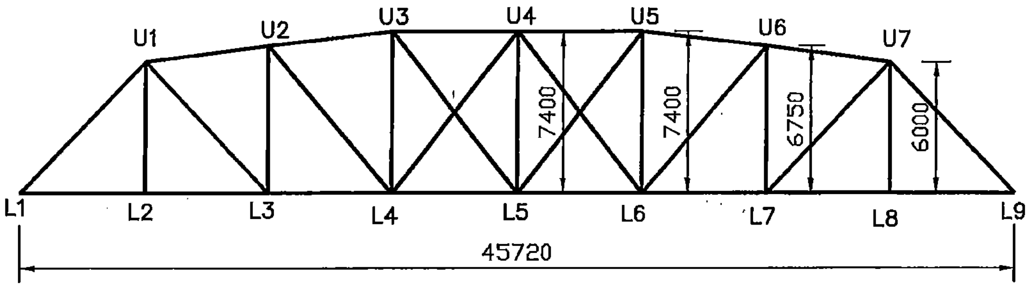
TOWNSHIP OF WILMOT
REGION OF WATERLOO

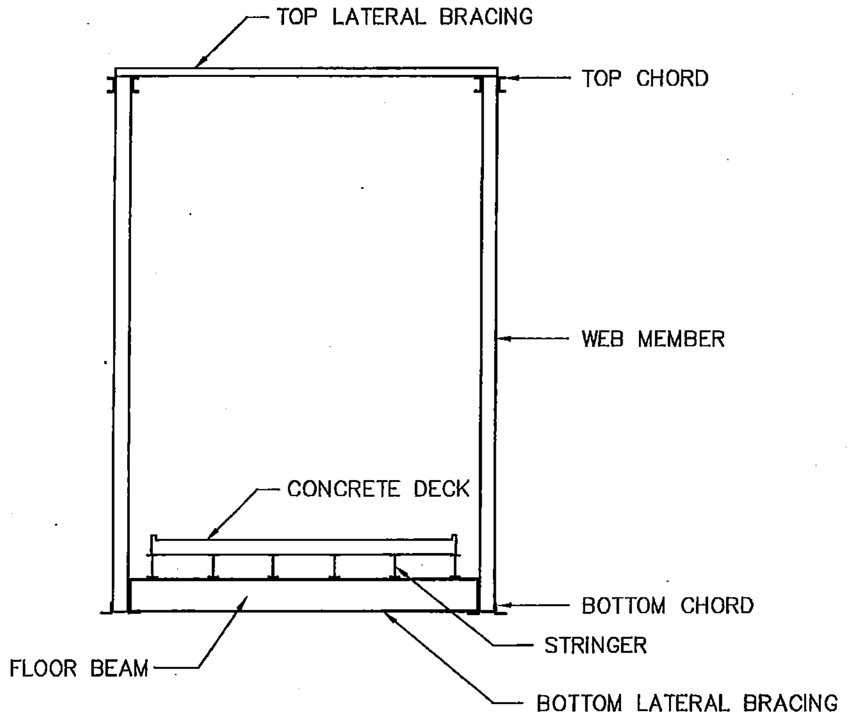
JOB NUMBER
15-102

SEPT 2015

FIGURE
1

\\server\data\2015\15-102\Drafting\KEY MAP FOR STRUCTURE EVALUATION REPORT.dwg KEY PLAN 11-Sep-15 11:12:54 AM





TYPICAL CROSS-SECTION

- EXTERIOR STRINGERS SISTERED WITH NEW STRINGERS IN 2011
- FLOOR BEAM "ENDS" AND 1 ENTIRE FLOOR BEAM REPAIRED IN 2011
- END DIAGONAL MEMBER OF TRUSS HAS SEVERE COROSION THROUGH WEB WITH OVER 50% OF MATERIAL LOSS.

DRAWING 3

BRIDGE NO. 34/B-T9
TOWNSHIP OF WILMOT

J:\05-045\Wilmot Bridges Sketch 05-045.dwg 10/21/2005 09:24:53 AM EDT

3.

EXTERNAL CONSULTATION

3.1 List of Agencies/Communities/Groups/Organizations/Properties Contacted

3.2 Notice of Study Commencement

3.3 Virtual Public Information Centre (PIC)

3.4 Notice of Study Completion

3.5 Consultation Logs

3.1 LIST OF AGENCIES / COMMUNITIES / GROUPS / ORGANIZATIONS / PROPERTIES CONTACTED

The following list identifies the agencies, communities, groups, organizations, and properties that were contacted throughout the various stages of the Environmental Assessment process

- *Township of Wilmot
- Ministry of Environment and Climate Change Canada
- Ministry of Natural Resources and Forestry
- *Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI)
- Ontario Ministry of Agriculture Food and Rural Affaris
- *Ontario Ministry of Environment, Conservation & Parks
- Transport Canada
- *Grand River Conservation Authority (GRCA)
- Department of Fisheries and Oceans Canada (DFO)
- Region of Waterloo, Planning, Development and Legislative Services
- *Heritage Wilmot Advisory Committee
- Waterloo Catholic District School Board
- Waterloo Region District School Board
- Haudenosaunee Confederacy
- Métis Nation of Ontario, Regional Consultation Committee
- *Mississaugas of the Credit First Nation, Department of Consultation & Accommodation
- *Six Nations of the Grand River Elected Council
- Bell Canada
- Enbridge Gas
- Kitchener Wilmot Hydro Inc.
- Rogers
- *Infrastructure Canada
- *3302 Bridge St
- 3303 Bridge St
- 3245 Bridge St
- Property located at northeast of the existing Bridge St Bridge – Lot 20, Concession 3, with Property Identification Number (PIN) 22204-0082(LT)
- *Waterloo Region Nature

(*) Indicates additional correspondence occurred beyond submission of the Notice of Study Commencement. Copies of this correspondence is not included within this Report, but can be provided upon request.

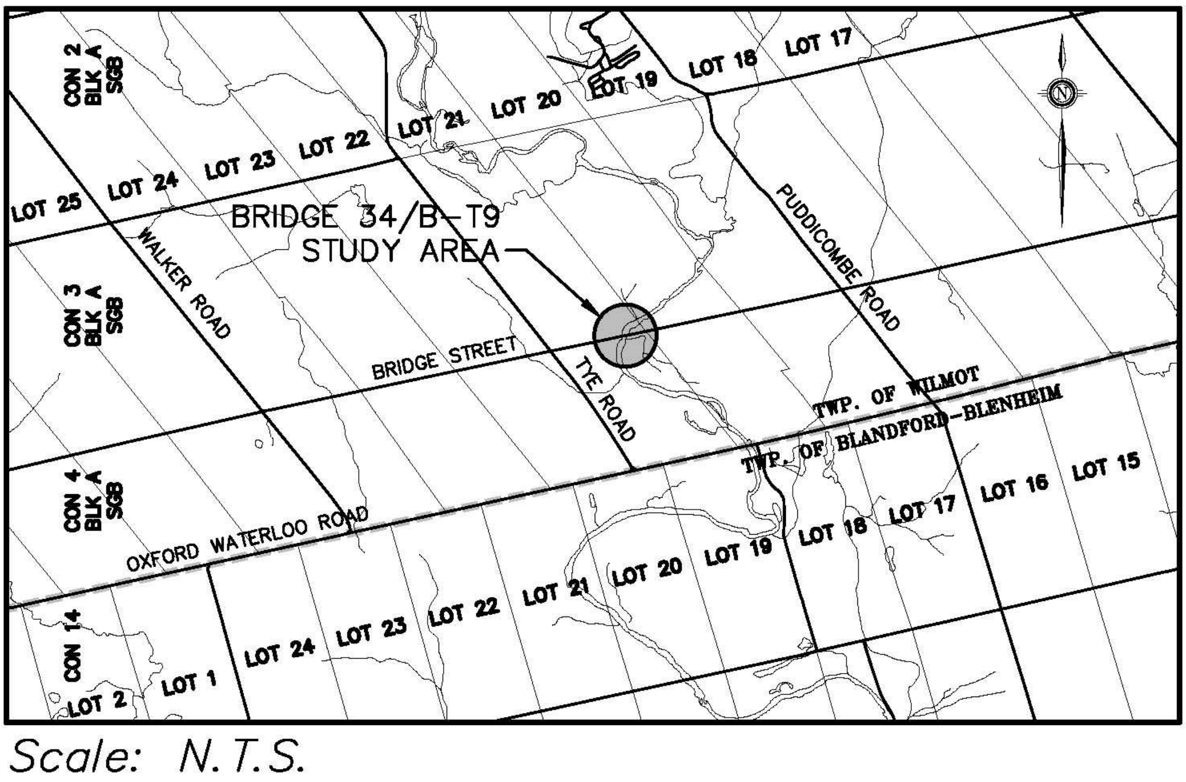
Correspondence logs can be found in Section 3.5

3.2 NOTICE OF STUDY COMMENCEMENT

The following Notice of Study Commencement appeared in the Wednesday, August 12, 2020 and Wednesday, August 19, 2020 editions of the New Hamburg Independent. This same notice also appeared on Township of Wilmot's webpage and social media outlets.

NOTICE OF STUDY COMMENCEMENT
TOWNSHIP OF WILMOT
CLASS ENVIRONMENTAL ASSESSMENT
BRIDGE 34/B-T9 (BRIDGE STREET BRIDGE)
BRIDGE STREET AT THE NITH RIVER

The Township of Wilmot has initiated a Municipal Class Environmental Assessment (EA) Study to assess the need to rehabilitate or replace Bridge 34/B-T9, Bridge St. Bridge, which is located in the Township of Wilmot (please refer to Study Area map). The Study will review existing conditions and provide recommendations related to the rehabilitation or replacement of the existing bridge structure based on current bridge and highway standards in order to achieve an enhanced level of service for vehicles and pedestrians and overall increased safety.



This Study is being undertaken in accordance with the planning and design process for Schedule B projects, as outlined in the Municipal Class Environmental Assessment document (October 2000, as amended in 2007, 2011 and 2015), which is an approved process under the Ontario Environmental Assessment Act.

Public input and comments are invited and may be incorporated into the planning and design of this project. Subject to comments received and receipt of necessary approvals, the Township of Wilmot intends to proceed with the planning, design and construction of this project to be completed by late 2022.

If you would like more information on the Study or wish to be added to the project mailing list, please contact:

Mr. Allan Garnham, P. Eng.
Project Manager
K. Smart Associates Limited
85 McIntyre Drive
Kitchener ON N2R 1H6
Phone: 519-748-1199 ext. 246
E-mail: agarnham@ksmart.ca

or

Mr. Mark Jeffery C.E.T.
Senior Engineering Technologist
Township of Wilmot
60 Snyder's Road West
Baden ON N3A 1A1
Phone: 519-634-8444
E-mail: mjeffery@wilmot.ca

All comments and information received from individuals, stakeholder groups and agencies regarding this project are being collected under the authority of the "Municipal Act" to assist the Township of Wilmot in making a decision. Information will be collected in accordance with the Freedom of Information and Protection of Privacy Act. With the exception of personal information, all comments will become part of the public record.

This Notice issued August 12, 2020.

3.3 VIRTUAL PUBLIC INFORMATION CENTRE

The following Notice of Virtual Public Information Centre (PIC) appeared in Township of Wilmot’s webpage on October 18, 2021 and on their social media outlets. This notice was also sent to those identified in Section 3.1.

The materials that were provided at the Virtual Public Information Centre on Township of Wilmot’s webpage follow the above-mentioned notice.

TOWNSHIP OF WILMOT

MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

BRIDGE 34/B-T9 (BRIDGE STREET BRIDGE)

BRIDGE STREET AT NITH RIVER

NOTICE OF VIRTUAL PUBLIC INFORMATION CENTRE (PIC)

The Township of Wilmot is studying the structural and physical deficiencies associated with Bridge 34/B-T9. In order to eliminate most deficiencies and provide improved levels of traffic service and overall safety, the Township is considering complete replacement of the existing structure.

This project is being planned as a **Schedule "B"** project under the **Municipal Class Environmental Assessment**. A virtual Public Information Centre (PIC) is planned to provide further information to the public on the proposal and to receive input and comment from interested persons:

Virtual Public Information Centre (PIC):

PIC date: Monday, October 18, 2021 to Monday, November 1, 2021
PIC link: https://www.youtube.com/watch?v=-HURe5OwPNA&ab_channel=TownshipofWilmot

During this Public Information Centre (PIC), comments are invited for incorporation into the planning and design of this project. Comments can be submitted by filling a form via the following link:

Comment submission link: https://www.wilmot.ca/en/doing-business/resources/Documents/Current_Projects/PIC-Comment-Sheet.pdf

For further information, please contact:

Mr. Jeff Molenhuis, P. Eng.,
Director of Public Works & Engineering
Township of Wilmot
60 Snyder's Road West
Baden, Ontario, N3A 1A1
Phone: 519-634-8519 ext. 9238
Fax: 519-634-5044
E-mail: jeff.molenhuis@wilmot.ca

Allan Garnham, P.Eng.
K. Smart Associates Limited
85 McIntyre Drive
Kitchener, Ont., N2R 1H6
Phone: 519-748-1199 ext. 246
Fax: 519-748-6100
E-mail: agarnham@ksmart.ca

Subject to comments received as a result of this Notice, the Township of Wilmot intends to proceed with the detailed design of this project and a Project File will be prepared and placed on the public record for a minimum 45 day review period.

With the exception of personal information, all comments will become part of the public record.

This Notice issued Monday, October 18, 2021.

TOWNSHIP OF Wilmot

BRIDGE STREET BRIDGE REPLACEMENT

(WILMOT BRIDGE 34/B-T9)

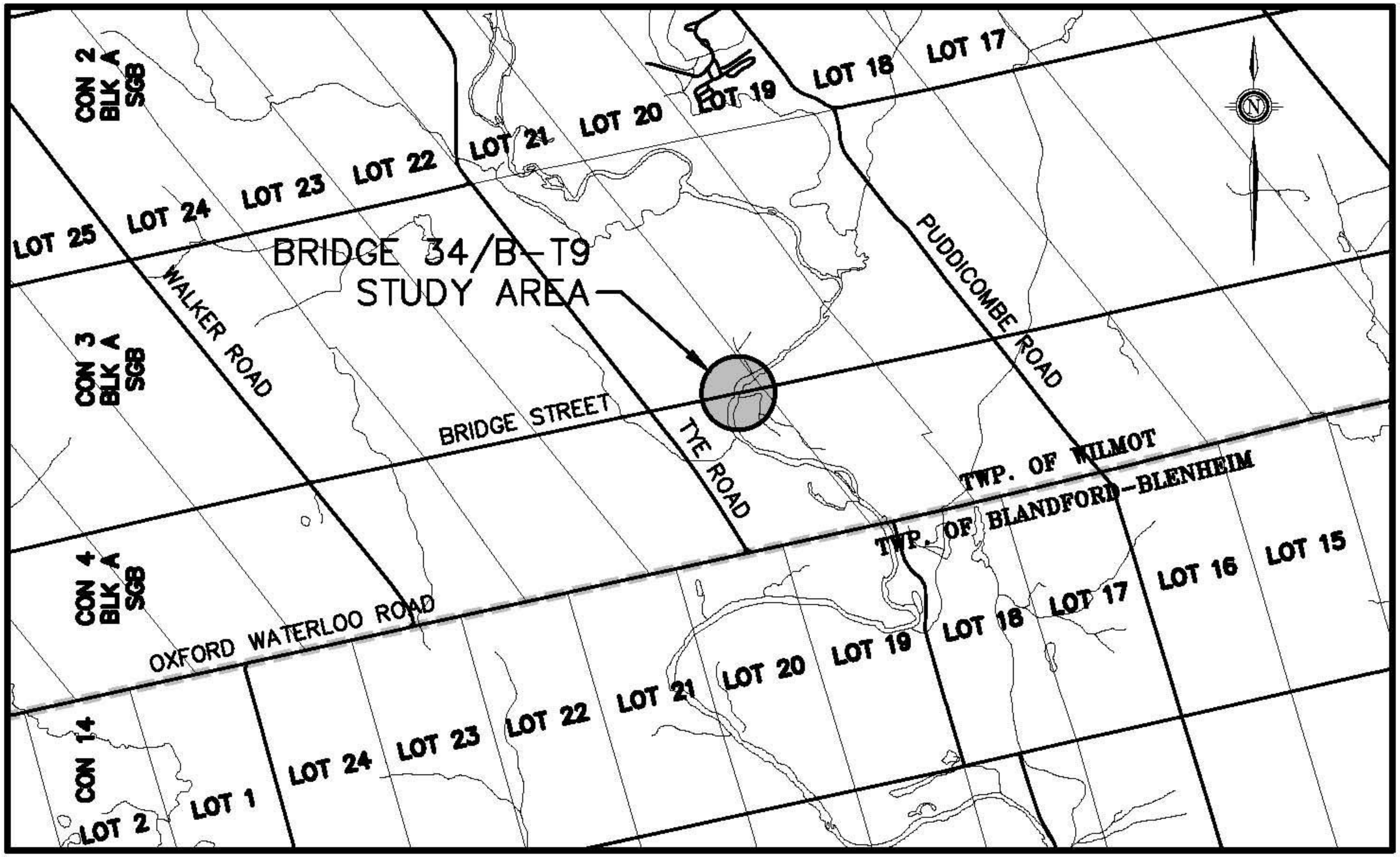
SCHEDULE B MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Public Information Centre (Virtual)

2021

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

Public Information Centre



Scale: N.T.S.

WELCOME

Municipal Class Environmental Assessment Process

Phase 1: Identify the Problem/Opportunity

Phase 2: Alternative Solutions (We are here)

- Identify reasonable alternative solutions to the problem(s)
- Inventory natural, social and economic environments
- Identify impacts of the alternative solutions on the environment and mitigating measures
- Evaluate the alternative solutions and identify the recommended solutions
- Consult review agencies and the public
- Select the preferred solution

Phase 5: Implementation

- Complete contract drawings
- Proceed to design/construction of the project
- Monitor for environmental provisions and commitments

Note: Phase 3 & 4 Do Not Apply to Schedule B Projects

Study Background and Location

North / Upstream Elevation (looking south)

- Bridge Street Bridge spans the Nith River on Bridge Street between Tye Road and Puddicombe Road.
- Bridge Street Bridge is in overall poor condition and nearing the end of its useful life. In addition, it is deficient in width, vertical clearance, and loading capacity.
- The study is being completed as a Schedule 'B' project, following the Municipal Class Environmental Assessment (October 2000, as amended)
- The Municipal Class EA provides a decision-making process to ensure that all relevant engineering and environmental features are considered in the planning and design of municipal infrastructure. The process requires public and agency involvement.

Some Recurring Problems

- **During the last 10 years, this bridge has been closed multiple times. This averages to almost 1 closure per year.**

- **The overhead bracing (portal bracing) is routinely struck by vehicles. This results in the need for frequent repairs to this element.**

- **Despite the numerous repairs completed over the last 15 years, every year more of the original remaining bridge continues to deteriorate. It is not sustainable to continually repair this bridge.**

The latest road closure started from mid-September 2021 due to vehicular collision with the overhead bracings. Note one of the bent bracing angles in picture above.

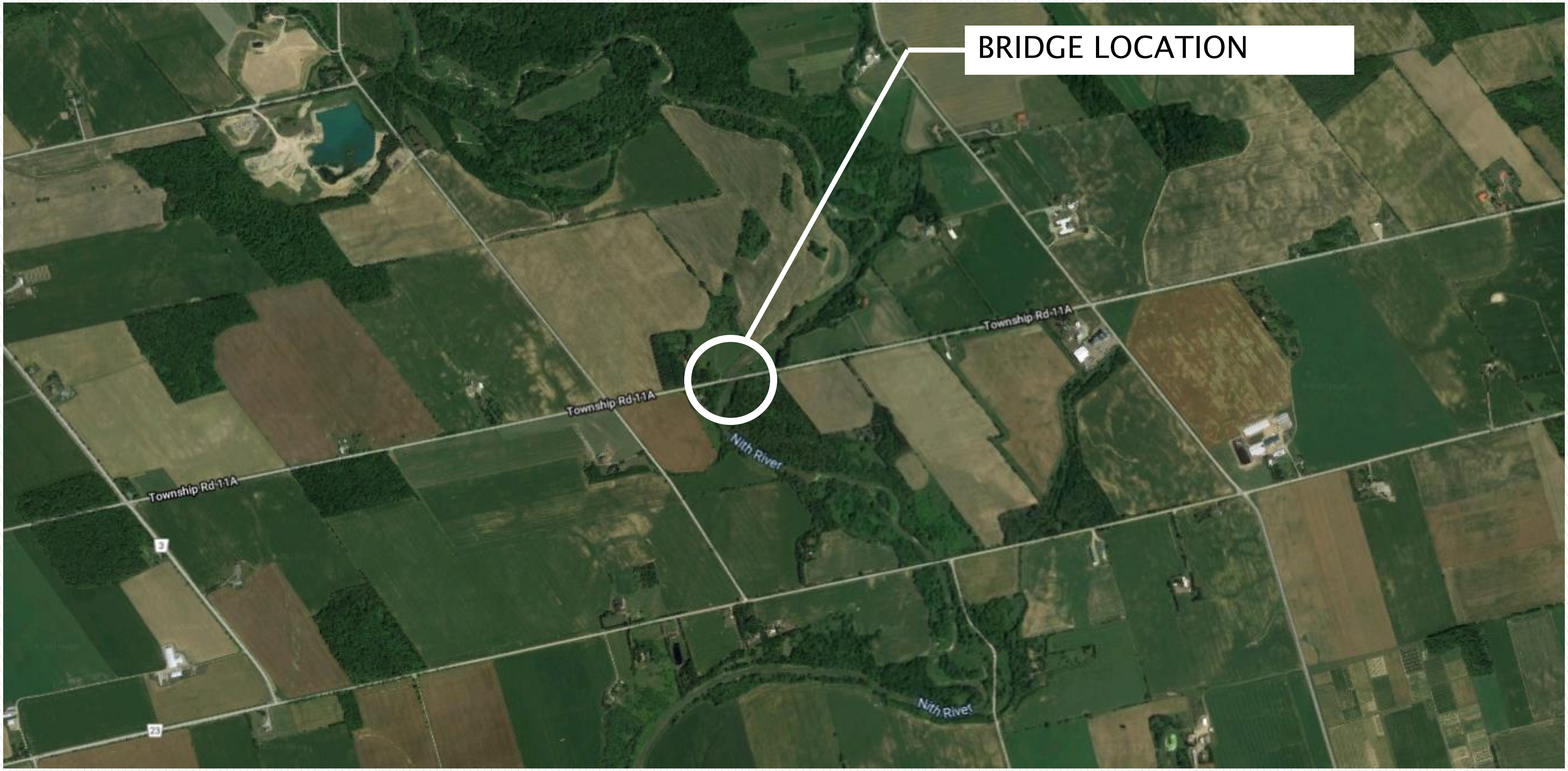
Study Objective

Problem/Opportunity Statement:

To investigate possible improvements to Bridge Street Bridge to eliminate deficiencies and provide improved levels of traffic service and overall safety.

West Approach (looking east)

The goal of this public information centre is to display background information, present the evaluation of alternatives considered to address the problem identified, and receive input on the preferred alternative.



https://www.google.com/maps/@43.3350617,-80.6389114,4132m/data=!3m1!1e3

https://www.google.com/maps/@43.3339423,-80.6419933,1198m/data=!3m1!1e3

Far East Approach (looking west)

East Approach (looking west)

North Elevation (looking south)

Looking Upstream (looking north)

Looking Downstream (looking south)

Deck Surface

Typical Railing

Typical Perforated Stringer

Typical Repaired Floor Beam

Typical Repaired Truss Chord

Typical Soffit

Field Entrance 1 - West of Bridge (looking north)

Field Entrance 2 - Future Driveway – East of Bridge

Entrance 3 – Residence East of Bridge (looking south)

Field Entrance 4 - East of Bridge (looking north)

Additional Studies Completed

As part of the decision-making process, the following studies were completed:

- **A Geotechnical Investigation was completed to have an understanding of the foundation conditions.**
- **A Hydrology Study is underway to ensure the preferred alternative has no impact on the Nith River.**
- **Environmental Screening Studies were completed at the subject area.**
- **An Archaeological Assessment was completed at the subject area.**
- **A Cultural Heritage Evaluation Report (CHER) / Heritage Impact Assessment (HIA) study was completed at the subject area.**
- **A Legal Survey was completed to determine the location of the existing property lines.**

Copies of the above studies are available upon request.

Evaluation of Alternatives (part 1 of 4)

Criteria Group	No.	Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Repair Existing Bridge)	Alternative 3 (Replace Superstructure)	Alternative 4 (Replace with Single Span Steel Truss Bridge)	Alternative 5 (Replace with Multi Span Slab-on-Girder Bridge)	Comment
Natural Environment	1	Disruption to fish and changes to fish habitat	1	2	3	4	5	Considers disruption to fish and potential loss of fish habitat.
	2	Changes to vegetation and flora	1	2	3	4	5	Considers overall loss of vegetation. 1 does not result in any loss of vegetation 5 results in a significant loss of vegetation
	3	Disruption to wildlife and changes to wildlife habitat	1	2	3	4	5	Considers loss of habitat for wildlife such as birds and animals. 1 does not result in any loss of habitat 5 results in a significant loss of habitat
	4	Changes to surface water quality and quantity	1	2	4	5	3	Considers both increase and level of contamination of runoff. 1 does not 5 will not result in an improvement
	5	Changes to ground water quality and quantity	3	3	3	3	3	No changes to the quality or quantity of groundwater are anticiapted
	6	Changes to stream flow	1	2.5	2.5	5	4	Considers changes to the overall alignment of the watercourse. 1 indicates the least disruption 5 has the most disruption
	7	Potential for ice jams	2.5	2.5	2.5	2.5	5	2.5 has no potential for ice jams 5 has potential for ice jams

Evaluation of Alternatives (part 2 of 4)

Criteria Group	No.	Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Repair Existing Bridge)	Alternative 3 (Replace Superstructure)	Alternative 4 (Replace with Single Span Steel Truss Bridge)	Alternative 5 (Replace with Multi Span Slab-on-Girder Bridge)	Comment
Socio-Economic Environment	8	Changes to quality and quantity of agriculture	4.5	4.5	3	1.5	1.5	Considers change to the quality and quantity of farming
	9	Disruption to community due to frequent or permanent closure(s) of the crossing	5	4	3	2	1	Considers disruption to the community by not having a permanent crossing 2 if a new bridge is built 5 if no bridge is built
	10	Disruption to local business due to frequent or permanent closure(s) of the crossing	5	4	3	2	1	Considers disturbance to local business by not having a permanent crossing 1 if a new bridge is built 5 if no bridge is built
	11	Changes to recreation resulting from changing the status quo	1.5	1.5	4	4	4	Considers potential changes to navigation
	12	Changes to future development due to frequent or permanent closure(s) of the crossing	5	4	3	1.5	1.5	Considers loss of future development by not having a permanent crossing 1 if a new bridge is built 5 if no bridge is built
	13	Need for property acquisition if a new structure is pursued	2	2	2	4.5	4.5	1 requires no property to be purchased 5 requires the most amount of property to be purchased
	14	Length of construction if work is pursued	1	2	3	4	5	1 is the shortest to construct 5 is the longest to construct
	15	Improvement to traffic movement if a new structure is pursued	4.5	4.5	3	2	1	1 will provide improvement 5 will not provide improvement
	16	Changes to noise and vibration if a new structure is pursued	1.5	1.5	3.5	5	3.5	1 will result in a reduction in noise and vibration 5 will result in changes to noise and vibration
	17	Changes to air quality	5	4	3	2	1	Considers positive change to air quality as a result of quicker travel times 1 if a new bridge is built 5 if no bridge is built
	18	Access to emergency services due to frequent or permanent closure(s) of the crossing	5	4	2	2	2	Considers response times 1 if a new bridge is built 5 if no bridge is built
	19	Change in aesthetics	1	2	4	3	5	1 will restore aesthetics of Bridge Street Bridge 5 indicates the most change to original aesthetics

Evaluation of Alternatives (part 3 of 4)

Criteria Group	No.	Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Repair Existing Bridge)	Alternative 3 (Replace Superstructure)	Alternative 4 (Replace with Single Span Steel Truss Bridge)	Alternative 5 (Replace with Multi Span Slab-on-Girder Bridge)	Comment
Cultural Environment	20	Potential presence of archaeological cultural heritage resources on or adjacent to the study area	1.5	1.5	4	5	3	1 would be no disturbance to existing ground 5 indicates major disturbance to existing ground
	21	Preservation of cultural heritage landscapes	1.5	1.5	4	5	3	1 indicates retention of existing landscape 5 indicates altering current landscape
	22	Preservation of existing built heritage resources	1.5	1.5	3	4.5	4.5	1 indicates retention of existing structure 5 indicates loss of current structure
Technical Considerations	23	Extent the alternative addresses the problem statement	5	4	3	1.5	1.5	1 meets the problem statement 5 does not meet the problem statement
	24	Effect on existing utilities	1.5	1.5	4	5	3	1 indicates least potential to affect utilities 5 indicates most potential to affect utilities
	25	Elimination of height restrictions	4	4	1.5	4	1.5	4 if there is a height limit across the bridge 1.5 if there is no limit
	26	Elimination of Load Posting	4.5	4.5	3	1.5	1.5	2 eliminates load posting 4.5 does not eliminate load posting
	27	Elimination of width restriction	4	4	4	1.5	1.5	4 if the structure is limited in width 1.5 if there is no limit
	28	Ability to improve geometry of roadway	5	4	3	2	1	1 will allow modifications 5 will not allow modifications
	29	Increase of traffic volume and speed due to overall improved geometry	5	4	3	2	1	1 indicates improvement to traffic volume and speed 5 indicates no improvements to traffic speed and volume
	30	Need to reconfigure laneways immediately adjacent to bridge	1.5	1.5	4.5	4.5	3	1 indicates no need for reconfiguration 5 indicates reconfiguration required
	31	Improvements to safety	5	4	3	2	1	1 provides many improvements 5 provides no improvements
	32	Ability to improve hydrology/hydraulic conditions	4	4	4	2	1	1 allows for improvement 5 does not allow improvement
	33	Constructability	1	2	3	5	4	1 is the easiest to construct 5 is the hardest to construct
	34	Construction timeline	1	2	3	5	4	1 is the shortest to construct 5 is the longest to construct
	35	Lifespan	5	4	3	2	1	1 is the longest period prior to reconstruction of the bridge 5 is the shortest period prior to reconstruction of the bridge
	36	Need for ongoing maintenance	5	4	3	2	1	Assumes replacing the bridge would require little maintenance whereas doing nothing would require

Evaluation of Alternatives
(part 4 of 4)

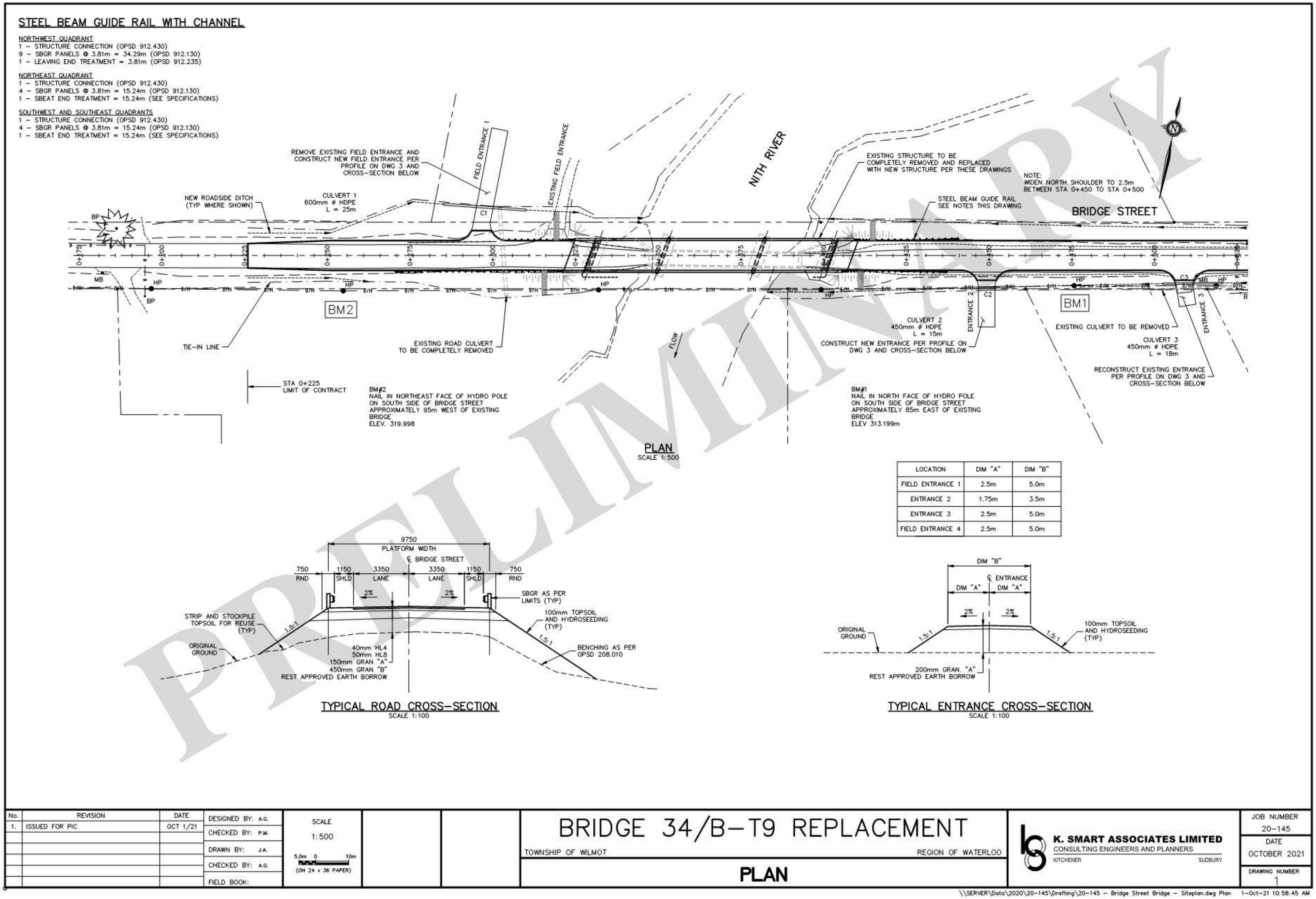
Criteria Group	No.	Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Repair Existing Bridge)	Alternative 3 (Replace Superstructure)	Alternative 4 (Replace with Single Span Steel Truss Bridge)	Alternative 5 (Replace with Multi Span Slab-on-Girder Bridge)	Comment
Cost	37	Purchase of private property	1.5	1.5	3	5	4	1 does not require purchasing property 5 requires purchasing private property
	38	Maintenance costs	5	4	3	2	1	Assumes a new modern bridge requires little or no maintenance and "doing nothing" would require frequent maintenance
	39	Cost to mitigate impacts to the natural environment	1	2.5	2.5	4	5	1 requires no mitigation 5 requires substantial mitigation
	40	Overall construction cost	1	3	2	5	4	1 would be the lowest cost 5 would be the highest cost
		Totals	**116**	**117**	**124**	**131.5**	**111.5**	

Note:
Alternatives are ranked 1 to 5 with 1 having the least disturbance and 5 having the most disturbance except where noted.
Each row totals 15 points to ensure each criterion is weighted the same.

Alternative 5 (Replace with Multi Span Slab-on-Girder Bridge) has the lowest overall score.

Based on this evaluation, the Township intends to proceed with **Alternative 5**.

Preferred Alternative – Drawing 1 of 5



LOCATION	DIM "A"	DIM "B"
FIELD ENTRANCE 1	2.5m	5.0m
ENTRANCE 2	1.75m	3.5m
ENTRANCE 3	2.5m	5.0m
FIELD ENTRANCE 4	2.5m	5.0m

No.	REVISION	DATE
1.	ISSUED FOR PIC	OCT 1/21

DESIGNED BY: A.G.
CHECKED BY: P.M.
DRAWN BY: J.A.
CHECKED BY: A.G.
FIELD BOOK:

SCALE
1:500
5.0m 0 10m
(ON 24 x 36 PAPER)

BRIDGE 34/B–T9 REPLACEMENT
TOWNSHIP OF WILMOT
REGION OF WATERLOO
PLAN

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

JOB NUMBER 20–145
DATE OCTOBER 2021
DRAWING NUMBER 1

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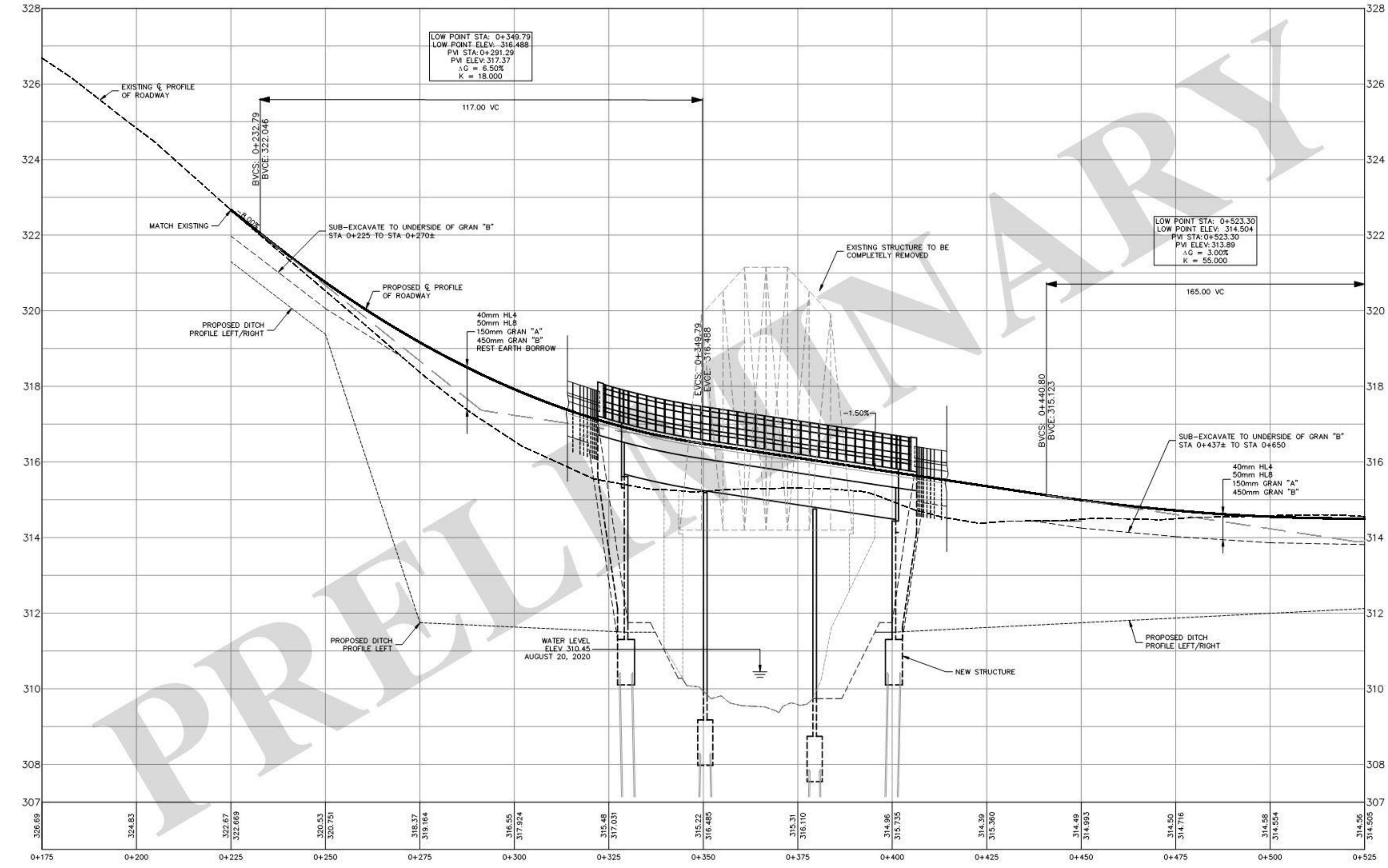
Preferred Alternative – Drawing 2 of 5



No.	REVISION	DATE
1.	ISSUED FOR PIC	OCT 1/21

DESIGNED BY: A.G.
CHECKED BY: P.M.
DRAWN BY: J.A.
CHECKED BY: A.G.
FIELD BOOK:

SCALE

BRIDGE 34/B–T9 REPLACEMENT

TOWNSHIP OF WILMOT
REGION OF WATERLOO

PROFILE - STA 0+175 TO STA 0+525

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER
SUDBURY

JOB NUMBER 20–145
DATE OCTOBER 2021
DRAWING NUMBER 2

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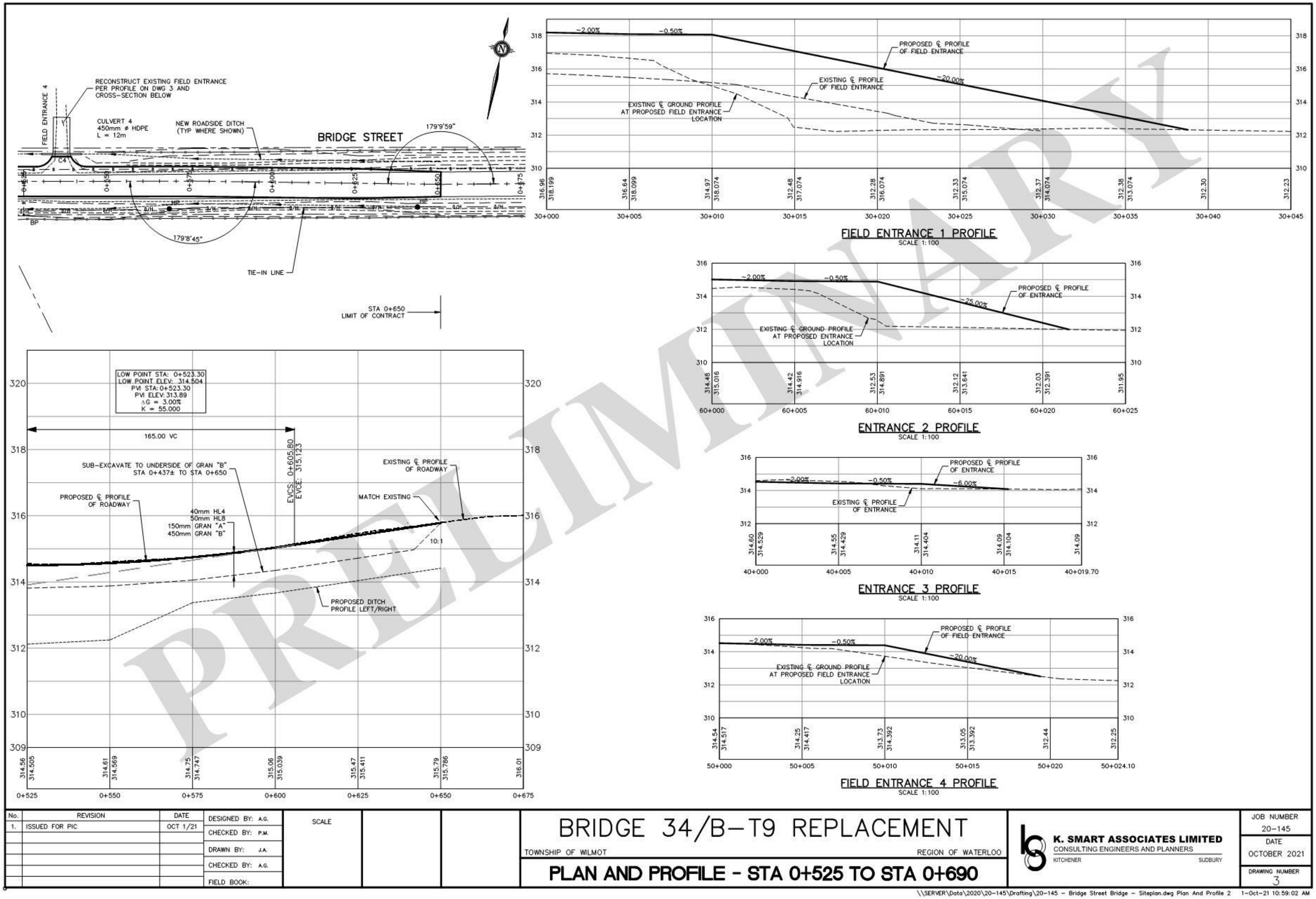
Preferred Alternative – Drawing 3 of 5



No.	REVISION	DATE
1.	ISSUED FOR PIC	OCT 1/21

DESIGNED BY: A.G.
CHECKED BY: P.M.
DRAWN BY: J.A.
CHECKED BY: A.G.
FIELD BOOK:

SCALE

BRIDGE 34/B-T9 REPLACEMENT
TOWNSHIP OF WILMOT
REGION OF WATERLOO
PLAN AND PROFILE - STA 0+525 TO STA 0+690

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

JOB NUMBER 20-145
DATE OCTOBER 2021
DRAWING NUMBER 3

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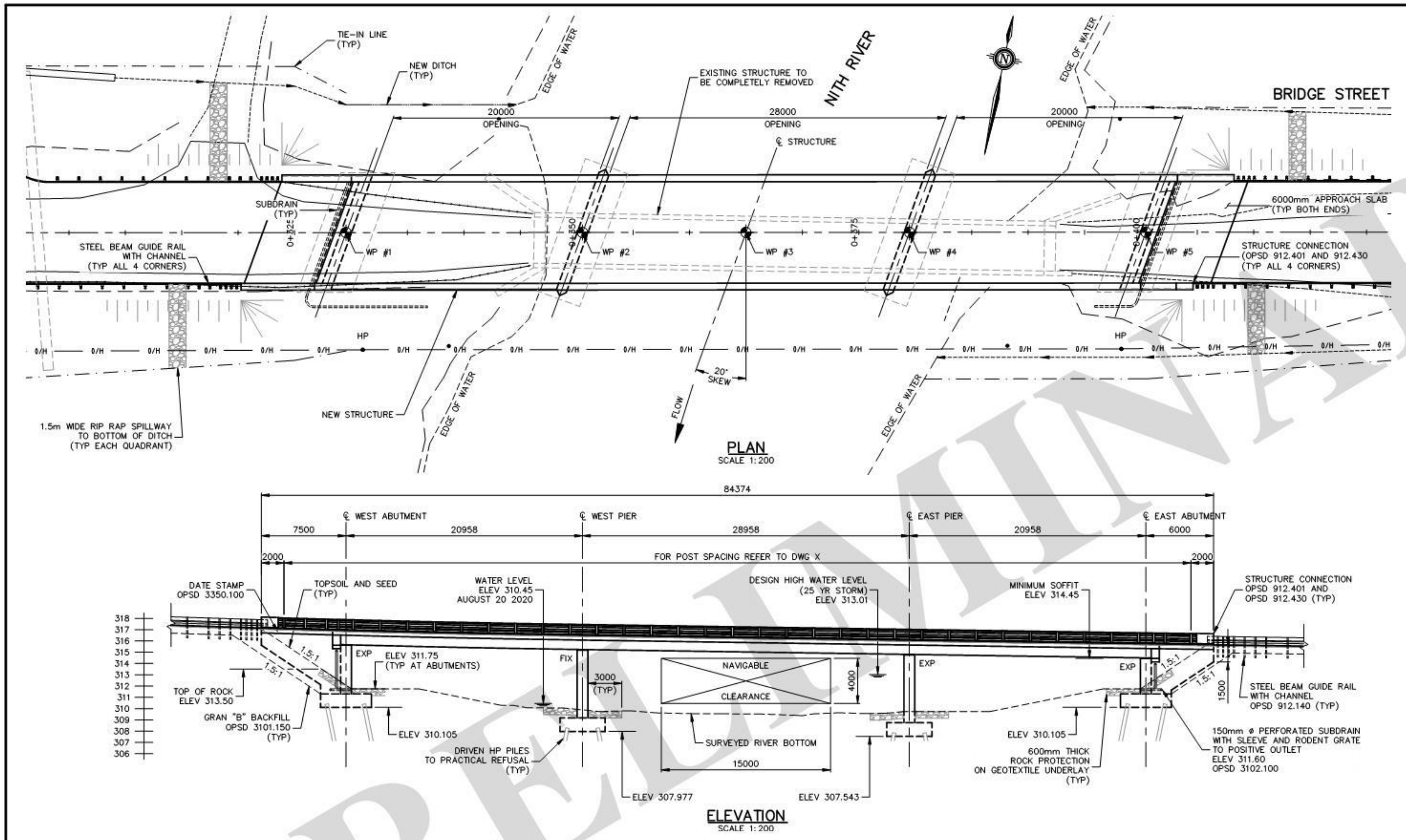
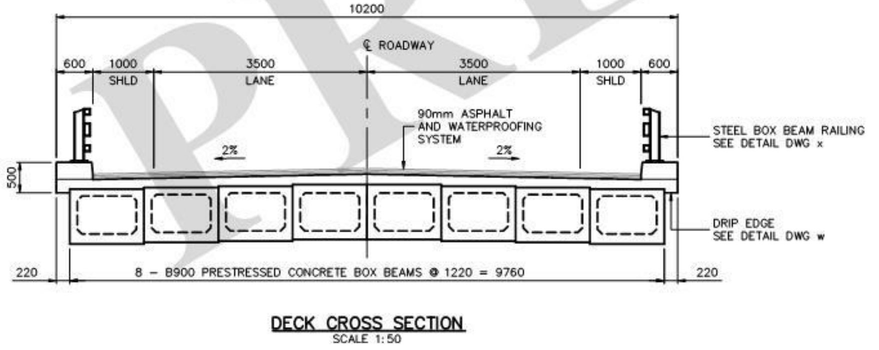
Preferred Alternative – Drawing 4 of 5





DECK CROSS SECTION
SCALE 1:50

	WP #1	WP #2	WP #3	WP #4	WP #5
STATION	0+329.563	0+350.521	0+365.000	0+379.479	0+400.437
ELEVATION	316.905	316.477	316.260	316.043	315.728

NOTE: WORKING POINT ELEVATIONS GIVEN TO TOP OF ASPHALT

GENERAL NOTES

1. STRUCTURE DESIGNED FOR CL-625 (ONT) LOADING PLUS 90mm ASPHALT AND WATERPROOFING SYSTEM IN ACCORDANCE WITH THE CANADIAN HIGHWAY BRIDGE DESIGN CODE 2019.
2. WORK ON THE STRUCTURE MUST NOT BE COMMENCED UNTIL MONUMENTS TO FIX CONTROL POINTS HAVE BEEN ERECTED AND CHECKED BY THE CONTRACT ADMINISTRATOR
3. STRUCTURE TO BE BUILT IN ACCORDANCE WITH THE MOST CURRENT OPS SPECIFICATIONS AND DRAWINGS AS WELL AS THE CONTRACT ADMINISTRATORS SPECIFICATIONS.
4. THE COMPLETE SOIL INVESTIGATION REPORT BY PETO MACCALLUM LTD. FORM PART OF THE CONTRACT DOCUMENTS. THE ENGINEER DOES NOT GUARANTEE THE ACCURACY OF THIS REPORT. THE CONTRACTOR SHALL REVIEW THE REPORT AND DETERMINE HIS OWN METHOD TO CONTROL GROUND WATER DURING THE CONSTRUCTION.
5. THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS ON THE JOB AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR BEFORE PROCEEDING WITH THE WORK
6. CLASS OF CONCRETE:

CAST-IN-PLACE CONCRETE	35 MPA C-1 MIX
PRESTRESSED CONCRETE	REFER TO RELEVANT DRAWINGS

ALL CONCRETE SHALL INCLUDE AN APPROVED AIR ENTRAINING ADMIXTURE

7. CLEAR COVER TO REINFORCING STEEL

FOOTINGS	100 ± 25mm
REMAINDER (UNLESS NOTED OTHERWISE)	70 ± 20mm

8. REINFORCING STEEL SHALL BE GRADE 400. BARS MARKED WITH A POSTFIX "S" DENOTE STAINLESS STEEL BARS. UNLESS OTHERWISE SHOWN, TENSION LENGTH LAPS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS "B". BAR HOOKS SHALL BE MINIMUM LENGTH AND STIRRUPS SHALL HAVE MINIMUM HOOKS, UNLESS INDICATED OTHERWISE.
9. STAINLESS STEEL BARS SHALL BE TYPE 316 LN OR DUPLEX 2205 WITH A MINIMUM YIELD STRENGTH OF 500 MPA.
10. MINIMUM LAP OF REINFORCING STEEL SHALL BE IN ACCORDANCE WITH THE CHBDC (2019)
11. ALL CONCRETE SHALL BE PLACED IN THE DRY.
12. NO CONCRETE SHALL BE PLACED BEFORE MATERIALS, FORMWORK AND REINFORCING STEEL HAVE BEEN CHECKED BY THE CONTRACT ADMINISTRATOR
13. ALL EXPOSED EDGES TO BE CHAMFERED 19mm UNLESS OTHERWISE NOTED. ALL ACUTE ANGLES SHALL BE FILLETED AS NOTED.
14. CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR.
15. BEARING SEATS SHALL BE FINISHED DEAD LEVEL TO THE SPECIFIED ELEVATIONS TO A TOLERANCE OF ±3mm.
16. THE BRIDGE DECK SHALL BE FINISHED USING AN APPROVED FINISHING MACHINE IN ACCORDANCE WITH OPS.MUNI 904.
17. ANY EXCAVATED OR IMPORTED MATERIAL SHALL BE STOCKPILED WELL AWAY FROM THE EDGE OF THE EXCAVATION AND AT APPROVED LOCATIONS.
18. NO BACKFILL SHALL BE PLACED UNLESS APPROVED BEFOREHAND BY THE CONTRACT ADMINISTRATOR. NATIVE MATERIAL SHALL NOT BE REMOVED FROM THE CONSTRUCTION SITE WITHOUT WRITTEN APPROVAL FROM THE CONTRACT ADMINISTRATOR.
19. ROCK PROTECTION SHALL BE 300mm NOMINAL SIZE WITH 50% LARGER THAN 300mm AND 50% SMALLER THAN 300mm. ROCK PROTECTION SHALL BE PLACED ON GEOTEXTILE UNDERLAY.

SUGGESTED SEQUENCE OF CONSTRUCTION

YEAR 1

1. DEMOLISH EXISTING BRIDGE
2. CONSTRUCT PIERS TO BEARING SEAT ELEVATIONS
3. CONSTRUCT ABUTMENTS AND WINGWALLS TO BEARING SEAT ELEVATIONS
4. PLACE BACKFILL AND ROCK PROTECTION AS REQUIRED
5. PLACE GIRDERS

YEAR 2

1. CONSTRUCT BRIDGE DECK AND WINGWALL TOPS
2. PLACE REMAINING BACKFILL
3. CONSTRUCT APPROACH SLABS, CURBS AND END POSTS
4. ERECT BRIDGE RAILING
5. COMPLETE ROAD RECONSTRUCTION INCLUDING GUIDE RAIL
6. WATERPROOF BRIDGE DECK AND PAVE ROADWAY APPROACHES
7. COMPLETE ANY REMAINING RESTORATION WORK

No.	REVISION	DATE
1.	ISSUED FOR PIC	OCT 1/21

DESIGNED BY: A.G.
CHECKED BY: P.M.
DRAWN BY: J.A.
CHECKED BY: A.G.
FIELD BOOK:

SCALE

BRIDGE 34/B-T9 REPLACEMENT
TOWNSHIP OF WILMOT
REGION OF WATERLOO

GENERAL ARRANGEMENT

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

JOB NUMBER 20-145
DATE OCTOBER 2021
DRAWING NUMBER 4

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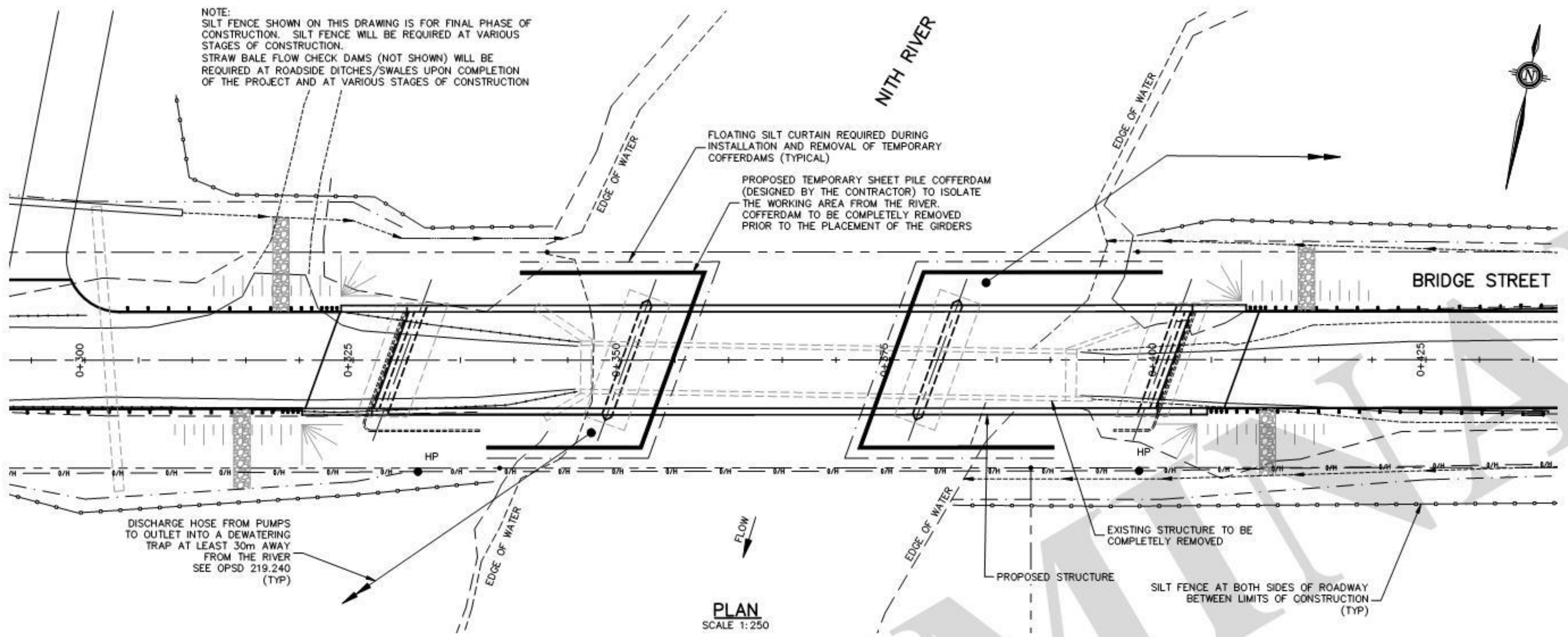
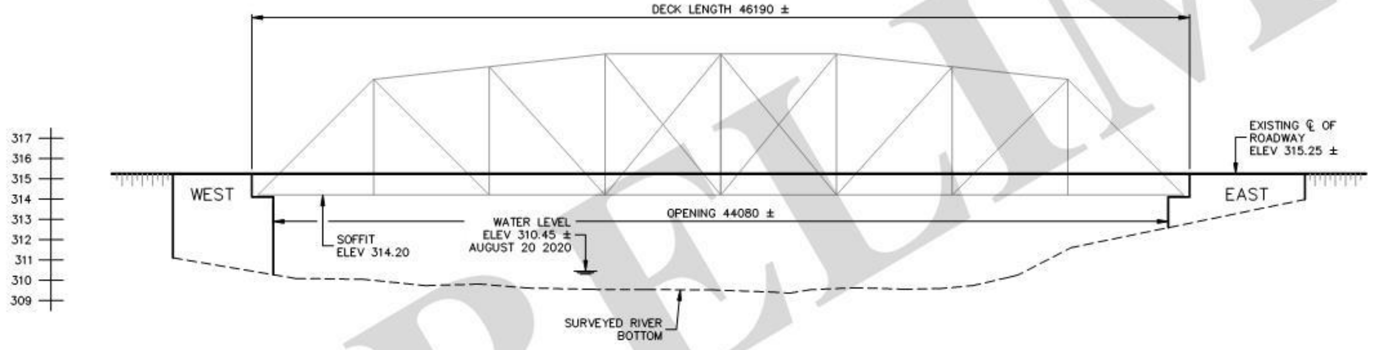
Preferred Alternative – Drawing 5 of 5



PLAN
SCALE 1:250



EXISTING STRUCTURE
SCALE 1:150

NAVIGATION

1. SIGNS TO BE PLACED 50m UPSTREAM AND DOWNSTREAM WARNING BOATERS OF THE CONSTRUCTION WORK AHEAD..
2. SILT CURTAINS OR DEWATERING BERMS, INSTALLED DURING NAVIGATION SEASON, ARE TO BE MARKED WITH YELLOW BUOYS AND/OR YELLOW LIGHTS.
3. NO PERSON SHALL PERMIT ANY TOOLS, EQUIPMENT, VEHICLES, TEMPORARY STRUCTURES OR PARTS THEREOF USED OR MAINTAINED FOR THE PURPOSE OF BUILDING OR PLACING A WORK IN A NAVIGABLE WATER TO REMAIN IN SUCH WATER AFTER THE COMPLETION OF THE PROJECT.
4. WHERE A WORK OR PORTION OF A WORK THAT IS BEING CONSTRUCTED OR MAINTAINED IN A NAVIGABLE WATER CAUSES DEBRIS OR OTHER MATERIAL TO ACCUMULATE ON THE BED OR SURFACE OF THE WATER, THE OWNER OF THAT WORK OR PORTION OF THAT WORK SHALL CAUSE THE DEBRIS OR OTHER MATERIAL TO BE REMOVED TO THE SATISFACTION OF THE MINISTER OF TRANSPORT, INFRASTRUCTURE AND COMMUNITIES.

DEWATERING SEQUENCE

1. ATTEND A PRE-CONSTRUCTION MEETING WITH THE OWNER AND CONTRACT ADMINISTRATORPRIOR TO COMMENCEMENT OF CONSTRUCTION.
2. INSTALL SILT FENCE, STRAW BALE CHECK DAMS AND ANY OTHER EROSION CONTROL MEASURES WHICH MAY BE REQUIRED.
3. CONSTRUCT DEMOLITION PLATFORM UNDERNEATH EXISTING BRIDGE AND REMOVE EXISTING SUPERSTRUCTURE.
4. CLEAN DEBRIS, DUST AND SLURRY FROM DEMOLITION PLATFORM AND REMOVE PLATFORM.
5. PLACE SILT FENCE AND/OR FLOATING SILT CURTAINS OUTSIDE OF PLANNED COFFERDAM LOCATIONS.
6. INSTALL TEMPORARY COFFERDAMS OR OTHER CONTAINMENT SYSTEM AS REQUIRED.
7. COMPLETE DEMOLITION OF THE EXISTING BRIDGE.
8. EXCAVATE AS REQUIRED IN ORDER TO CONSTRUCT NEW STRUCTURE.
9. DRIVE PILES, CONSTRUCT FOOTINGS AND CONSTRUCT PIERS AND ABUTMENTS TO BEARING SEAT ELEVATIONS.
10. PLACE BACKFILL AND ROCK PROTECTION AS REQUIRED TO FACILITATE REMOVAL OF COFFERDAMS. PLACE ROCK PROTECTION.
11. REMOVE COFFERDAMS.
12. REMOVE FLOATING SILT CURTAINS.
13. COMPLETE REMAINING CONSTRUCTION OF THE BRIDGE.
14. COMPLETE ROADWORK.
15. INSTALL PERMANENT SILT FENCE AND STRAW BALE CHECK DAMS.

EROSION CONTROL – BRIDGE RECONSTRUCTION

1. ALL WORK SHALL BE DONE IN THE DRY.
2. IN-WATER WORK SHALL ONLY TAKE PLACE BETWEEN JULY 15 AND MARCH 14. NO IN-WATER WORK MAY OCCUR OUTSIDE OF THESE DATES FOR ANY REASON.
3. DEWATERING OF THE SITE SHALL BE ACHIEVED BY THE INSTALLATION OF COFFERDAMS TO ISOLATE THE WORKING AREA, AND THE PLACEMENT OF CONVENTIONAL SUMP PUMPS WHERE REQUIRED. THE CONTRACTOR'S SPECIFIC METHOD SHALL BE APPROVED BEFOREHAND BY THE CONTRACT ADMINISTRATOR. ALTERNATIVE METHODS OF DEWATERING SUCH AS SHEET PILE COFFERDAMS AROUND THE PIERS, BYPASS CHANNEL, OR AQUA DAMS MAY BE POSSIBLE PENDING THE WRITTEN APPROVAL OF THE CONTRACT ADMINISTRATOR.
4. DISCHARGE FROM PUMPING OPERATIONS SHALL FIRST OUTLET INTO A SILTING POND OR SEDIMENT TRAP BEFORE THE WATER IS ALLOWED TO RE-ENTER THE STREAM OR ANOTHER WATERCOURSE.
5. COFFERDAMS SHALL BE DESIGNED BY THE CONTRACTOR AND SUBMITTED TO THE CONTRACT ADMINISTRATOR FOR REVIEW PRIOR TO CONSTRUCTION.
6. ALL DISTURBED AREAS INCLUDING BANKS ABOVE WATER LEVEL SHALL BE REGRADED, TOPSOILED AND SEEDED TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AS SOON AS POSSIBLE.
7. ALL EROSION CONTROL MEASURES (SILT FENCE, ROCK DAMS, SILTATION POND/DEWATERING TRAP, ETC.) SHALL BE CHECKED DAILY DURING ON-SITE WORK AND BE MAINTAINED IN GOOD STATE SO THAT THEY ARE FUNCTIONING PROPERLY. SILT FENCE AND STRAW BALE CHECK DAMS TO BE LEFT IN PLACE FOR 12 MONTHS OR UNTIL SUCH TIME AS THE SITE STABILIZES (THESE ARE LOCATED ABOVE HIGH WATER LEVEL).
8. NO MACHINERY SHALL CROSS THE RIVER AT ANY TIME. ANY MACHINERY THAT IS REQUIRED ON THE OTHER SIDE OF THE RIVER WHILE THE BRIDGE IS DISMANTLED OR UNDER CONSTRUCTION SHALL BE HAULED BY FLOAT OR DRIVEN AROUND ON THE ROADS. MACHINERY, VEHICLES, EQUIPMENT PUMPS, ETC., WILL NOT BE REFUELED WITHIN 30 METRES OF THE WATERCOURSE. MACHINERY SHALL NOT BE CLEANED WITHIN 30 METRES OF THE RIVER.
9. ALL WASTE MATERIAL FROM CONSTRUCTION SHALL BE STORED AWAY AND ABOVE THE HIGH WATERMARK AND AT NO TIME SHALL SUCH MATERIAL ENTER IN THE WATER.
10. FOR TYPICAL CHECK DAMS REFER TO OPSD 219.210
11. FOR SILT FENCE REFER TO OPSD 219.130 HEAVY DUTY.

ADDITIONAL ENVIRONMENTAL MEASURES TO BE ADHERED TO:

1. SEDIMENT AND EROSION CONTROL MEASURES SHOULD BE IMPLEMENTED PRIOR TO WORK, AND MAINTAINED DURING THE WORK PHASE, TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATER OR THE MOVEMENT OF RE-SUSPENDED SEDIMENT.
2. A FLOATING TURBIDITY CURTAIN OR SILT FENCE SHOULD BE PLACED IMMEDIATELY AROUND THE WORK SITE PRIOR TO THE INSTALLATION OF COFFERDAMS.
3. ALL DISTURBED WORK AREAS SHOULD BE STABILIZED AND RE-VEGETATED AS REQUIRED UPON THE COMPLETION OF WORK AND RESTORED TO A PRE-DISTURBED STATE OR BETTER.
4. SEDIMENT AND EROSION CONTROL MEASURES SHOULD BE LEFT IN PLACE UNTIL ALL DISTURBED AREAS HAVE BEEN STABILIZED.
5. EXISTING STREAM FLOWS SHOULD BE MAINTAINED DOWNSTREAM OF THE DE-WATERED WORK AREA WITHOUT INTERRUPTION, DURING ALL STAGES OF WORK. THERE SHOULD BE NO INCREASE IN WATER LEVELS UPSTREAM OF THE DE-WATERED WORK AREA.
6. FISH SHOULD BE REMOVED FROM THE WORK AREA PRIOR TO DE-WATERING AND RELEASED ALIVE IMMEDIATELY DOWNSTREAM.
7. SILT OR DEBRIS THAT HAS ACCUMULATED AROUND THE TEMPORARY COFFERDAMS SHOULD BE REMOVED PRIOR TO THE WITHDRAWAL.
8. NATURAL STRUCTURES SUCH AS LOGJAMS AND IN-STREAM WOODY COVER SHOULD NOT BE REMOVED UNLESS THEY REPRESENT A BARRIER TO FLOWS OR FISH MOVEMENT.
9. OPERATE HEAVY MACHINERY ON LAND AND IN A MANNER THAT MINIMIZES DISTURBANCE TO THE BANKS OR BED OF THE STREAM.
10. ENSURE THAT MACHINERY ARRIVES ON SITE IN A CLEAN, WASHED CONDITION AND IS MAINTAINED FREE OF FLUID LEAKS.
11. WASH, REFUEL AND SERVICE MACHINERY AND STORE FUEL AND OTHER MATERIALS FOR THE MACHINERY AWAY FROM THE WATER TO PREVENT ANY DELETERIOUS SUBSTANCE FROM ENTERING THE WATER OR SPREADING ONTO THE ICE SURFACE.
12. KEEP AN EMERGENCY SPILL KIT ON SITE IN CASE OF FLUID LEAKS OR SPILLS FROM MACHINERY.
13. STABILIZE ANY WASTE MATERIALS REMOVED FROM THE WORK SITE TO PREVENT IT FROM ENTERING THE RIVER. THIS COULD INCLUDE COVERING STOCKPILES WITH BIODEGRADABLE MATS OR TARPS, OR PLANTING STOCKPILES WITH GRASS OR SHRUBS.
14. ALL UNSTABLE BANKS OF THE WATERCOURSE SHOULD BE STABILIZED AND SIDE RUN-OFF DITCHES SHOULD BE CONSTRUCTED TO DIVERT ROAD RUN-OFF THROUGH THE GREENBELT BEFORE ENTERING THE STREAM.
15. VEGETATE AND STABILIZE ANY DISTURBED AREAS BY SEEDING AND PLANTING TREES, SHRUBS, OR GRASSES PER SPECIFICATIONS.
16. STREAM CROSSINGS SHOULD ALLOW FOR UNIMPEDED UPSTREAM AND DOWNSTREAM MOVEMENT OF FISH.
17. CONCRETE LEACHATE IS ALKALINE AND HIGHLY TOXIC TO FISH AND AQUATIC LIFE AND MEASURES MUST BE TAKEN TO PREVENT ANY INCIDENCE OF CONCRETE OR CONCRETE LEACHATE FROM ENTERING THE RIVER. ALL CAST-IN-PLACE CONCRETE, GROUT, MORTARS, ETC. SHOULD BE TOTALLY ISOLATED FROM PRECIPITATION AND THE WATERS OF THE WATERCOURSE FOR A MINIMUM 48 HOUR PERIOD OR UNTIL SIGNIFICANTLY CURED TO ALLOW THE pH TO REACH NEUTRAL LEVELS. CONTAINMENT FACILITIES SHOULD BE PROVIDED AT THE SITE FOR THE WASH-DOWN FROM CONCRETE DELIVERY TRUCKS, CONCRETE PUMPING EQUIPMENT, AND OTHER TOOLS AND EQUIPMENT AS REQUIRED.

No.	REVISION	DATE
1.	ISSUED FOR PIC	OCT 1/21

DESIGNED BY: A.G.
CHECKED BY: P.M.
DRAWN BY: J.A.
CHECKED BY: A.G.
FIELD BOOK:

SCALE

BRIDGE 34/B-T9 REPLACEMENT
TOWNSHIP OF WILMOT
REGION OF WATERLOO
EROSION AND SEDIMENT CONTROL

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER
SUDBURY

JOB NUMBER
20-145
DATE
OCTOBER 2021
DRAWING NUMBER
5

\\SERVER\Data\2020\20-145\Drafting\20-145 – Bridge Street Bridge – Siteplan.dwg Erosion And Sediment Control 1-Oct-21 10:59:16 AM

Preliminary Cost Estimate

Category No.	Category Description	Total Price
1	General Requirements	$ 135,000
2	Roadwork	$ 426,250
3	Removals	$ 188,500
4	Roadside Safety	$ 81,002
5	Restoration	$ 62,000
6	Bridge Work	$ 2,482,950
7	Contingency	$ 150,000

Total	$ 3,525,702

A detailed cost breakdown is available upon request.

Next Steps:

- **Receive feedback on preferred alternative.**
- **Finalize the 'Project File'**
- **Publish a 'Notice of Completion' and distribute via the New Hamburg Independent, Township of Wilmot website, and private notice to interested agencies and residents adjacent to the study area. The notice will identify the opportunity to review the 'Project File' over a 45 calendar day period.**
- **Assuming that comments raised during the 45 day review period can be resolved, the Township will proceed with the detailed design, tendering, and construction.**

Comments regarding this PIC will be received until Monday, November 1, 2021. You can submit your comments by way of either of the following methods:

- **By visiting the following link and completing the online form:**
  https://www.wilmot.ca/en/doing-business/resources/Documents/Current_Projects/PIC-Comment-Sheet.pdf
- **By regular mail or email to either of the following contacts:**

Mr. Jeff Molenhuis, P. Eng.,
Director of Public Works & Engineering
Township of Wilmot
60 Snyder's Road West
Baden, ON N3A 1A1
Phone: 519-634-8519 ext. 9238
Email: jeff.molenhuis@wilmot.ca

Mr. Allan Garnham, P. Eng.
K. Smart Associates Limited
85 McIntyre Drive
Kitchener, ON, N2R 1H6
Phone: 519-748-1199 ext. 246
Email: agarnham@ksmart.ca

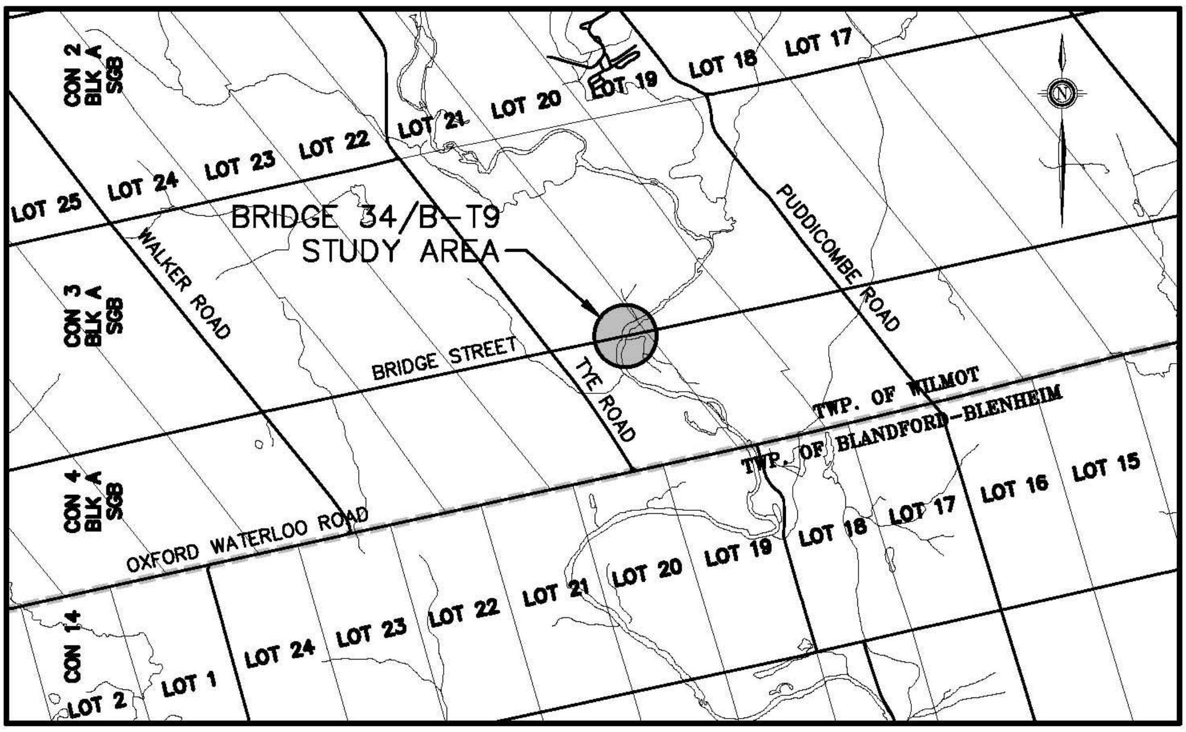
THANK YOU FOR ATTENDING

3.4 NOTICE OF STUDY COMPLETION

The following Notice of Study Completion will be placed in two (2) consecutive editions of the New Hamburg Independent and Wilmot Post newspapers. This same notice will be placed on Township of Wilmot's webpage and social media outlets. Copies of this Notice will also be sent to those identified in Section 3.1

NOTICE OF STUDY COMPLETION
TOWNSHIP OF WILMOT
CLASS ENVIRONMENTAL ASSESSMENT
BRIDGE 34/B-T9 (BRIDGE STREET BRIDGE)
BRIDGE STREET AT THE NITH RIVER

The Township of Wilmot has completed a Municipal Class Environmental Assessment (Class EA) to address width, height, and capacity deficiencies, as well as to achieve an overall increased traffic and pedestrian safety at Bridge Street at the Nith River. As a result of this study, the Township is proposing to replace Bridge 34/B-T9 (Bridge Street Bridge). The preferred alternative identified through the Class EA process is a multi-span slab-on-girder bridge constructed at the same location.



Scale: N.T.S.

The project is being planned under Schedule B of the Municipal Class Environmental Assessment. Subject to comments received as a result of this Notice, the Township intends to obtain the necessary approvals and proceed with the design and construction of this project to be completed in 2023.

A digital copy of the Project File can be obtained via the following link:

https://www.wilmot.ca/en/doing-business/resources/Documents/Current_Projects/20-145-Bridge-St-Bridge---Project-File.pdf

To provide comment on the project, or to obtain the Project File via alternative means, please contact:

Mr. Allan Garnham, P. Eng. Project Manager K. Smart Associates Limited 85 McIntyre Drive Kitchener ON N2R 1H6 Phone: 519-748-1199 ext. 246 Fax: 519-748-6100 E-mail: agarnham@ksmart.ca	or	Mr. Mark Jeffery, C.E.T. Project Manager Township of Wilmot 60 Snyder's Road West Baden, ON N3A 1A1 519-634-8519 ext. 9263 Fax: 519-634-5522 E-mail: mark.jeffery@wilmot.ca

Interested persons should provide written comment to the Township on the proposal within 45 calendar days from the date of this Notice. Comments should be directed to one of the project contacts noted above.

If concerns arise regarding this project, which cannot be resolved in discussion with the Township, a person may request that the The Minister of the Environment, Conservation and Parks make an order for the project to comply with Part II of the Environmental Assessment Act. (also referred to as Section 16 Order Requests), which addresses individual environmental assessments. Instructions on how to make this request are provided in the following link:

https://www.ontario.ca/page/class-environmental-assessments-section-16-order

The Minister, the Director, and the Township (as per addresses provided within this notice) must receive requests within 45 calendar days of this Notice. If there are no requests received by March 4, 2022, this project will proceed to design and construction as presented.

Minister
Ministry of the Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
Minister.mecp@ontario.ca

Director
Environmental Assessment Branch
Ministry of the Environment, Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto ON M4V 1P5
EABDirector@ontario.ca

All comments and information received from individuals, stakeholder groups and agencies regarding this project are being collected under the authority of the “Municipal Act” to assist the Township of Wilmot in making a decision. Information will be collected in accordance with the Freedom of Information and Protection of Privacy Act. With the exception of personal information, all comments will become part of the public record.

This Notice issued January 18, 2022.

STRUCTURAL EVALUATION REPORT

FOR

BRIDGE NO. 15/B-NH
BRIDGE NO. 34/B-T9
BRIDGE NO. 37/B-OXF

Prepared For:

THE CORPORATION OF THE TOWNSHIP OF WILMOT

by

K. SMART ASSOCIATES LIMITED
85 McIntyre Drive
Kitchener ON N2R 1H6

FEBRUARY 2018

INDEX

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
85 McIntyre Drive
Kitchener ON N2R 1H6
Tel: (519) 748-1199
Fax: (519) 748-6100
www.ksmart.ca

February 2018

File No. 17-188

STRUCTURAL EVALUATION REPORT

FOR

BRIDGE NO. 15/B-NH
BRIDGE NO. 34/B-T9
BRIDGE NO. 37/B-OXF

TOWNSHIP OF WILMOT

1.0 INTRODUCTION

K. Smart Associates Limited (KSA) was retained by the Township of Wilmot to inspect, complete a structural analysis and provide recommendations for gross weight limits on each of the following bridges:

Bridge No. 15/B-NH located on Shade Street
Bridge No. 34/B-T9 located on Bridge Street
Bridge No. 37/B-OXF located on the Oxford-Waterloo Road

A visual inspection and examination of the four structures was carried out on September 26, 2017 and October 3, 2017 by Trevor Hoard, CET and Darryl Schwartzentruber, C.Tech.

The visual inspection was performed in accordance with the Ontario Structure Inspection Manual (OSIM) and included measurements of all structure members and a recording of all visual deterioration. For details of the visual inspection, refer to the OSIM Report.

The structural evaluation was made in accordance with Section 14 of the Canadian Highway Bridge Design Code 2014.

2.0 EVALUATION METHODOLOGY

The evaluator normally has access to original design drawings to obtain actual member sizes, connection details and specified steel strengths, however no drawings for this structure are available. This requires that individual members be measured in the field and records taken so that either a common section size can be assigned to the member or so that any required section properties can be calculated.

The ultimate limit state will be used in the determination of the load-carrying capacity and load posting of the bridges as outlined in the Canadian Highway Bridge Design Code 2014, Section 14.

The resistance of any member is based on the field measured cross-section less loss of material (5% min. unless otherwise stated) to allow for corrosion and deterioration.

The properties of the original existing materials are not known. Reference is made to Section 14 of the Canadian Highway Bridge Design Code 2014 to establish the grade of steel according to its vintage.

To keep the analysis simple, the structure was modeled assuming truss behavior of the superstructure i.e. only axial forces in each truss member. This is a valid assumption considering the structure was most likely designed as a truss given the date of construction and lack of modern analysis programs. When resistances of individual members were calculated, it was assumed that pin ended connections were present (k=1). It was soon evident that this assumption was not suitable for some members of the truss because unrealistic member resistances were found. As a result, different end conditions (partial fixidity, k=0.8) were assumed for these members and this resulted in satisfactory results. This is summarized in detail later in the report.

Three levels of Ontario truck or lane loading will be used in the load rating and posting of the structures.

This evaluation refers to the capacity of the superstructure only. Section 14 Evaluation does not make reference to the evaluation of the substructure.

The following drawings were made available by the Township of Wilmot:

a) Rehabilitation drawing for Bridge 15/B-NH - 2010
b) Rehabilitation drawing for Bridge 34/B-T9 – 1982 & 2010
c) Rehabilitation drawing for Bridge 37/B-OXF – 1990 & 2014

3.0 EVALUATION

3.1 General

Type of Structure:	Single span steel through truss
Material:	Steel and concrete or timber deck
Highway Classification:	Class C
Deck Finish:	Concrete
Number of Design lanes:	2 for Bridge No. 15/B-NH, 1 for rest
Design Criteria:	Canadian Highway Bridge Design Code 2014

3.2 Material Strengths

Original construction drawings are either not available or grade of materials are not called for. Reference is made to Section 14 of CHBDC.

Steel

Bridge No. 15/B-NH	Bridges No. 34 & 37
Fy = 230 MPa	Fy = 210 MPa
Fu = 420 MPa	Fu = 420 MPa
(for 1933 to 1975 vintage)	(for 1905 - 1932 vintage)

3.3 Dimensions, Thicknesses, Etc.

Sectional dimensions of all structural members were measured in the field. A reduction for deterioration and loss of materials was used in the analysis.

3.4 Analysis

The trusses are analyzed on the assumption that their members are interconnected through pin connections. The maximum axial load in each truss member was computed using Dr. Frame 2.0.2 software. The bending moments and shears in the floor beams and stringers were calculated from first principles (hand calculations) and verified using Dr. Beam software.

3.5 Evaluation Load Factor

The Canadian Highway Bridge Design Code 2014 relates the evaluation load factor to target reliability index of the structure.

3.6 Target Reliability Factor

"The life safety criterion that forms the basis for the reliability indices considers only loss of life resulting directly from the failure of the structure."

The philosophy behind the evaluation of existing bridges is to maintain a consistent level of risk to human life for each element of the bridge. The failure of bridge elements which receive regular inspection, show warning of failure and can redistribute load to other elements are less likely to result in loss of life than the failure of an element lacking one or all of these traits. Therefore, a consistent level of risk to human life is maintained, through the entire structure if a higher probability of failure is accepted in elements which are less likely to produce a loss of life if failure occurs." (CHBDC Commentary)

The risk to human life can be expressed as the probability of failure times the consequences of failure. For bridge evaluation, the annual (or notional) probability of failure (P_f) is used for the determination of a reliability index.

$$P_f = \frac{A\,k}{w\,\sqrt{n}}$$

For normal traffic evaluation

$A = 3.0$
$k = 10^{-4}$
$w = 1.0$ for no warning of failure expected
$n = 10$

$$P_f = \frac{3 \times 10^{-4}}{1 \ \sqrt{10}}$$
$$= 9.5 \times 10^{-5}$$

This notional probability is then reduced in a systematic way to account for improved warning of failure which comes from the following:

a) System Behaviour
The target reliability index is reduced as the effect of failure of an element on the overall integrity of the structure is reduced.

b) Element Behaviour
The target reliability index is reduced for elements which fail in a ductile manner.

c) Inspection Level
The target reliability index is reduced as the level of inspection increases.

3.7 Determination of Load Factor and Dynamic Load Allowance (DLA)

The following table shows the Target Reliability Index (β), Load Factor (∝) and DLA.

	CATEGORY		
	Stringer	Floor Beam	Trusses
System Behaviour	S3	S2	S2
Element Behaviour	E3	E3	E2
Inspection Level	INSP3	INSP3	INSP3
β	2.50	2.75	3.00
∝D	1.05 & 1.10	1.10	1.07
∝L	1.35	1.42	1.49
DLA	1.30	1.30	1.25 or 1.3*

Reference is made to Section 14.11 of the CHBDC 2014.
* *Depending on number of axles. See CHBDC 2014.*

3.8 Live Load Capacity Factor (LLCF)

Live load capacity factor is a factor of the residual loading capacity of the element under consideration.

The CHBDC commentary describes the LLCF as follows:
"The live load capacity factor, F, is the factor by which the evaluation live load has to be multiplied so that the factored capacity of the bridge is not exceeded for the continuation of permanent and live loads under consideration."

For the bridge to carry full loading, i.e. no post load limit, the LLCF must not be less than 1.0. When the LLCF is less than 1.0, posting load limits on the bridge would be recommended. When the LLCF is less than 0.3, closing the bridge to vehicular traffic is recommended.

5.0 BRIDGE NO. 34/B-T9 – BRIDGE STREET

5.1 Description of Structure

The bridge is located on Bridge Street (Township Road 9) over the Nith River and is approximately 0.45 km east of Tye Road (Township Road 13). The bridge was constructed in 1913.

The structure consists of a 45.7m single span steel through truss with an exposed concrete deck road surface. The overall deck width at the bridge is 4.1m for one lane of traffic. The railing is a steel lattice type.

The structure underwent several rehabilitations since 1982. The 1982 rehabilitation included repairs to the abutments and the placement of new concrete deck. In 2006 and 2011 rehabilitation included the repairs of all floor beams, placement of new stringers on the outer edges and repairs to the truss bottom chords at the four ends.

The structure is posted for 11 t loading.

5.2 Field Findings

.1 Superstructure

Deck

- Concrete deck top has an exposed wearing surface and is in good condition with a few narrow transverse cracks in various locations, the deck is severely scoured approximately 1m wide down the middle.
- Steel corrugated deck forms present on underside except at east and west truss panels (good condition); severe rust staining typically evident on exterior edges of steel forms.

Trusses

- Bottom chords typically exhibit medium-to-severe rust with accumulation of debris and gravel. Bottom chords at ends were repaired in 2011.
- Top chords typically shows light to medium rusting. Southwest end diagonal member is severely corroded with loss of material and perforations over 50% of one web for 1.8m. Small perforations at bottom of southeast and northeast main truss diagonals. Northwest end diagonal severely corroded with loss of material and perforations for 2.7m. End diagonal/top chord has numerous perforations near bearing.
- End diagonals exhibit severe corrosion with loss of material and perforations over 50% of inside channel web.
- Connections generally in poor condition with medium to severe rusting of structural steel plates. Perforated stiffener plate between build-up channel of the west portal frame at all bearing locations. Bottom chord connection plates at eight locations are completely deteriorated with the remaining bottom connections in very poor condition due to
severe loss of rivet material.
- First vertical chord from west at north side twisted at bottom

Joints

- Open gap joint at east and west abutment ends, abrasion marks from snowplow on joint steel. Uneven joint at northeast corner of structure

Beams

- All floor beams are severely rusted with perforations and loss of material. Remainder of floor beams exhibit medium to severe rusting with section loss. The severe corrosion at the ends of all beams were repaired in 2005 and 2011.
- Exterior stringers are severely rusted with perforations and loss of material. One outside stringer web has completely disintegrated at end for a distance of 600mm ± (2nd from east at south side). New stringers were placed next to the outside stringers (sistered) in 2011.
- Inside stringers exhibit medium surface rust.

Bracing

- Underside bracing typically severely rusted, perforation holes occur at some of the connections to the bottom truss chords. Three (3) bracings were replaced in 2005.
- End overhead portal bracing is severely damaged due to impact.

Barriers

- Steel lattice type railing is generally in poor condition with bent top and bottom rails, medium rusting, missing rivets, broken, bent and twisted lattice and numerous perforations in bottom rail.
- All end post at bridge corners are severely rusted and disconnected at bottom leaving rails unsupported at the end sections. The railing is generally in poor condition.

.2 *Substructure*

Abutments

- East and west abutments are in poor condition. Previous concrete patch repair (1982) has now mostly delaminated and spalled off exposing severe deterioration on original abutment (60% and 30% of total exposed areas delaminated on west and east abutments respectively). Concrete is missing at northeast corner under bearing.
- Debris accumulated on bearing location at all corners.
- East abutment roller bearing exhibits severe rust and has seized.

Wingwalls

- All wingwalls are in poor condition.

5.3 Summary of Structural Evaluation

CONCRETE DECK

As per Clause 14.14.1.3.1, the concrete deck is assumed to carry full vehicular loading since no structural cracking or punching failures were observed and all requirements surrounding the use of the empirical design method are satisfied. New reinforced concrete deck was placed in 1982.

DECK FRAMING

a) BENDING

					Load Capacity (t)		
Member	MDL	MLL	Mr	LLCF	Level 1	Level 2	Level 3
Floor Beam	94.0	286.0	273.0	0.46	27	20	11
Stringers	20.0	105.0	122.0	0.73	45	32	18

b) SHEAR

					Load Capacity (t)		
Member	SDL	SLL	Sr	LLCF	Level 1	Level 2	Level 3
Floor Beam	76.0	244.0	778.0	2.17	NPR	NPR	NPR
Stringers	14.0	74.0	296.0	2.89	NPR	NPR	NPR

Moments are in kN·m
Shears are in kN
NPR - No posting required
Dead and live loads are factored.
Ø = 0.95
U = 1.00
DLA = 0.25

TRUSSES

					Load Capacity (t)		
Member	DL-kn	LL-kn	R-kn	LLCF	Level 1	Level 2	Level 3
Top Chord							
U1U2	+438	+745	+1383	1.08	NPR	NPR	NPR
U2U3	+498	+833	+1383	0.91	56	40	22
U3U4	+519	+852	+1388	0.87	53	38	21
Bottom Chord							
L1L3	-285	-483	-720	0.84	52	37	20
L3L4	-434	-739	-1124	0.87	53	38	21
L4L5	-504	-828	-1124	0.69	42	31	17
Diags.							
L1U1	+413	+700	+1025	0.74	45	32	18
U1L3	-216	-444	-578	0.76	46	34	19
U2L4	-94	-310	-315	0.67	42	30	16
U3L5	-39	-305	-245	0.64	40	28	15
Verticals							
U1L2	-86	-305	-352	0.82	52	36	20
U2L3	+71	+249	+570	1.78	NPR	NPR	NPR
U3L4	-25	+169	+570	3.19	NPR	NPR	NPR
U4L5	0	-119	-570	4.30	NPR	NPR	NPR

+ Compression
- Tension
NPR - No posting required
Dead loads (DL) and live loads (LL) are factored
Live load includes DLA
See Drawing 3 (***Appendix A***) for joint identification and locations

5.4 Evaluation Findings and Recommendations

The evaluation analysis has indicated that the structure is not adequate to support full Ontario Highway Truck Loading. The loading capacity is limited by the continuous deterioration and loss of material in the floor beams (even after 2010 temporary repairs).

The bridge may be posted as follows:

a) Single posting - 11 t

b) Triple posting
  - 11 t single truck
  - 20 t single truck and trailer
  - 27 t single truck and more than one trailer

c) Axial weights posting
- 4 t single
- 8 t tandem
- 11 t tridem

It is recommended that this bridge remain posted for a single posting of 11 tonnes (maximum).

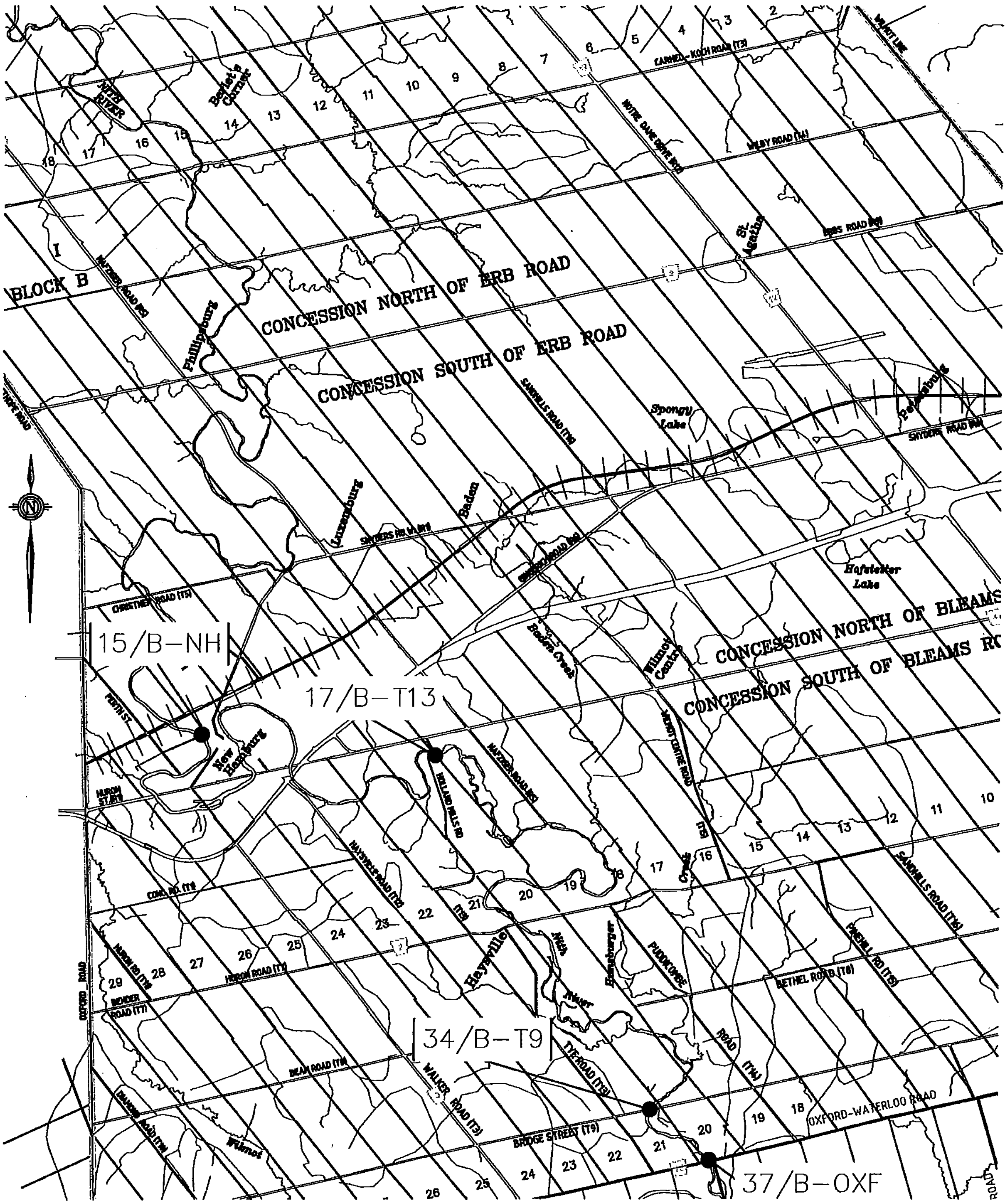
APPENDIX A

KEYPLAN – LOCATION OF STRUCTURES

DRAWING 1 – BRIDGE NO. 15/B-NH

DRAWING 2 – BRIDGE NO. 34/B-T9

DRAWING 3 – BRIDGE NO. 37/B-OXF



N.T.S.

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER NEW LISKEARD SUDBURY RAINY RIVER

KEY PLAN

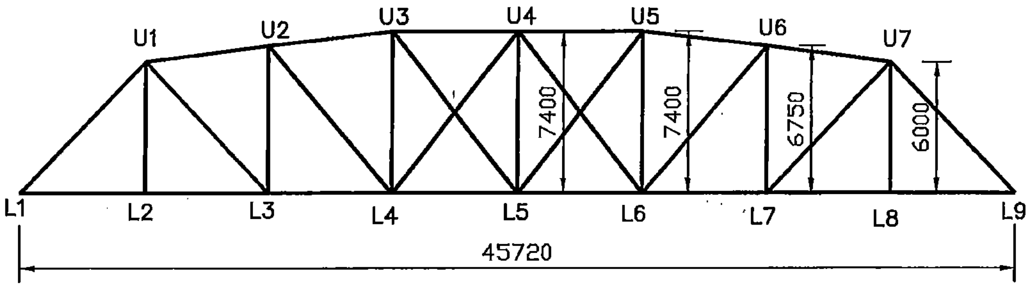
TOWNSHIP OF WILMOT
REGION OF WATERLOO

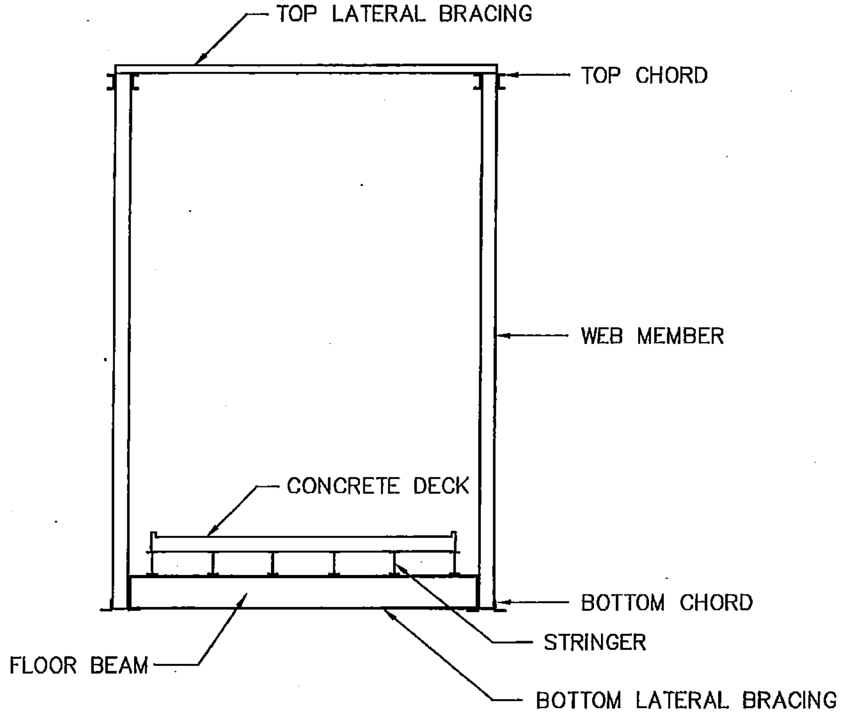
JOB NUMBER
15-102

SEPT 2015

FIGURE
1

\\server\data\2015\15-102\Drafting\KEY MAP FOR STRUCTURE EVALUATION REPORT.dwg KEY PLAN 11-Sep-15 11:12:54 AM





TYPICAL CROSS-SECTION

- EXTERIOR STRINGERS SISTERED WITH NEW STRINGERS IN 2011
- FLOOR BEAM "ENDS" AND 1 ENTIRE FLOOR BEAM REPAIRED IN 2011
- END DIAGONAL MEMBER OF TRUSS HAS SEVERE COROSION THROUGH WEB WITH OVER 50% OF MATERIAL LOSS.

DRAWING 3

BRIDGE NO. 34/B–T9
TOWNSHIP OF WILMOT

3.5 CONSULTATION LOGS

The following consultation logs summarize the various correspondence that occurred during this EA Study.

Township of Wilmot - Bridge 34/B-T9 (Bridge St. Bridge) Replacement

LAST UPDATED March 15, 2022

Agency Consultation Log

Agency Involved	Nature of Communication	Recipient	Communication Type	Received From	Date	Summary of Communication
Ontario Ministry of the Environment, Conservation and Parks (MECP)	Comment	KSAL Township of Wilmot	Email	MECP	2022.03.01	In response to the published Notice of Study Completion, MECP provided the following comments: - MECP provided recommendations for report formatting. - Notice of Study Completion should reflect changes made to the Environmental Assessment Act in July 2020. - Discuss Planning and Policy. - Discuss Climate Change Mitigation and Adaptation. - Provide summary or discussion of comments received during public consultation. - Provide the record of indigenous consultation. - Remind proponent of their responsibility to ensure SAR are not killed, harmed, or harrased, and that their habitat is not damaged or destroyed through the proposed activities to be carried out on the project site. - Remind proponent of O.Reg. 406/19, and the ministry's guidance document titled Management of Excess Soil - A Guide for Best Management Practices. - Remind proponent of plan to install sediment and erosion control measures during construction. - Remind proponent of Permit to Take Water requirements.
	Response	MECP	Email	KSAL	2022.03.16	KSAL addressed and discussed the above-mentioned comments with MECP, and resubmitted a revised Project File to MECP accordingly.

Township of Wilmot - Bridge 34/B-T9 (Bridge St. Bridge) Replacement

Agency Consultation Log

LAST UPDATED March 15, 2022

Agency Involved	Nature of Communication	Recipient	Communication Type	Received From	Date	Summary of Communication
Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI)	Comment	KSAL Township of Wilmot	Email	MHSTCI	2021.04.14	MHSTCI provided comments on the draft CHER / HIA report: - To include an Executive Summary to summarize the findings of the evaluation and the recommendations for impact assessment. - Numerous recommendations mostly consisting of re-organizing the contents of the report. MHSTCI also provided general comments on this project: - Reminder that MHSTCI requires archaeological assessments submitted to them by the licensed archaeologist. - Reminder of the overall process required to consider archaeological concerns being addressed. - Reminder that "A summary of all technical cultural heritage studies and their recommendations are to be incorporated in the final EA report."
	Response	MHSTCI	Email	KSAL	2021.06.29	After meeting earlier with MHSTCI to further discuss their comments (dated 2021.04.14), KSAL revised and then re-submitted the CHER/HIA reports to MHSTCI.

Township of Wilmot - Bridge 34/B-T9 (Bridge St. Bridge) Replacement

Agency Consultation Log

LAST UPDATED March 15, 2022

Agency Involved	Nature of Communication	Recipient	Communication Type	Received From	Date	Summary of Communication
Grand River Conservation Authority (GRCA)	Comment	KSAL Township of Wilmot	Email	GRCA	2021.07.29	After reviewing the draft CHER/HIA and Environmental Screening reports, GRCA provided highlights of GRCA policy requirements to be considered when evaluating different bridge crossing alternatives.
	Response	GRCA	Email	KSAL	2021.08.09	After correspondence between the environmental expert hired by the proponent and GRCA, the parties met on site to discuss GRCA's comments and also perform a field investigation to update ELC mapping. It was also confirmed that wetlands are absent from around the bridge. It was also decided that the environmental expert, Dr Dean Fitzgerald will be updating his environmental report accordingly, and KSAL will conduct a HEC-RAS hydrology modelling.
	Comment	KSAL Township of Wilmot	Email	GRCA	2021.08.19	Having completed a technical review of the natural heritage report, GRCA provided further comments what the revised report should include. They also provided a few advisory comments.
	Response	GRCA	Email	ELM Inc (environmental sub-consultant)	2021.09.17	ELM submitted a revised environmental study report based on GRCA's inputs.
	Update	GRCA	Email	KSAL	2021.11.15	KSAL submitted the completed Hydrology Report for a replacement structure, which included some HEC-RAS modelling results using the model GRCA had provided.
	Comment	KSAL Township of Wilmot	Email	GRCA	2021.11.15	GRCA also asked KSAL to send them the modified version of the HEC-RAS model.
	Response	GRCA	Email	KSAL	2021.11.16	KSAL sent GRCA the modified version of the HEC-RAS model.
	Comment	KSAL Township of Wilmot	Email	GRCA	2021.12.09	GRCA provided technical comments on the hydraulic model that was sent to them by KSAL.
	Response	GRCA	Email	KSAL	2022.02.10	KSAL sent GRCA an updated hydrology reprot and HEC-RAS modelling, implementing GRCA's prior technical comments.

Township of Wilmot - Bridge 34/B-T9 (Bridge St. Bridge) Replacement

LAST UPDATED March 15, 2022

Agency Consultation Log

Agency Involved	Nature of Communication	Recipient	Communication Type	Received From	Date	Summary of Communication
Heritage Wilmot Advisory Committee	Comment	KSAL Township of Wilmot	Email	Heritage Wilmot Advisory Committee	2021.10.26	Heritage Wilmot reviewed the CHER/HIA reports and commented accordingly: "Should the decision be made to replace the existing structure with a new one, Heritage Wilmot encourages the project team to consider the possible reuse of the bridge span to serve the public, for example, as a section of trail within the Township. Failing the ability to reuse the structure, Heritage Wilmot would support the creation of a commemorative feature utilizing salvage materials from the bridge."
	Response	Heritage Wilmot Advisory Committee	Email	Township of Wilmot	-	The Township is looking into the option of relocating the existing bridge.

Township of Wilmot - Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Public Consultation Log

LAST UPDATED March 15, 2022

Address / Public Entity Involved	Nature of Communication	Recipient	Communication Type	Received From	Date	Summary of Communication
Waterloo Region Nature (WRN)	Comment	K Smart Associates Limited (KSAL)	Email	WRN	2020.08.17	As a response to the published Notice of Study Commencement, the sender provided the following comments: "We suggest, should a new bridge be chosen, that the span be increased to reduce flow velocity and upstream water levels during flood events." "We believe also, from member observations, that flood frequency and intensity are increasing in recent years, probably due to climate change. No doubt you will be considering these factors during the Class EA." "We also request that provision be made during the design of the bridge and approaches, for a pedestrian access ramp or stairs down the embankment to our property." "We request consideration of parking along the road shoulder for WRN members and others who wish to access our property. This aspect is of particular concern as the new bridge will likely be two-lane. Traffic speed and volume is likely to increase as a consequence."
	Response	WRN - David Gascoigne	Email	KSAL	2021.08.06	KSAL sent WRN a letter, providing them an update on the project and on the status of WRN's comments provided on 2020.08.17. "we have been able to address some of your requests. These requests include providing a larger structure and providing better access to Waterloo Region Nature's property. Unfortunately, we are unable to provide on street parking." "we are providing a field entrance that can be used to access the property directly." "We do note, however, that the entrance needs to be located beyond the limit of the guide rail and the east property line." KSAL also offered to "arrange a meeting near the site to further discuss this project and its potential impact to Waterloo Region Nature's property."
	Update	WRN - David Gascoigne	Email	KSAL	2021.08.06	KSAL sent WRN draft preliminary design drawings showing the proposed work. KSAL offered WRN to meet on site, should they want to further discuss the project. KSAL also mentioned that there will be an upcoming virtual Public Information Centre, for which WRN will be receiving a formal notification soon.

Address / Public Entity Involved	Nature of Communication	Recipient	Communication Type	Received From	Date	Summary of Communication
3302 Bridge St - Anne Loeffler	Comment	Township of Wilmot	Email	3302 Bridge St - Anne Loeffler	2021.10.30	"I am concerned about the effect on traffic volume, and how this will impact my personal safety. Please note that the issues described pertain to both my lane and the Leis lane (3303) on the south side of the road." "I expect traffic to increase dramatically since Bridge St will become a more popular route for traffic from the 401 to reach Hwy 7/8 while bypassing Kitchener." "The issue is the height and steepness of the hill on the west side of the bridge." "I'm also concerned about the safety of the mail carrier at our mailboxes, the waste disposal crews picking up waste, and any large trucks that need to back out of our lanes." "I'm requesting that the Township consider what options would be available to address this significant safety issue if the bridge is replaced, and how this will impact the overall cost of the bridge replacement project." *The resident also asked for a few clarifications on the material provided in the Virtual Public Information Centre presentation*
3303 Bridge St - Wes and Janice Leis	Comment	Township of Wilmot	Email	3303 Bridge St - Wes and Janice Leis	2021.10.31	Wes and Janice sent the proponent an email as their feedback to the Virtual Public Consultation. Their comments were as follows: "We are concerned about the safety issues which currently exist and will only get worse with the new bridge." "This road is also being used as a speedway and raceway. leaving much of their rubber on the bridge and the road on the hill prior to our drive way." "it might help if we had signs up to inform people of possible dangers to citizens living in the area." "Preferred 60km and Hidden Driveway sign in this area would be great."

Township of Wilmot - Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Public Consultation Log

LAST UPDATED March 15, 2022

Address / Public Entity Involved	Nature of Communication	Recipient	Communication Type	Received From	Date	Summary of Communication
3302 Bridge St - Anne Loeffler & 3303 Bridge St - Wes and Janice Leis	Response	3302 Bridge St - Anne Loeffler	Site meeting, then discussions summarized via email	KSAL	2021.11.09	KSAL, Township of Wilmot, Anne Loeffler, Wes and Janice Leis, met at the Bridge St Bridge site to discuss the project and residents' comments. A summary of the discussion is as follows: "Bridge Street will be designed and posted for 60 km/hr between the limits of construction. We discussed the evaluation methodology used and how this was established and reviewed by the Township. We also provided comment on why each criterion has the same weight. We also discussed the ranking system and what other consultants use. Bridge Street will be raised about 1.5m (5 feet) overtop the bridge. The tie-in points are east of the driveways west of the bridge and east of the field entrance at the northeast corner of the bridge. The new bridge will have a width of 9.0m (29.5 feet) between the railings. There will be a 1.0m (3 feet) shoulder on both sides. This information is taken directly from the preliminary design drawings. The roadway width will be maintained at 6.7m (22 feet) and shoulders will be provided on both sides of the road. The shoulder width will be 1.15m (3.75 feet). Again, this information is taken directly from the preliminary design drawings. The new bridge will be similar in appearance to Bridge 20 in Blandford Blenheim Township. We sent a Google Pin of the location in a separate email. We are providing a “widened shoulder” at the northeast corner to facilitate parking for people using Waterloo Region Nature’s property. We have already spoken to Hardy Weiss regarding the field entrance at the northwest corner of the bridge. This field entrance will be moved further west. We anticipate construction to begin in July 2022 and be completed in June 2023 with a winter shutdown between January and March. Bridge Street will be closed during the construction. The estimated construction cost is 3.5 million. We will include a drawing (in the tender drawing set) showing the required signage; this will include “hidden driveway” signage. We are still finalizing the Hydrology Report. GRCA has requested HEC RAS modeling which we are just finalizing. The proposed bridge has been sized using other methods which were used for at least 2 other structures over the Nith River. We confirmed that the proposed work will stop short of your driveways. This is why neither of your laneways are referenced in the Preliminary Design Drawings. We confirmed that no property acquisitions are required. That is, all the work can be completed within the Township’s right-of-way." "Once a new bridge is constructed, the Township anticipates 10% truck traffic and a standard annual AADT increase of around 2% per year."

Township of Wilmot - Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Public Consultation Log

LAST UPDATED March 15, 2022

Address / Public Entity Involved	Nature of Communication	Recipient	Communication Type	Received From	Date	Summary of Communication
1219018 Ontario Inc - Hardy Weiss (part owner of the property at the northwest corner of the bridge)	Update	1219018 Ontario Inc - Hardy Weiss (part owner of the property at the northwest corner of the bridge)	Email	KSAL	2021.08.04	KSAL sent Hardy draft preliminary design drawings showing the proposed work. KSAL also notified Hardy that access to their property will be maintained from Tye Road during the duration of construction. KSAL also mentioned that there will be an upcoming virtual Public Information Centre, for which Hardy will be receiving a formal notification soon.
	Comment	KSAL	Phonecall	1219018 Ontario Inc - Hardy Weiss (part owner of the property at the northwest corner of the bridge)	2021.08.25	KSAL spoke with Hardy and confirmed that he does not have any concerns with the bridge replacement, and moving field entrance at northwest further west.
	Response	Comment addressed during phone conversation above.				
Ralph Cressman - Farms the land northwest of Nith River	Comment	KSAL	Email	Ralph Cressman - Farms the land northwest of Nith River	2022.02.07	Ralph emailed KSAL and Township and commented on what their ideal driveway would be.
	Response	Ralph Cressman - Farms the land northwest of Nith River	Email	KSAL	2022.02.07	KSAL sent Ralph drawings showing details of the proposed work, to which Ralph did not make any objections.
3245 Bridge St - Steve and Sharon Schnore	Update	3245 Bridge St - Steve and Sharon Schnore	Email	KSAL	2021.08.06	KSAL sent Steve and Sharon draft preliminary design drawings showing the proposed work. KSAL also notified Hardy that access to their property will be maintained from Puddicombe Road during the duration of construction. KSAL also mentioned that there will be an upcoming virtual Public Information Centre, for which Hardy will be receiving a formal notification soon.

Township of Wilmot - Bridge 34/B-T9 (Bridge St. Bridge) Replacement

Public Consultation Log

LAST UPDATED March 15, 2022

Address / Public Entity Involved	Nature of Communication	Recipient	Communication Type	Received From	Date	Summary of Communication
Yvonne Zyma - 28 Bleams Road East, New Hamburg	Comment	KSAL Township of Wilmot	Email	Yvonne Zyma - 28 Bleams Road East, New Hamburg	2021.10.31	Yvonne povided comments after reviewing the virtual Public Information Centre. The comments revolved around: - concern about losing the heritage value that the existing Bridge St Bridge provides; - asked for clarification on the rationality behind the alternative evaluation methodology; - concern about traffic speed on Bridge St once the proposed alternative is completed
	Response	Yvonne Zyma - 28 Bleams Road East, New Hamburg	Email	KSAL	2021.11.08	KSAL responded to Yvonne's email, addressing each of her comments.

Allan Garnham

From:	Taslema Khan <taslema.khan@infc.gc.ca>
Sent:	January 26, 2022 3:31 PM
To:	Allan Garnham
Cc:	patrick.kelly@wilmot.ca; 'grant.whittington@wilmot.ca'; 'barb.mcleod@wilmot.ca'; Meng Koh; Luke Maybury; Gordon Voogd; Miguel Iriondo; Jillian.Soule@ontario.ca; Mary.Wyga@ontario.ca; jane.adair@ontario.ca; ICIPRural@ontario.ca; POB Ontario / Ontario DGOP (INFC)
Subject:	REQUIREMENTS MET: Indigenous Consultation and Environmental Assessment Obligations for the Replacement of Structure 34/B-T9 over the Nith River Project (ICIP 54563)

Good afternoon Allan,

Please be advised that Infrastructure Canada (INFC) has received consultation related documents for the proposed Replacement of Structure 34/B-T9 over the Nith River Project (ICIP 54563). Upon review, INFC is satisfied with the Indigenous consultation completed by the Township of Wilmot and confirms that Infrastructure Canada's Indigenous consultation obligations for the proposed project have been met, as they were outlined in the letter dated April 27, 2020.

Note, should the Township of Wilmot consider future changes to the nature, design, location, start or end date of the Project, please immediately notify INFC so we may re-evaluate our legislative requirements.

Please do not hesitate to contact me should you have any questions or concerns.

King regards,

Taslema Khan
Environmental Reviews and Approvals Analyst

Environmental Assessment and Indigenous Consultation
Infrastructure Canada/Government of Canada
taslema.khan@infc.gc.ca/ (343) 551-0416

Évaluation Environnementale et Consultation Autochtone
Infrastructure Canada/ Gouvernement du Canada
taslema.khan@infc.gc.ca/ (343) 551-0416

Canadä

From: Koh, Meng (INFC)
Sent: April 27, 2020 12:09 PM
To: 'patrick.kelly@wilmot.ca' <patrick.kelly@wilmot.ca>
Cc: 'grant.whittington@wilmot.ca' <grant.whittington@wilmot.ca>; 'barb.mcleod@wilmot.ca' <barb.mcleod@wilmot.ca>; 'bryan.bishop@wilmot.ca' <bryan.bishop@wilmot.ca>; Voogd, Gordon (INFC) <gordon.voogd@canada.ca>; MacFarlane, Shainah (INFC) <shainah.macfarlane@canada.ca>; Iriondo, Miguel (INFC) <miguel.iriondo@canada.ca>; Khan, Taslema (INFC) <taslema.khan@canada.ca>; 'stephen.direnzo@ontario.ca' <stephen.direnzo@ontario.ca>; 'grace.kahara@ontario.ca' <grace.kahara@ontario.ca>; 'ICIPRural@ontario.ca' <ICIPRural@ontario.ca>

Subject: RE: Indigenous Consultation and Environmental Assessment Obligations for the Replacement of Structure 34/B-T9 over the Nith River Project (ICIP 54563)

Good afternoon Mr. Kelly,

Please find attached a letter dated April 27, 2020, regarding Infrastructure Canada's Environmental Assessment and Indigenous Consultation determination for the Replacement of Structure 34/B-T9 over the Nith River Project (ICIP 54563).

Please do not hesitate to share this letter with any person involved in this project who should have been included in this email. As the letter notes, if you or anyone involved in this project should have any questions, please contact Taslema Khan via email (taslema.khan@canada.ca) or phone call at (343) 551-0416.

Kind regards,

Meng Koh, Fitwel Amb.
Senior Environmental Review and Approvals Officer
180 Kent St., Ottawa, Ontario K1P 0B6
Infrastructure Canada / Government of Canada
meng.koh@canada.ca / Tel: 343-551-0418

Agent principal d'examen environnemental et approbations
180, rue Kent, Ottawa, Ontario K1P 0B6
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Detailed Correspondence Log

LAST UPDATED January 26, 2022
Township of Wilmot
Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Aboriginal Consultation Log

Correspondence #	Aboriginal Community / Stakeholder	Recipient	Communication Type	Received From	Phone Number	Time of Call	Date	Communication Details	Concern Raised	Concern Addressed
1	All	Township of Wilmot	Email	Meng Koh (INFC) (meng.koh@canada.ca)	-	-	2020.04.20	In this email, INFC sent their determination letter to the Township of Wilmot, giving instructions regarding the Aboriginal Consultation process, and which Aboriginal communities may be impacted by the project. The proponent is instructed to contact said communities.	-	-
2	All	K Smart Associates Limited (KSAL)	Email	Township of Wilmot	-	-	2020.08.18	The letter of determination was forwarded to KSAL.	-	-
3	All	KSAL & Township of Wilmot	Email	Barb Slattery (MECP) (barbara.slattery@ontario.ca)	-	-	2020.08.24	Received Acknowledgement letter from MECP, which included suggested Aboriginal communities to contact for consultation.	-	-
4	Metis Nation of Ontario	mno@metisnation.org	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.04	Emailed them to confirm preferred person of contact in their organization.	-	-
5	Haudenosaunee Confederacy	hdi2@bellnet.ca	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.04	Emailed them to confirm preferred person of contact in their organization.	-	-
6	Six Nations of the Grand River	Tammy (chief's assistant)	Phonecall	Pedram Yazdan Panah (K Smart Associates)	(519) 445-2201	Roughly 4pm	2020.09.04	KSAL called them to confirm preferred person of contact in their organization. KSAL was transferred to Tammy, the chief's assistant. Was instructed to send letter by mail, addressed to the chief, and then it would be given to the right person. She also confirmed their mailing address.	-	-
7	Mississaugas of the Credit First Nation	Chief Stacey LaForme	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.04	Emailed them to confirm preferred person of contact in their organization.	-	-
8	Mississaugas of the Credit First Nation	Pedram Yazdan Panah (K Smart Associates)	Email	Chief Stacey LaForme	-	-	2020.09.05	Chief Stacey replied to KSAL's email in which they were asked to confirm preferred person of contact in their organization. His response: "Fawn sault in our duty to consult office would be the appropriate contact"	-	-
9	Haudenosaunee Confederacy	Hohahes Leroy Hill (jocko@sixnations.ca)	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.09	After attempting to call Secretary Hill, KSAL sent an email asking who the preferred person of contact in their organization would be.	-	-
10	Mississaugas of the Credit First Nation	Receptionist	Phonecall	Pedram Yazdan Panah (K Smart Associates)	905-768-4260	10:49am	2020.09.09	Called to verify mailing address to send EA Study Commencement notification commencement to Fawn Sault. It's: 4065 Hwy 6, Hagersville, ON, N0A 1H0	-	-
11	Metis Nation of Ontario	Linda Norheim & Ted Cousins	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.09	Emailed Linda and Ted to confirm preferred address for communication	-	-
12	Metis Nation of Ontario	Pedram Yazdan Panah (K Smart Associates)	Email	Linda Norheim & Ted Cousins	-	-	2020.09.09	Linda and Ted responded to my email, and said consultations@metisnation.org would be best for contact	-	-
13	Metis Nation of Ontario	consultations@metisnation.org	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.09	Emailed to ask for mailing address to send out physical copy of notification	-	-
14	**Mississaugas of the Credit First Nation**	**Pedram Yazdan Panah (K Smart Associates)**	**Email**	**Fawn Sault**	-	-	**2020.09.09**	**I was informed that "MCFN requires our Field Liaison Representatives (FLR's) on location while any fieldwork is occurring." and was asked about field work progress status**	-	-
15	Mississaugas of the Credit First Nation	Garth Grimes: garth@golden.net (Detritus Consulting Ltd.)	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.09	Emailed Garth and asked him to hold off on fieldwork because the MCFN would want to be involved in the archaeological investigation.	-	-
16	**Mississaugas of the Credit First Nation**	**Pedram Yazdan Panah (K Smart Associates)**	**Email**	**Fawn Sault**	-	-	**2020.09.10**	**Fawn reached out to KSAL and the Township to set up a video conference for everyone to introduce themselves and for MCFN to share their history with us.**	-	-
17	Haudenosaunee Confederacy	Hohahes Leroy Hill (jocko@sixnationsns.com)	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.10	Emailed a new address in an attempt to establish contact with the Haudenosaunee Confederacy.	-	-
18	**Six Nations of the Grand River**	**Mark Hill**	**Email**	**Pedram Yazdan Panah (K Smart Associates)**	-	-	**2020.09.10**	**Emailed the group to give them an electronic notice of study commencement and INFC funding, in addition to sending them hard copies.**	-	-
19	**Mississaugas of the Credit First Nation**	**Fawn Sault**	**Email**	**Pedram Yazdan Panah (K Smart Associates)**	-	-	**2020.09.10**	**Emailed the group to give them an electronic notice of study commencement and INFC funding, in addition to sending them hard copies.**	-	-
20	**Haudenosaunee Confederacy**	**hdi2@bellnet.ca & jocko@sixnationsns.com**	**Email**	**Pedram Yazdan Panah (K Smart Associates)**	-	-	**2020.09.10**	**Emailed the group to give them an electronic notice of study commencement and INFC funding, in addition to sending them hard copies.**	-	-
21	**Metis Nation of Ontario**	**consultations@metisnation.org**	**Email**	**Pedram Yazdan Panah (K Smart Associates)**	-	-	**2020.09.10**	**Emailed the group to give them an electronic notice of study commencement and INFC funding, in addition to sending them hard copies.**	-	-
22	**Mississaugas of the Credit First Nation**	**Pedram Yazdan Panah (K Smart Associates)**	**Email**	**Megan.DeVries@mncfn.ca**	-	-	**2020.09.11**	**Megan from MCFN's DOCA provided the following documents for the Township's review and approval:**	-	-
					-	-		-DOCA Project Response Letter re Archaeological Review [2020]	-	-
					-	-		-DOCA Project Response Letter re FLR Participation [2020]	-	-
					-	-		-MCFN Standards and Guidelines for Archaeology [2020]	-	-

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					-	-		-MCFN Standards and Guidelines for Archaeology [2020]	-	-
					-	-		-DOCA Archaeological Review Agreement [2020]	-	-
23	Mississaugas of the Credit First Nation	Dean Fitzgerald (ELM)	Phonecall	Pedram Yazdan Panah (K Smart Associates)	226-606-1072	2:30pm	2020.09.18	Called Dean and informed him that MFCFN would like to be involved with the environmental investigation. Dean said he'd like to do it before October 12.	-	-
24	Mississaugas of the Credit First Nation	Jeff Molenhuis & Mark Jeffrey from the Township of Wilmot, and Allan Garnham from K Smart Associates Limited.	MS Teams meeting	Pedram Yazdan Panah (K Smart Associates)	MS Teams meeting	2:00-2:30pm	2020.09.21	MS Teams video meeting to discuss next steps in consulting with MCFN's DOCA department.	-	-
25	Mississaugas of the Credit First Nation	Megan.DeVries@mncfn.ca	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.21	KSAL asked Megan from MCFN for some clarifications regarding the documents provided on 2020.09.11	-	-
26	Mississaugas of the Credit First Nation	Fawn.Sault@mncfn.ca	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.21	In order to facilitate a response from MCFN, KSAL also asked Fawn from MCFN for some clarifications regarding the documents provided on 2020.09.11	-	-
27	Mississaugas of the Credit First Nation	Garth Grimes: garth@golden.net (Detritus Consulting Ltd.)	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.22	Garth confirmed that the MHSTCI has not yet issued a letter of entry into register for the study area.	-	-
28	Mississaugas of the Credit First Nation	Fawn Sault (Consultation Coordinator)	Phonecall	Pedram Yazdan Panah (K Smart Associates)	289-527-6580	Roughly 11:00am	2020.09.22	Called Fawn to follow up on an email KSAL had sent out yesterday, asking a few questions regarding MCFN's agreements and Requests for Missing Information. Unfortunately no response to the phonecall.	-	-
29	Mississaugas of the Credit First Nation	Pedram Yazdan Panah (K Smart Associates)	Phonecall	Mark LaForme (Director of DOCA)	519-748-1199	Roughly 11:00am	2020.09.23	Mark LaForme called to follow up on / provide answers to a few questions KSAL has been asking about the agreement. The following were his instructions;	-	-
								1. Use the "track change" feature from MS Word to change the invoice information to what KSAL is proposing, and if DOCA accepts, they will "accept" it in the file.	-	-
								2. In the PDF file MCFN FLR Participation, there is a question asking about short-term / long-term protection strategies. Since we're unaware of any in place, Mark said KSAL can just say "no", and if need be, measures will be implemented through the consultation process	-	-
30	Mississaugas of the Credit First Nation	Mark LaForme (Director of DOCA)	Phonecall	Pedram Yazdan Panah (K Smart Associates Limited)	905-768-4260	Roughly 2:30pm	2020.09.24	Per Allan's (KSAL) request, called Mark LaForme to ask whether the monthly compounding interest of 5% is negotiable. He said KSAL could change it to 3% in the agreements.	-	-
31	Mississaugas of the Credit First Nation	Mark LaForme: Mark.LaForme@mncfn.ca	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.24	Sent draft of filled contract documents to Mark LaForme and Megan DeVries from MCFN's DOCA for theor review. Per their approval, KSAL reduced the compounded interest rate from 5% to 3% when submitting this draft to them.	-	-
32	Mississaugas of the Credit First Nation	Mark LaForme (Director of DOCA)	Phonecall	Pedram Yazdan Panah (K Smart Associates Limited)	905-768-4260	9:14am	2020.09.25	KSAL Spoke with Mark LaForme to confirm whether MCFN would be open to us attempting to have the Environmental and Archaeological studies be undertaken on the same day. He suspected that that shouldn't be an issue, and suggested his Archaeological Assessment supervisor, Megan, call KSAL on Monday Sept. 28, 2020 to have a general and more technical discussion about the study.	-	-
33	Mississaugas of the Credit First Nation	Pedram Yazdan Panah (K Smart Associates Limited)	Zoom Call	Mark LaForme (Director of DOCA)	Zoom Call	9:30am - 10:00am	2020.09.28	Attendants from MCFN were Mark LaForme, Megan, Peter. Attendants from KSAL were Allan Garnham and Pedram Yazdan Panah. We discussed general matters regarding archaeology and environmental field works. KSAL said that they'll get schedule from Detritus (archaeological subconsultant) and ELM (environmental subconsultant), and relay them to MCFN.	-	-
34	Mississaugas of the Credit First Nation	Pedram Yazdan Panah and Allan Garnham (KSAL), and Mark Jeffery and Jeff Molenhuis (Township of Wilmot)	Zoom Call	Mark Laforme, Megan DeVries, Fawn Sault, Darin	Zoom Call	10:00am - 11:20am	2020.09.29	In this meeting, MCFN shared with us their history, treaties and land claims. They also gave us the opportunity to ask for questions and clarifications. Everyone seems to be in agreement with each other and expressed that their looking forward to working together.	-	-
35	Mississaugas of the Credit First Nation	Dean (ELM)	Phonecall	Pedram Yazdan Panah (K Smart Associates Limited)	226-606-1072	Morning	2020.09.30	KSAL had a phone conversation with Dean (ELM) on morning of Thursday September 30, 2020. Emphasized to ELM that MCFN requires to participate in any environmental investigation.	-	-
36	**Mississaugas of the Credit First Nation**	**Pedram Yazdan Panah (K Smart Associates Limited)**	**Email**	**Megan.DeVries@mncfn.ca**	-	-	**2020.09.30**	**Received email from Megan (MCFN), which cc'd Mark LaForme (MCFN), Allan Garnham (KSAL), Mark Jeffery and Jeff Molenhuis (Township of Wilmot). The email contained attached fully executed "Review" and "FLR" agreements.**	-	-

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37	Mississaugas of the Credit First Nation	Megan.DeVries@mncfn.ca	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.30	Sent information to MCFN, which they required for their FLR to attend site on the next day for the environmental investigation.	-	-
38	Mississaugas of the Credit First Nation	Dean Fitzgerald (ELM)	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.09.30	Emailed ELM, and emphasizing that that MCFN requires to be on site whenever there is an environmental investigation.	-	-
39	Mississaugas of the Credit First Nation	Megan.DeVries@mncfn.ca	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.10.08	Emailed Megan DeVries and Mark LaForme and asked whether they'll have FLR available for October 13, 2020 Archaeology and Environmental investigations.	-	-
40	Mississaugas of the Credit First Nation	Joelle Williams (Joelle.Williams@mncfn.ca)	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.10.08	Joelle from MCFN said they have added the Oct 13 field work to their tentative schedule, and requested the generic information for their FLR.	-	-
41	Mississaugas of the Credit First Nation	Joelle Williams (Joelle.Williams@mncfn.ca)	Email	Pedram Yazdan Panah (K Smart Associates)	-	-	2020.10.09	Sent MCFN the required information for their FLR to attend site on October 13.	-	-
42	**Mississaugas of the Credit First Nation**	**Detritus and MCFN**	**Email**	**Pedram Yazdan Panah (K Smart Associates)**	-	-	**2020.10.13**	**After discussion with Chris (MCFN's FLR) when on site today, he indicated that a 30 meter width for scope of the archaeological investigation is not sufficient, and he proposed we double that to 60 meter. The sub-consultant, Detritus, KSAL and the Township took action accordingly. In the following couple of hours, KSAL officially proposed the change to Detritus for the archaeological investigation's scope, and cc'd MCFN and the Township to the email. Afterwards, KSAL had a phonecall with Detritus and confirmed that there are no issues with the proposed change and the investigation proceeded accordingly.**	**X**	**X**
43	All	Mark Jeffery (Township of Wilmot) Jeff Molenhuis (Township of Wilmot) Pedram Yazdan Panah (KSAL) Allan Garnham (KSAL)	Email	Taslema Khan (INFC) taslema.khan@canada.ca	-	-	2021.02.24	After reviewing the project's Aboriginal Consultation Log completed so far, INFC advised Wilmot Twp and KSAL that "consultation efforts have been reasonable and therefore satisfied". With respect to the MCFN, INFC advised that "consultation is considered ongoing and that "When providing the final reports to the First Nation for review and comments, to cc Taslema and the general inbox: infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca.		
44	**Six Nations of the Grand River; Mississaugas of the Credit First Nation**	**Mark Jeffery (Township of Wilmot)** **Jeff Molenhuis (Township of Wilmot)** **Pedram Yazdan Panah (KSAL)** **Allan Garnham (KSAL)**	**Email**	**Meng Koh (INFC) (meng.koh@canada.ca)**	**-**	**-**	**2021.04.27**	**- INFC advised KSAL and Wilmot Twp that Taslema's role changed with INFC and Meng Koh will be managing the project file moving forward.** **- Meng asked for a follow up on the status of the two draft reports to be sent to MCFN** **- Meng also advised the following: "INFC recently discovered that there was a change in the consultation contact for the Six Nations of the Grand River and is requesting that your team reach out to notify them of the project and afford an opportunity to review and provide comments."**	**X**	**X** **(Addressed on April 3, 2021)**
45	Six Nations of the Grand River	Six Nations of the Grand River	Phonecall	Pedram Yazdan Panah (KSAL)	519-753-0665	Approx 10:50am	2021.04.29	Per INFC's instruction, called the number provided to us. The person that picked up, transferred Pedram to Robbin Vanstone's phone, and it went to voicemail. Pedram introduced himself, and described the project, and then asked whether Six Nations of the Grand River is aware of the project. Pedram then provided his contact information before ending the call.		
46	Six Nations of the Grand River	Six Nations of the Grand River	Phonecall	Pedram Yazdan Panah (KSAL)	519-753-0665	10:00am	2021.04.30	Pedram Attempted to contact Robbin Vanstone again. The person that picked up, transferred Pedram to Robbin's phone. Robbin was not available to pick up, and the call went to voicemail.		

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47	Six Nations of the Grand River	Robbin Vanstone, Consultation Supervisor, rvanstone@sixnations.ca; Pedram also cc'd: meng.koh@canada.ca; infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca; miguel.iriondo@canada.ca; shainah.macfarlane@canada.ca; gordon.voogd@canada.ca; mark.jeffery@wilmot.ca; jeff.molenhuis@wilmot.ca; curtis.schaerer@wilmot.ca; AGarnham@ksmart.ca;	Email	Pedram Yazdan Panah (KSAL)	-	-	2021.05.03	Pedram emailed Robbin Vanstone (Six Nations of the Grand River) with the purpose of ensuring Six Nations of the Grand River is aware of this project.		
48	Six Nations of the Grand River	Pedram Yazdan Panah (KSAL); and the following: meng.koh@canada.ca; infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca; miguel.iriondo@canada.ca; shainah.macfarlane@canada.ca; gordon.voogd@canada.ca; mark.jeffery@wilmot.ca; jeff.molenhuis@wilmot.ca; curtis.schaerer@wilmot.ca; AGarnham@ksmart.ca;	Email	Six Nations of the Grand River	-	-	2021.05.03	Robbin Vanstone responded to KSAL's email that was sent to notify Six Nations of the Grand River earlier on the same day, with the purpose of ensuring Six Nations of the Grand River is aware of this project. Robbin advised that: - The project lies within their treaty land and is subject to the unresolved land rights issues of the Six Nations of the Grand River and litigations against Canada and Ontario; -Six Nations of the Grand River is concerned about any development relating to air, land, water and resources which occur throughout their treaty territory and any archeological issues associated with such development(s); - the Nith River is a tributary of the Grand River which is central to their Treaty Territory and they would want to ensure that this project does not impact the environment.		
49	Six Nations of the Grand River	Robbin Vanstone, Consultation Supervisor, rvanstone@sixnations.ca; Allan also cc'd: meng.koh@canada.ca; infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca; miguel.iriondo@canada.ca; shainah.macfarlane@canada.ca; gordon.voogd@canada.ca; mark.jeffery@wilmot.ca; jeff.molenhuis@wilmot.ca; curtis.schaerer@wilmot.ca; pyazdan@ksmart.ca;	Email	Allan Garnham (KSAL)	-	-	2021.05.05	Allan responded to Robbin with details on what has and has not been done so far with respect to this project.		
50	Mississaugas of the Credit First Nation	Fawn Sault, Consultation Coordinator, Fawn.Sault@mncfn.ca; Pedram also cc'd: mark.jeffery@wilmot.ca; agarnham@ksmart.ca;	Email	Pedram Yazdan Panah (KSAL)	-	-	2021.06.29	Pedram forwarded the latest revision of the CHER/HIA report to MCFN.		
51	Six Nations of the Grand River	Robbin Vanstone, Consultation Supervisor, rvanstone@sixnations.ca; Pedram also cc'd: mark.jeffery@wilmot.ca; agarnham@ksmart.ca;	Email	Pedram Yazdan Panah (KSAL)	-	-	2021.06.30	Pedram forwarded the latest revision of the CHER/HIA report to SNGR.		

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52	**Mississaugas of the Credit First Nation** **Six Nations of the Grand River**	**Mississaugas of the Credit First Nation:** **Fawn Sault, Consultation Coordinator, Fawn.Sault@mncfn.ca;** **Pedram also cc'd:** **mark.jeffery@wilmot.ca;** **agarnham@ksmart.ca;** **Six Nations of the Grand River:** **Robbin Vanstone, Consultation Supervisor, rvanstone@sixnations.ca;** **Pedram also cc'd:** **mark.jeffery@wilmot.ca;** **agarnham@ksmart.ca;**	**Email**	**Pedram Yazdan Panah (KSAL)**	**-**	**-**	**2021.07.13**	**Pedram forwarded the Environmental Screening report to MCFN and SNGR for their use.**		
53	**Mississaugas of the Credit First Nation** **Six Nations of the Grand River**	**Mississaugas of the Credit First Nation:** **Fawn Sault, Consultation Coordinator, Fawn.Sault@mncfn.ca;** **Pedram also cc'd:** **mark.jeffery@wilmot.ca;** **agarnham@ksmart.ca;** **Six Nations of the Grand River:** **Robbin Vanstone, Consultation Supervisor, rvanstone@sixnations.ca;** **Pedram also cc'd:** **mark.jeffery@wilmot.ca;** **agarnham@ksmart.ca;**	**Email**	**Pedram Yazdan Panah (KSAL)**	**-**	**-**	**2021.07.19**	**Pedram forwarded the Stage 1-2 Archaeological Assessment report to MCFN and SNGR for their use.**		
54	Six Nations of the Grand River	Pedram Yazdan Panah (KSAL) Robbin also cc'd: - mark.jeffery@wilmot.ca - AGarnham@ksmart.ca - tanyahill-montour@sixnations.ca	Email	Robbin Vanstone (Six Nations of the Grand River)	-	-	2021.07.20	SNGR acknowledged the receipt of the Archaeological Assessment report, and advised KSAL to send all future archaeology-related emails to Tanya Hill-Montour, who was cc'd to this email.		
55	Mississaugas of the Credit First Nation	Pedram Yazdan Panah (KSAL) Erika also cc'd: Megan.DeVries@mncfn.ca mark.jeffery@wilmot.ca AGarnham@ksmart.ca Fawn.Sault@mncfn.ca	Email	Mississaugas of the Credit First Nation: Erika Johannsen Field Archaeologist Erika.Johannsen@mncfn.ca	-	-	2021.07.23	Erika (MCFN) had 2 revision suggestions for the Archaeological Assessment report: - Request for a more clear mapping / photo documentation of a sloped area that was deemed to have no archaeological potential. - Request for citation of the Between the Lakes Treaty, No. 3 (1792) in which the property falls.	**X**	**X**
56	Mississaugas of the Credit First Nation	Garth Grimes: garth@golden.net (Detritus Consulting Ltd.) Pedram also cc'd Allan G. (KSAL)	Email	Pedram Yazdan Panah (KSAL)	-	-	2021.07.23	Pedram (KSAL) informed Garth (Detritus) of MCFN's two (2) comments about the report revision requests.		
57	Mississaugas of the Credit First Nation	Erika Johannsen Pedram also cc'd: Megan.DeVries@mncfn.ca mark.jeffery@wilmot.ca AGarnham@ksmart.ca Fawn.Sault@mncfn.ca	Email	Pedram Yazdan Panah (KSAL)	-	-	2021.07.25	KSAL also that they will forward MCFN's comments regarding the report to Detritus for revision.		
58	Six Nations of the Grand River	Pedram Yazdan Panah (KSAL) Tanya also cc'd: - mark.jeffery@wilmot.ca - AGarnham@ksmart.ca	Email	Tanya Hill-Montour (SNGR) tanyahill-montour@sixnations.ca	-	-	2021.07.27	Tanya emailed, asking to receive the Archaeological Assessment for the project (KSAL was under the impression that Robbin Vanstone had already forwarded the report to Tanya on 2021.07.20)	**X**	**X** **(Addressed on July 27, 2021)**

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59	Six Nations of the Grand River	Tanya Hill-Montour (SNGR): tanyahill-montour@sixnations.ca Mark also cc'd: - Pedram Yazdan Panah (KSAL) - Allan Garnham (KSAL)	Email	Mark Jeffery (Township of Wilmot)	-	-	2021.07.27	Mark responded to Tanya Hill-Montour and attached the latest Archaeological Assessment report to the email for her use.		
60	Mississaugas of the Credit First Nation	Pedram Yazdan Panah (KSAL) Garth also cc'd: jeff.molenhuis@wilmot.ca curtis.schaerer@wilmot.ca bryan.bishop@wilmot.ca	Email	Garth Grimes: garth@golden.net (Detritus Consulting Ltd.)	-	-	2021.07.28	Garth (Detritus) confirmed that he will be making the requested changes to the report and prepare for resubmission.		
61	**Mississaugas of the Credit First Nation** **Six Nations of the Grand River**	**Meng Koh (INFC):** **meng.koh@canada.ca** **Mark also cc'd:** **- jeff.molenhuis@wilmot.ca** **- pyazdan@ksmart.ca** **- AGarnham@ksmart.ca**	**Email**	**Mark Jeffery (Township of Wilmot)**	**-**	**-**	**2021.07.28**	**Mark (Township of Wilmot) forwarded the following correspondences to INFC:** **- Correspondence that took place on 2021.07.13, wherein KSAL circulated the Environmental Screening Report to MCFN and SNGR for their review.** **- Correspondence that took place on 2021.07.19, wherein KSAL circulated the Archaeological Assessment report to MCFN and SNGR for their review.**		
62	Mississaugas of the Credit First Nation	Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca> Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram Yazdan Panah (KSAL)	-	-	2021.08.30	KSAL informed MCFN that KSAL found a discrepancy between the limits of the fieldwork completed by Detritus and the proposed limits of construction, and that they plan to have Detritus complete additional fieldwork to clear the required additional areas. KSAL stated that they will be in touch with MCFN to arrange to have their monitor present during this work.		
63	Six Nations of the Grand River	Tanya Hill-Montour <tanyahill-montour@sixnations.ca> Robin Vanstone <rvanstone@sixnations.ca> Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram Yazdan Panah (KSAL)	-	-	2021.08.30	KSAL informed SNGR that KSAL found a discrepancy between the limits of the fieldwork completed by Detritus and the proposed limits of construction, and that they plan to have Detritus complete additional fieldwork to clear the required additional areas with the presence of a monitor from MCFN. KSAL asked if SNGR would be interested to have their monitor on site as well.		
64	Six Nations of the Grand River	Pedram Yazdan Panah pyazdan@ksmart.ca Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Tanya also cc'd: Dawn LaForme <dlaforme@sixnations.ca>	Email	Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	-	-	2021.09.06	SNGR informed KSAL that they have interest in the fieldwork, and asked for timeline. SNGR also informed KSAL that Dawn LaForme will send KSAL a standard agreement.		

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Correspondence #	Aboriginal Community / Stakeholder	Recipient	Communication Type	Received From	Phone Number	Time of Call	Date	Communication Details	Concern Raised	Concern Addressed
65	Six Nations of the Grand River	Pedram Yazdan Panah pyazdan@ksmart.ca Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Dawn also cc'd: Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	Email	Dawn LaForme <dlaforme@sixnations.ca>	-	-	2021.09.07	SNGR sent their Archaeology Monitor agreement to be filled in, signed and send back to them for processing.		
66	Six Nations of the Grand River	Dawn LaForme <dlaforme@sixnations.ca> Tanya Hill-Montour <tanyahill-montour@sixnations.ca> Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>;	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.08	KSAL informed SNGR that KSAL will be in touch with them to schedule a date that works for everyone, and that KSAL is hoping to perform fieldwork round #2 in a week or two. KSAL also let SNGR know that KSAL will aim to fill/sign the agreement in the next couple of days and send it back to SNGR.		
67	Six Nations of the Grand River	Dawn LaForme <dlaforme@sixnations.ca> Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.09	KSAL asked SNGR for clarification regarding an item in SNGR's agreement.		
68	Mississaugas of the Credit First Nation	Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca> cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.09	KSAL asked MCFN if fieldwork on the week of SEPT 27 to OCT 1 would work for MCFN, and if they had a preferred date for that week.		
69	Mississaugas of the Credit First Nation	Pedram (KSAL) cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Erika Johannsen <Erika.Johannsen@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Joelle Wiliams <Joelle.Williams@mncfn.ca>	Email	Megan DeVries <Megan.DeVries@mncfn.ca>;	-	-	2021.09.09	MCFN responded to KSAL that week of Sept 27 to Oct 1 would work for them. They also sent their updated agreement, as the previous one expired.		

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70	Six Nations of the Grand River	Dawn LaForme <dlaforme@sixnations.ca> Tanya Hill-Montour <tanyahill-montour@sixnations.ca> Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>;	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.09	KSAL asked SNGR if fieldwork on the week of SEPT 27 to OCT 1 would work for SNGR.		
71	Mississaugas of the Credit First Nation	Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca> Joelle Wiliams <Joelle.Williams@mncfn.ca> cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.09	KSAL acknowledged the receipt of the updated agreement from MCFN.		
72	Mississaugas of the Credit First Nation	Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca> Joelle Wiliams <Joelle.Williams@mncfn.ca> cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.09	KSAL filled the updated agreement, and sent it to MCFN as a draft document for MCFN's approval. KSAL used the tracking feature from MS Word to track every activity done on the document. KSAL also asked the following from MCFN: "Also similar to last year, I revised the monthly compounded interest rate from 5% to 3%, assuming that MCFN still finds this acceptable?"		
73	Six Nations of the Grand River	Pedram Yazdan Panah pyazdan@ksmart.ca Tanya also cc'd: Dawn LaForme <dlaforme@sixnations.ca>	Email	Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	-	-	2021.09.09	SNGR provided the clarification that KSAL had asked for earlier in the day.		
74	Six Nations of the Grand River	Pedram Yazdan Panah pyazdan@ksmart.ca Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Tanya also cc'd: Dawn LaForme <dlaforme@sixnations.ca>	Email	Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	-	-	2021.09.09	SNGR responded to KSAL's question from earlier in the day about whether fieldwork for the week of Sept 27 to Oct 1 would work for them. They confirmed it will work provided a few days' notice is given.		

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75	Mississaugas of the Credit First Nation	Pedram (KSAL) cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Erika Johannsen <Erika.Johannsen@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Joelle Wiliams <Joelle.Williams@mncfn.ca> Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>	Email	Megan DeVries <Megan.DeVries@mncfn.ca>;	-	-	2021.09.10	MCFN responded to KSAL's question asked on previous day regarding the contract document, gave their ok for 3% monthly interest rate, but warned that the fee increases to 20% after six months in the event of unpaid invoices. MCFN also stated that if KSAL is ready to proceed, KSAL should execute the agreements on their end (so far the document was in a draft state)		
76	Mississaugas of the Credit First Nation	Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca> Joelle Wiliams <Joelle.Williams@mncfn.ca> Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca> cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.10	KSAL said: "Thank you Megan. While I get our company president to sign this agreement (aiming for today), I'm hoping to let the other parties know what date the fieldwork will be taking place at. Would September 28, 2021 work for you?"		
77	Six Nations of the Grand River	Dawn LaForme <dlaforme@sixnations.ca> Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.10	Regarding SNGR's agreement, KSAL asked for another clarification.		
78	**Mississaugas of the Credit First Nation**	**Erika Johannsen <Erika.Johannsen@mncfn.ca>;** **Megan DeVries <Megan.DeVries@mncfn.ca>;** **Fawn Sault <Fawn.Sault@mncfn.ca>** **Joelle Wiliams <Joelle.Williams@mncfn.ca>** **Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>** **cc'd:** **Allan Garnham <AGarnham@ksmart.ca>;** **Mark Jeffery <mark.jeffery@wilmot.ca>**	**Email**	**Pedram Yazdan Panah pyazdan@ksmart.ca**	**-**	**-**	**2021.09.10**	**KSAL executed the updated agreements from KSAL's end and sent them to MCFN.**		
79	Six Nations of the Grand River	Pedram Yazdan Panah pyazdan@ksmart.ca cc'd: Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	Email	Dawn LaForme <dlaforme@sixnations.ca>	-	-	2021.09.13	SNGR provided the clarification requested by KSAL on 2021.09.10 regarding the agreement.		

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80	**Six Nations of the Grand River**	**Dawn LaForme** **<dlaforme@sixnations.ca>** **Tanya Hill-Montour** **<tanyahill-montour@sixnations.ca>** **Pedram also cc'd:** **Allan Garnham** **<AGarnham@ksmart.ca>;** **Mark Jeffery** **<mark.jeffery@wilmot.ca>;**	**Email**	**Pedram Yazdan Panah** **pyazdan@ksmart.ca**	**-**	**-**	**2021.09.14**	**KSAL sent the executed agreement to SNGR.**		
81	Six Nations of the Grand River	Dawn LaForme <dlaforme@sixnations.ca> Tanya Hill-Montour <tanyahill-montour@sixnations.ca> Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>;	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.15	KSAL asked if fieldwork for 2021.09.28 would work for SNGR.		
82	Six Nations of the Grand River	Pedram Yazdan Panah pyazdan@ksmart.ca Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Tanya also cc'd: Dawn LaForme <dlaforme@sixnations.ca>	Email	Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	-	-	2021.09.15	SNGR indicated that September 28 works for them.		
83	Mississaugas of the Credit First Nation	Joelle Wiliams <Joelle.Williams@mncfn.ca>	Phonecall	Pedram Yazdan Panah pyazdan@ksmart.ca	905-870-2918	Morning	2021.09.15	KSAL contacted MCFN to confirm whether fieldwork on September 28 would work for them. MCFN said it should be okay, but if they weren't able to schedule an FLR, they will instead give a link to the archaeologist to submit their report to MCFN after the fieldwork.		
84	Mississaugas of the Credit First Nation	Joelle Wiliams <Joelle.Williams@mncfn.ca> cc'd: Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca> Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca> Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.15	KSAL sent an email to MCFN, confirming per the phonecall earlier in the day that KSAL will proceed to schedule fieldwork round #2 for September 28.		

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85	Mississaugas of the Credit First Nation Six Nations of the Grand River	Megan DeVries <Megan.DeVries@mncfn.ca>; Joelle Wiliams <Joelle.Williams@mncfn.ca>; Dawn LaForme <dlaforme@sixnations.ca>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Erika Johannsen <Erika.Johannsen@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>; Garth Grimes <garth@golden.net>; 'Mark Jeffery' <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.15	KSAL sent an email to MCFN and SNGR, confirming that next round of fieldwork is set to take place on September 28, and provided details such as marked up plan drawing, location of site and parking spot.		
86	Mississaugas of the Credit First Nation	Pedram (KSAL) cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Erika Johannsen <Erika.Johannsen@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>	Email	Megan DeVries <Megan.DeVries@mncfn.ca>;	-	-	2021.09.15	MCFN sent the fully executed agreement to KSAL for KSAL's records.		
87	Six Nations of the Grand River	Pedram Yazdan Panah pyazdan@ksmart.ca Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Dawn also cc'd: Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	Email	Dawn LaForme <dlaforme@sixnations.ca>	-	-	2021.09.21	SNGR sent the fully executed agreement to KSAL for KSAL's records.		

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88	Mississaugas of the Credit First Nation Six Nations of the Grand River	Megan DeVries <Megan.DeVries@mncfn.ca>; Joelle Wiliams <Joelle.Williams@mncfn.ca>; Dawn LaForme <dlaforme@sixnations.ca>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Erika Johannsen <Erika.Johannsen@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>; Garth Grimes <garth@golden.net>; 'Mark Jeffery' <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.23	KSAL sent SNGR, MCFN and Detritus an email, consisting of a list of action items to go over on site (for Sept 28 fieldwork), to ensure fieldwork is done in a manner satisfactory to all parties. The list consisted of: 1) Introductions; 2) Health and Safety Concerns; 3) Methodology to Complete Fieldwork; 4) Complete Fieldwork; 5) Discussion of Findings/Debriefing; 6) Closing Remarks (if any); 7) Other Items.		
89	Mississaugas of the Credit First Nation	Pedram (KSAL) cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Garth Grimes <garth@golden.net>	Email	Megan DeVries <Megan.DeVries@mncfn.ca>;	-	-	2021.09.27	MCFN informed KSAL that no FLR is available for the upcoming day's fieldwork, and instead provided a link for Detritus to submit their report to.		
90	Mississaugas of the Credit First Nation	Ryan (MCFN's monitor on site)	Email	Pedram (KSAL)	-	-	2021.09.28	When on site, KSAL forwarded the marked up plan to the MCFN's monitor for their reference.		
91	Mississaugas of the Credit First Nation Six Nations of the Grand River	Megan DeVries <Megan.DeVries@mncfn.ca>; Joelle Wiliams <Joelle.Williams@mncfn.ca>; Dawn LaForme <dlaforme@sixnations.ca>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Erika Johannsen <Erika.Johannsen@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>; Garth Grimes <garth@golden.net>; 'Mark Jeffery' <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca> Jeff Molenhuis <jeff.molenhuis@wilmot.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.09.30	KSAL informed everyone that the next fieldwork date (round #3) to dig the remaining pits is scheduled for 2021.10.05.		
92	Mississaugas of the Credit First Nation	Erika Johannsen <Erika.Johannsen@mncfn.ca>;	Phonecall	Pedram (KSAL)	905-870-5844	Afternoon	2021.10.01	KSAL asked MCFN if they would be okay with getting assistance from a mini-excavator to dig the remaining pits down to 1.2m as suggested by SNGR on 2021.09.28 during fieldwork. MCFN gave their approval for this.		

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93	Mississaugas of the Credit First Nation	Pedram <pyazdan@ksmart.ca> Megan DeVries <Megan.DeVries@mncfn.ca>; Joelle Wiliams <Joelle.Williams@mncfn.ca>; Dawn LaForme <dlaforme@sixnations.ca>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>; Garth Grimes <garth@golden.net>; 'Mark Jeffery' <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca> Jeff Molenhuis <jeff.molenhuis@wilmot.ca>	Email	Erika Johannsen <Erika.Johannsen@mncfn.ca>;	-	-	2021.10.01	MCFN sent an email confirming that they are not opposed to using a machine to remove recent/sterile fill covering an area in order to investigate the potential for deeply buried archaeological deposits.		
94	Six Nations of the Grand River	Dawn LaForme <dlaforme@sixnations.ca> Tanya Hill-Montour <tanyahill-montour@sixnations.ca> Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca> Garth Grimes <garth@golden.net>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.10.01	KSAL followed up with SNGR regarding whether they would be okay with a mini-excavator being used to facilitate digging the deeper pits.		
95	Six Nations of the Grand River	Pedram Yazdan Panah pyazdan@ksmart.ca Tanya also cc'd: Dawn LaForme <dlaforme@sixnations.ca> Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca> Garth Grimes <garth@golden.net>	Email	Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	-	-	2021.10.02	SNGR confirmed that they are okay with the strategy of a mini-excavator being used to facilitate digging the deeper pits.		

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96	Mississaugas of the Credit First Nation Six Nations of the Grand River	Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Dawn LaForme <dlaforme@sixnations.ca>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>; Garth Grimes <garth@golden.net> Pedram also cc'd: Mark Jeffery <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca>	Email	Pedram (KSAL)	-	-	2021.10.04	KSAL sent an email confirming with all involved parties that all parties are now in agreement with the strategy of a mini-excavator being used to facilitate digging the deeper pits.		

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97	Mississaugas of the Credit First Nation Six Nations of the Grand River	Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Dawn LaForme <dlaforme@sixnations.ca>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>; Garth Grimes <garth@golden.net> Pedram also cc'd: Mark Jeffery <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca>	Email	Pedram (KSAL)	-	-	2021.10.04	KSAL sent a reminder to all parties that Tuesday October 5, 2021 is the next day for fieldwork.		

Correspondence #	Aboriginal Community / Stakeholder	Recipient	Communication Type	Received From	Phone Number	Time of Call	Date	Communication Details	Concern Raised	Concern Addressed
98	Six Nations of the Grand River	Dawn LaForme <dlaforme@sixnations.ca> Tanya Hill-Montour <tanyahill-montour@sixnations.ca> Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca>	Email	Pedram Yazdan Panah pyazdan@ksmart.ca	-	-	2021.10.05	After attempting to give SNGR a phonecall, KSAL emailed SNGR asking for a phonecall at their earliest convenience regarding requirements for the latest developments on the remainder of the test pits.		
99	Mississaugas of the Credit First Nation Six Nations of the Grand River	Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Dawn LaForme <dlaforme@sixnations.ca>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>; Garth Grimes <garth@golden.net> Pedram also cc'd: Mark Jeffery <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca>	Email	Pedram (KSAL)	-	-	2021.10.08	KSAL sent an email to all parties stating that the next fieldwork is scheduled for Wednesday, October 20, 2021. KSAL confirmed through the email that the pits will go to a maximum of 1.5m deep (based on correspondence between SNGR and Detritus) using the assistance of a smooth-edged bucket of a mini-excavator.		
	Mississaugas of the Credit First Nation	Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Dawn LaForme <dlaforme@sixnations.ca>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>;						KSAL sent an email to all parties confirming that the next fieldwork is scheduled for Wednesday, October 20, 2021. KSAL confirmed through the email that the		

Detailed Correspondence Log

LAST UPDATED January 26, 2022
Township of Wilmot
Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Aboriginal Consultation Log

Correspondence #	Aboriginal Community / Stakeholder	Recipient	Communication Type	Received From	Phone Number	Time of Call	Date	Communication Details	Concern Raised	Concern Addressed
100	Six Nations of the Grand River	Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>; Garth Grimes <garth@golden.net> Pedram also cc'd: Mark Jeffery <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca>	Email	Pedram (KSAL)	-	-	2021.10.15	pits will go to a maximum of 1.5m deep (based on correspondence between SNGR and Detritus) using the assistance of a smooth-edged bucket of a mini-excavator.		

Detailed Correspondence Log

LAST UPDATED January 26, 2022
Township of Wilmot
Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Aboriginal Consultation Log

Correspondence #	Aboriginal Community / Stakeholder	Recipient	Communication Type	Received From	Phone Number	Time of Call	Date	Communication Details	Concern Raised	Concern Addressed
101	Mississaugas of the Credit First Nation Six Nations of the Grand River	Erika Johannsen <Erika.Johannsen@mncfn.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Dawn LaForme <dlaforme@sixnations.ca>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>; Garth Grimes <garth@golden.net> Pedram also cc'd: Mark Jeffery <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca>	Email	Pedram (KSAL)	-	-	2021.10.15	KSAL sent an email to all parties reminding everyone that the next fieldwork is scheduled for Wednesday, October 20, 2021. KSAL confirmed through the email that the pits will go to a maximum of 1.5m deep (based on correspondence between SNGR and Detritus) using the assistance of a smooth-edged bucket of a mini-excavator.		
102	**Mississaugas of the Credit First Nation**	**Fawn Sault <Fawn.Sault@mncfn.ca>;** **Pedram also cc'd:** **Mark Jeffery <mark.jeffery@wilmot.ca>;** **Allan Garnham <AGarnham@ksmart.ca>;** **Jeff Molenhuis <jeff.molenhuis@wilmot.ca>** **Megan DeVries <Megan.DeVries@mncfn.ca>;** **Nicole LaForme-Hess <Nicole.LaForme-Hess@mncfn.ca>;** **'taslema.khan@canada.ca';** **'infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca'** **meng.koh@canada.ca (forwarded the email to Meng in a separate email)**	**Email**	**Pedram (KSAL)**	**-**	**-**	**2021.11.29**	**KSAL circulated the final draft of the Archaeological Assessment report with MCFN.**		

Detailed Correspondence Log

LAST UPDATED January 26, 2022
Township of Wilmot
Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Aboriginal Consultation Log

Correspondence #	Aboriginal Community / Stakeholder	Recipient	Communication Type	Received From	Phone Number	Time of Call	Date	Communication Details	Concern Raised	Concern Addressed
103	Six Nations of the Grand River	Tanya Hill-Montour <tanyahill-montour@sixnations.ca> Pedram also cc'd: rvanstone@sixnations.ca; Dawn LaForme <dlaforme@sixnations.ca>; Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; meng.koh@canada.ca; taslema.khan@canada.ca; infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca	Email	Pedram (KSAL)	-	-	2021.11.29	KSAL circulated the final draft of the Archaeological Assessment report with SNGR.		
104	Six Nations of the Grand River; Mississaugas of the Credit First Nation	Koh, Meng (INFC) <meng.koh@canada.ca> Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca>; Khan, Taslema (INFC) <taslema.khan@canada.ca>	Email	Pedram (KSAL)	-	-	2021.11.29	KSAL emailed this Indigenous Consultation Log to INFC for their assessment of the proponent/consultant's consultation efforts with MCFN and SNGR. The correspondence sent was updated up to the end of Correspondence #103 above.		
105	Six Nations of the Grand River; Mississaugas of the Credit First Nation	Pedram Yazdan Panah (KSAL) pyazdan@ksmart.ca Taslema also cc'd: meng.koh@canada.ca Mark Jeffery (Township of Wilmot) Jeff Molenhuis (Township of Wilmot) Allan Garnham <AGarnham@ksmart.ca>;	Email	Khan, Taslema (INFC) <taslema.khan@canada.ca>	-	-	2021.11.30	INFC responded to Correspondence #104, giving KSAL and Township of Wilmot instructions of the next steps to be taken.		

Detailed Correspondence Log

LAST UPDATED January 26, 2022
Township of Wilmot
Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Aboriginal Consultation Log

Correspondence #	Aboriginal Community / Stakeholder	Recipient	Communication Type	Received From	Phone Number	Time of Call	Date	Communication Details	Concern Raised	Concern Addressed
106	Six Nations of the Grand River	Pedram Yazdan Panah (KSAL) pyazdan@ksmart.ca Tanya also cc'd: Dawn LaForme <dlaforme@sixnations.ca>; Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; meng.koh@canada.ca; taslema.khan@canada.ca; infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca	Email	Tanya Hill-Montour <tanyahill-montour@sixnations.ca>	-	-	2021.12.03	SNGR acknowledged the receipt of the Archaeological Assessment report.		
107	Mississaugas of the Credit First Nation	Fawn Sault <Fawn.Sault@mncfn.ca>; Pedram also cc'd: Mark Jeffery <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca> Megan DeVries <Megan.DeVries@mncfn.ca>;	Email	Pedram (KSAL)	-	-	2021.12.07	KSAL followed up with MCFN, asking if MCFN has received the final draft of the Archaeological Asssessment report.		
108	Mississaugas of the Credit First Nation	Fawn Sault <Fawn.Sault@mncfn.ca>; Pedram also cc'd: Mark Jeffery <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca> Megan DeVries <Megan.DeVries@mncfn.ca>; Meng Koh <meng.koh@infc.gc.ca>; Taslema Khan <taslema.khan@infc.gc.ca> infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca	Email	Pedram (KSAL)	-	-	2021.12.10	KSAL followed up with MCFN: "Hi Fawn, We are just following up on the email that was forwarded to your attention containing the final archeological report for the Bridge St. Bridge EA. In an effort to keep this project moving forward, we would like all comments with regards to this report be forwarded to the undersigned by email, no later than 5 pm, Friday, December 17th, , 2021. If we do not hear from you by this date, we will assume you have no further comments with respect to the final archeological report. Kind regards,"		

Detailed Correspondence Log

LAST UPDATED January 26, 2022
Township of Wilmot
Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Aboriginal Consultation Log

Correspondence #	Aboriginal Community / Stakeholder	Recipient	Communication Type	Received From	Phone Number	Time of Call	Date	Communication Details	Concern Raised	Concern Addressed
109	Six Nations of the Grand River	Tanya Hill-Montour <tanyahill-montour@sixnations.ca> Pedram also cc'd: Dawn LaForme <dlaforme@sixnations.ca>; Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>; infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca Jeff Molenhuis <jeff.molenhuis@wilmot.ca>; Meng Koh <meng.koh@infc.gc.ca>; Taslema Khan <taslema.khan@infc.gc.ca>	Email	Pedram (KSAL)	-	-	2021.12.10	KSAL followed up with SNGR: "Hi Tanya, We are just following up on the email that was forwarded to your attention containing the final archeological report for the Bridge St. Bridge EA. In an effort to keep this project moving forward, we would like all comments with regards to this report be forwarded to the undersigned by email, no later than 5 pm, Friday, December 17th, , 2021. If we do not hear from you by this date, we will assume you have no further comments with respect to the final archeological report. Kind regards,"		
110	Mississaugas of the Credit First Nation	Pedram Yazdan Panah pyazdan@ksmart.ca Erika also cc'd: Adam LaForme <Adam.LaForme@mncfn.ca> Mark Jeffery <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca> Meng Koh <meng.koh@infc.gc.ca>; Taslema Khan <taslema.khan@infc.gc.ca> infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca 'Fawn Sault <Fawn.Sault@mncfn.ca>;	Email	Erika Johannsen <Erika.Johannsen@mncfn.ca>;	-	-	2021.12.10	MCFN replied to KSAL: "Thank you Pedram, The report has been uploaded to our review queue. I have placed it under my tasks for next week, and I will endeavor to provide comments by the 17th . Future communications can be directed to our new Archaeological Operations Supervisor Adam LaForme at Adam.LaForme@mncfn.ca. Kind regards,"		

Detailed Correspondence Log

LAST UPDATED January 26, 2022
Township of Wilmot
Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Aboriginal Consultation Log

Correspondence #	Aboriginal Community / Stakeholder	Recipient	Communication Type	Received From	Phone Number	Time of Call	Date	Communication Details	Concern Raised	Concern Addressed
111	Mississaugas of the Credit First Nation	Pedram Yazdan Panah pyazdan@ksmart.ca Erika also cc'd: Adam LaForme <Adam.LaForme@mncfn.ca> Mark Jeffery <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>; Jeff Molenhuis <jeff.molenhuis@wilmot.ca> Meng Koh <meng.koh@infc.gc.ca>; Taslema Khan <taslema.khan@infc.gc.ca> infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca	Email	Erika Johannsen <Erika.Johannsen@mncfn.ca>;	-	-	2021.12.15	MCFN sent KSAL their comments from their review of the final draft of the archaeological report. They stated that they had "no questions, comments or concerns regarding the conclusions/recommendations made within the report", but mentioend a few editorial notes for consideration: **"Section 1.2.1 Post-Contact Aboriginal Resources should make reference to the Study Area being located within the lands of the Between the Lakes Treaty, No. 3 (1792); the Mckee Treaty, No. 2 (1790) is cited in error. Additionally, the yellow shaded area on Figure 3 is not included in the map legend. Presumably this represents the area that was mechanically excavated. This work is depicted in Photo 19, the location of which is also missing from the Figure 3 map"**	X	X (Addressed on January 5, 2022)
112	Mississaugas of the Credit First Nation	garth@golden.net Pedram also cc'd: Mark Jeffery <mark.jeffery@wilmot.ca>; Allan Garnham <AGarnham@ksmart.ca>;	Email	Pedram (KSAL)	-	-	2021.12.15	KSAL relayed MCFN's comments to Detritus (archaeologist consultant)		
113	Mississaugas of the Credit First Nation	Pedram Yazdan Panah (KSAL) pyazdan@ksmart.ca	Email	Garth Grimes: garth@golden.net (Detritus Consulting Ltd.)	-	-	2022.01.05	Detritus sent KSAL the revised archaeological investigation report, finalized based on MCFN's comments.		
114	Metis Nation of Ontario	consultations@metisnation.org; tedc@metisnation.org; LindaN@metisnation.org; mno@metisnation.org Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram (KSAL)	-	-	2022.01.18	KSAL distributed the Notice of Study Completion to the recipient.		
115	Haudenosaunee Confederacy	jocko@sixnationsns.com; hdi2@bellnet.ca Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram (KSAL)	-	-	2022.01.18	KSAL distributed the Notice of Study Completion to the recipient.		

Detailed Correspondence Log

LAST UPDATED January 26, 2022
Township of Wilmot
Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Aboriginal Consultation Log

Correspondence #	Aboriginal Community / Stakeholder	Recipient	Communication Type	Received From	Phone Number	Time of Call	Date	Communication Details	Concern Raised	Concern Addressed
116	Six Nations of the Grand River	tanyahill-montour@sixnations.ca Pedram also cc'd: rvanstone@sixnations.ca; Dawn LaForme <dlaforme@sixnations.ca>; Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram (KSAL)	-	-	2022.01.18	KSAL distributed the Notice of Study Completion to the recipient.		
117	Mississaugas of the Credit First Nation	MCFN.Consultation@mncfn.ca'; 'DOCA.Admin@mncfn.ca'; Erika.Johannsen@mncfn.ca; Megan.DeVries@mncfn.ca; Fawn.Sault@mncfn.ca; Nicole.LaForme-Hess@mncfn.ca Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram (KSAL)	-	-	2022.01.18	KSAL distributed the Notice of Study Completion to the recipient.		
118	All	meng.koh@canada.ca; infc.aboriginalconsultenv-consultautochtonesenv.infc@canada.ca; miguel.iriondo@canada.ca; shainah.macfarlane@canada.ca; gordon.voogd@canada.ca Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram (KSAL)	-	-	2022.01.18	KSAL distributed the Notice of Study Completion to INFC.		
119	All	Taslema Khan <taslema.khan@infc.gc.ca> Pedram also cc'd: Allan Garnham <AGarnham@ksmart.ca>; Mark Jeffery <mark.jeffery@wilmot.ca>	Email	Pedram (KSAL)	-	-	2022.01.19	KSAL distributed the Notice of Study Completion to INFC.		
120	All	Pedram Yazdan Panah (KSAL) pyazdan@ksmart.ca	Email	Khan, Taslema (INFC) <taslema.khan@canada.ca>	-	-	2022.01.21	INFC acknowledged the receipt of the email containing the Notice of Study Completion.		
121	All	Allan Garnham <AGarnham@ksmart.ca> Taslema also cc'd: patrick.kelly@wilmot.ca; 'grant.whittington@wilmot.ca' <grant.whittington@wilmot.ca>; 'barb.mcleod@wilmot.ca' <barb.mcleod@wilmot.ca>; Meng Koh <meng.koh@infc.gc.ca>; Luke Maybury <luke.maybury@infc.gc.ca>; Gordon Voogd <gordon.voogd@infc.gc.ca>; Miguel Iriondo <miguel.iriondo@infc.gc.ca>; Jillian.Soule@ontario.ca; Mary.Wyga@ontario.ca; jane.adair@ontario.ca; ICIPRural@ontario.ca; POB Ontario / Ontario DGOP (INFC) <pobontario-ontariodgop@infc.gc.ca>	Email	Taslema Khan (INFC) taslema.khan@infc.gc.ca	-	-	2022.01.26	INFC informed and instructed the recipients of the following: "*Please be advised that Infrastructure Canada (INFC) has received consultation related documents for the proposed Replacement of Structure 34/B-T9 over the Nith River Project (ICIP 54563). Upon review, INFC is satisfied with the Indigenous consultation completed by the Township of Wilmot and confirms that Infrastructure Canada's Indigenous consultation obligations for the proposed project have been met, as they were outlined in the letter dated April 27, 2020.* *Note, should the Township of Wilmot consider future changes to the nature, design, location, start or end date of the Project, please immediately notify INFC so we may re-evaluate our legislative requirements.* "		

Contact Information

LAST UPDATED November 1, 2021
Township of Wilmot
Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Correspondence Address

Indigenous Group	Contact	Mailing Address	Phone Number	Email	Additional notes
Haudenosaunee Confederacy	Misty Hill	16 Sunrise Court, Suite 600 P.O. Box 714 Ohsweken, Ontario N0A 1M0	519-445-4222	hdi2@bellnet.ca	Sent Hohahes Leroy Hill and hdi2@bellnet.ca an email for preferred person. KSAL sent both mail and email notice to them.
	Hohahes Leroy Hill	2634 6th Line Road R.R. #2 Ohsweken, ON N0A 1M0	905-765-1749 & 519-717-7326	jocko@sixnationsns.com	
Mississaugas of the Credit First Nation	Chief Stacey Laforme	2789 Mississauga Road, RR 6, Hagersville, ON N0A 1H0	-	Stacey.laforme@mncfn.ca	-
	Fawn Sault (Consultation Coordinator)	4065 Hwy. 6, Hagersville, N0A 1H0	P: 905-768-4260 C:289-527-6580	Fawn.Sault@mncfn.ca	
	Mark LaForme (Director of MCFN – DOCA)	4065 Hwy. 6 | Hagersville, ON, NOA1H0	905-768-4260	Mark.LaForme@mncfn.ca	
	Megan DeVries (Archaeological Operations Supervisor)	4065 Highway 6 North, Hagersville, ON N0A 1H0	P: 905-768-4260 M: 289-527-2763	Megan.DeVries@mncfn.ca	
	Erika Johannsen (Field Archaeologist)	4065 Highway 6 North, Hagersville, ON N0A 1H0	M: 905-870-5844	Erika.Johannsen@mncfn.ca	
	Adam LaForme (Archaeological Operations Supervisor)	-	-	Adam.LaForme@mncfn.ca	
	Joelle Williams (Field Coordinator)	4065 Highway 6 North, Hagersville, ON N0A 1H0	P: 905-768-4260 M: 905-870-2918	Joelle.Williams@mncfn.ca	
Métis Nation of Ontario	-	-	-	mno@metisnation.org	Emailed them for preferred contact person. Their response was to email: consultations@metisnation.org. Regardless, KSAL mailed them as well.
	Linda Norheim	311-75 Sherbourne Street, Toronto, M5A 2P9	416-433-1315	LindaN@metisnation.org	
	Ted Cousins		416-346-9230	tedc@metisnation.org	
	-	-	-	consultations@metisnation.org	
Six Nations of the Grand River	Chief Mark Hill	2498 Chiefswood Road, P. O. Box 5000 Ohsweken ON, N0A 1M0	519 445-2201	markhill@sixnations.ca	Spoke with Tammy. They prefer mailing. The current mailing address in the table is fine. Address letter to the chief. But then Lonny Bomberry would actually get it. Regardless, KSAL sent an email notice as well.
	Lonny Bomberry		519-753-0665	lonnybomberry@sixnations.ca	
	Robbin Vanstone		519-753-0665 ext. 5433	rvanstone@sixnations.ca	On 2021.04.27, INFC advised that INFC: "recently discovered that there was a change in the consultation contact for the Six Nations of the Grand River and is requesting that your team reach out to notify them of the project and afford an opportunity to review and provide comments. Please reach out to: Robbin Vanstone, Consultation Supervisor via email @ rvanstone@sixnations.ca with a follow-up call @ 519-753-0665 ext. 5433."
	Dawn LaForme (Secretary/Receptionist)	-	(519) 753-0665	dlaforme@sixnations.ca	
	Tanya j. Hill-Montour (Archaeology Supervisor)	-	c.226.388.0665 t.519.754.0665	tanyahill-montour@sixnations.ca	

Site Visit Log

Township of Wilmot
Bridge 34/B-T9 (Bridge St. Bridge) Replacement
Site Meetings

Aboriginal Community	Date & Time	Location	Activity on Site	People on Site		Discussion Notes
Mississaugas of the Credit First Nation	2020.10.01	Bridge St Bridge	Environmental Investigation by Dean from ELM	Township of Wilmot	Mark Jeffery	-Chris talked about MCFN's experience working with Detritus. Township assured him that every effort will be made to ensure MCFN will be in agreement with the consultation process. -Chris also suggested considering aqua-dams instead of the typical sheetpile cofferdams because the prior is more environmental friendly.
	KSAL Was on site 11:10am to 12:00pm			MCFN	Chris Tobicoe	
				ELM	Dean Fitzgerald Ed Kott	
				KSAL	Pedram Yazdan Panah	
Mississaugas of the Credit First Nation	2020.10.13	Bridge St Bridge	Environmental Investigation by Dean from ELM, and Archaeology Investigation by Walter from Detritus	Township of Wilmot	Mark Jeffery	-Went to site today to ensure everything starts off smoothely with the field investigations. -MCFN's FLR, Chris, proposed for the width of the archaeological investigation to increase from 15m each side of road to 30m. In turn, KSAL reduced the length of the investigation scope from roughly 300m each side of bridge to 150m. -Everyone seemed to be in agreement with the proposed changes and overall with each other.
	KSAL Was on site 8:30am to 9:15am			MCFN	Chris Tobicoe	
				ELM	Dean and Jessical were scheduled to arrive on site at 10:30am	
				Detritus	Walter and Mathew	
				KSAL	Pedram Yazdan Panah	
Six Nations of the Grand River	2021.09.28	Bridge St Bridge	Perform archeological assessment by Detritus to clear additional areas within the study area.	Township of Wilmot	Mark Jeffery Curtis S.	- Today Detritus was on site perform archaeological field investigation to clear the additional areas within the study area. - Every area within the study area was cleared today, except a roughly 70 meter strech of area about 1.5m south of the road located at west of the existing bridge. The reason test pits were not completed in this area is that due to not encountering undisturbed soil by digging 0.6m by hand shovel, Ryan (SNGR) suggested Detritus dig down to 1.2m, and if no undisturbed soil was found, move on to the next pit. Since it was almost the end of the day, and Detritus stated that it is very difficult to did that deep by hand, it was decided that another round of fieldwork will be done at a later date.
				Detritus	Matthew, Albert and Aaron	
	KSAL in the morning and afternoon.			SNGR	Ryan Nanticoke	
				KSAL	Pedram Yazdan Panah	
Six Nations of the Grand River	2021.10.05	Bridge St Bridge	Perform archeological assessment by Detritus to dig pits down to 1.2m.	Detritus	Jonathan Peart	- Today Detritus was on site perform additional archaeological field investigation. All other areas falling within the scope of this study were assessed by the end of 2021.09.28. On 2021.09.28, at south of the road located west of the existing bridge, after digging 600mm, they were still not reaching undisturbed soil. It was suggested to Detritus that they dig deeper. - While everyone was waiting on site for the excavator, Detritus decided to get started with a shovel and manually dig pits until the excavator arrived. The first 1.2m was dug, and no undisturbed soil was reached. SNGR stated that digging should proceed until undisturbed soil is reached. It was decided that some more planning and discussion would be needed in relation to the requirements for digging down to 1.5m the remaining test pits, and so by around noon, everyone left site, and will come back to continue this work another day.
	KSAL in the morning.			SNGR	Ryan Nanticoke	
				KSAL	Pedram Yazdan Panah	
Six Nations of the Grand River Mississaugas of the Credit First Nation	2021.10.20	Bridge St Bridge	Perform archeological assessment by Detritus to dig pits down to 1.5m per SNGR's suggestion.	MCFN	Donavan King	MCFN, SNGR, Detritus, KSAL, and Village Earthworks showed up on site in the morning to dig the remainder of the test pits at south of the west road. Village Earthworks provided excavation services with their mini-excavator. Based on latest correspondence between Detritus and SNGR, the remainder of the pits were to be dug down to a maximum of 1.5m. No indigenous archaeological artifacts were found.
	KSAL in the morning.			Detritus	Jonathan Peart	
				SNGR	Bill Lucas	
				KSAL	Pedram Yazdan Panah	
				Village Earthworks	Dan	

4.

ALTERNATIVES CONSIDERED AND SELECTION OF THE PREFERRED ALTERNATIVE

4.1 ALTERNATIVES CONSIDERED

Five (5) alternatives are considered to address the deficiencies associated with the bridge. A "Do Nothing" alternative is considered as recommended in the EA Manual:

Alternative 1 – Do Nothing
This would entail leaving the structure in its current condition.

Alternative 2 – Repair Existing Bridge
This would involve strengthening and/or replacing truss members, installing new floor beams and stringers and replacing the concrete deck.

Alternative 3 – Replace Superstructure
The existing steel truss would be removed and a new superstructure such as a bailey bridge or truss bridge installed overtop the existing foundations.

Alternative 4 – Replace with Single Span Steel Truss Bridge

Alternative 5 – Replace with Multi Span Slab-on-Girder Bridge

In Alternatives 4 & 5, a new structure would be constructed over the river in approximately the same location with some minor realignment of the roadway approaches.

Other alternatives, such as a tunnel, may exist to address the deficiencies associated with this bridge, but are not considered viable because of either insufficient hydrologic/hydraulic capacity and/or cost.

4.2 SELECTION OF THE PREFERRED ALTERNATIVE

The general methodology to compare and evaluate the five (5) possible alternatives is a tabular ranking system. For a given criteria, alternatives are ranked 1-5 with 1 either being the best or having the least impact and 5 being the worst or having the most impact except as noted otherwise. To ensure each criterion is weighted the same, each row equals fifteen (15) points. The criteria are grouped into 5 main groupings.

The following criteria will be used to guide the decision making:

- Natural Environment
    - Disruption to fish and changes to fish habitat;
    - Changes to vegetation and flora;
    - Disruption to wildlife and changes to wildlife habitat;
    - Changes to surface water quality and quantity;
    - Changes to ground water quality and quantity;
    - Changes to stream flow;
    - Potential for ice jams.

- Socio-Economic Environment
    - Changes to quality and quantity of agriculture;
    - Disruption to community due to frequent or permanent closure(s) of the crossing;
    - Disruption to local business due to frequent or permanent closure(s) of the crossing;
    - Changes to recreation resulting from changing the status quo;
    - Changes to future development due to frequent or permanent closure(s) of the crossing;
    - Need for property acquisition if a new structure is pursued;
    - Length of construction if work is pursued;
    - Improvement to traffic movement if a new structure is pursued;
    - Changes to noise and vibration if a new structure is pursued;
    - Changes to air quality;
    - Access to emergency services due to frequent or permanent closure(s) of the crossing;
    - Change in aesthetics.

- Cultural Environment
    - Potential impacts of archeological resources or areas of archeological potential within or adjacent to the study area;
    - Potential impacts to known or potential cultural heritage landscapes;
    - Potential impacts to known or ptential built heritage resources;

- Technical Considerations
    - Extent the alternative addresses the problem statement;
    - Effect on existing utilities;
    - Elimination of height restrictions;
    - Elimination of Load Posting;
    - Elimination of width restriction;
    - Ability to improve geometry of roadway;
    - Increase of traffic volume and speed due to overall improved geometry;
    - Need to reconfigure laneways immediately adjacent to bridge;
    - Improvements to safety;
    - Ability to improve hydrology/hydraulic conditions;
    - Constructability;

  - Construction timeline;
  - Lifespan;
  - Need for ongoing maintenance.

- Cost
  - Purchase of private property;
  - Maintenance costs;
  - Cost to mitigate impacts to the natural environment;
  - Overall construction cost.

To simplify the evaluation process and eliminate the possibility of one stakeholder group from having more influence over the decision making process over another stakeholder group, a ranking system was used. Criterion were all be given the same weight. It can be said that one particular criterion is no more important than any other criterion. Although this ranking system will be controversial to some stakeholders, there is no other reasonable methodology to compare alternatives.

Table 1 - Evaluation of Alternatives (part 1 of 4)

Criteria Group	No.	Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Repair Existing Bridge)	Alternative 3 (Replace Superstructure)	Alternative 4 (Replace with Single Span Steel Truss Bridge)	Alternative 5 (Replace with Multi Span Slab-on-Girder Bridge)	Comment
Natural Environment	1	Disruption to fish and changes to fish habitat	1	2	3	4	5	Considers disruption to fish and potential loss of fish habitat.
	2	Changes to vegetation and flora	1	2	3	4	5	Considers overall loss of vegetation. 1 does not result in any loss of vegetation 5 results in a significant loss of vegetation
	3	Disruption to wildlife and changes to wildlife habitat	1	2	3	4	5	Considers loss of habitat for wildlife such as birds and animals. 1 does not result in any loss of habitat 5 results in a significant loss of habitat
	4	Changes to surface water quality and quantity	1	2	4	5	3	Considers both increase and level of contamination of runoff. 1 does not 5 will not result in an improvement
	5	Changes to ground water quality and quantity	3	3	3	3	3	No changes to the quality or quantity of groundwater are anticipated
	6	Changes to stream flow	1	2.5	2.5	5	4	Considers changes to the overall alignment of the watercourse. 1 indicates the least disruption 5 has the most disruption
	7	Potential for ice jams	2.5	2.5	2.5	2.5	5	2.5 has no potential for ice jams 5 has potential for ice jams

Table 1 - Evaluation of Alternatives Continued (part 2 of 4)

Criteria Group	No.	Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Repair Existing Bridge)	Alternative 3 (Replace Superstructure)	Alternative 4 (Replace with Single Span Steel Truss Bridge)	Alternative 5 (Replace with Multi Span Slab-on-Girder Bridge)	Comment
Socio-Economic Environment	8	Changes to quality and quantity of agriculture	4.5	4.5	3	1.5	1.5	Considers change to the quality and quantity of farming
	9	Disruption to community due to frequent or permanent closure(s) of the crossing	5	4	3	2	1	Considers disruption to the community by not having a permanent crossing 2 if a new bridge is built 5 if no bridge is built
	10	Disruption to local business due to frequent or permanent closure(s) of the crossing	5	4	3	2	1	Considers disturbance to local business by not having a permanent crossing 1 if a new bridge is built 5 if no bridge is built
	11	Changes to recreation resulting from changing the status quo	1.5	1.5	4	4	4	Considers potential changes to navigation
	12	Changes to future development due to frequent or permanent closure(s) of the crossing	5	4	3	1.5	1.5	Considers loss of future development by not having a permanent crossing 1 if a new bridge is built 5 if no bridge is built
	13	Need for property acquisition if a new structure is pursued	2	2	2	4.5	4.5	1 requires no property to be purchased 5 requires the most amount of property to be purchased
	14	Length of construction if work is pursued	1	2	3	4	5	1 is the shortest to construct 5 is the longest to construct
	15	Improvement to traffic movement if a new structure is pursued	4.5	4.5	3	2	1	1 will provide improvement 5 will not provide improvement
	16	Changes to noise and vibration if a new structure is pursued	1.5	1.5	3.5	5	3.5	1 will result in a reduction in noise and vibration 5 will result in changes to noise and vibration
	17	Changes to air quality	5	4	3	2	1	Considers positive change to air quality as a result of quicker travel times 1 if a new bridge is built 5 if no bridge is built
	18	Access to emergency services due to frequent or permanent closure(s) of the crossing	5	4	2	2	2	Considers response times 1 if a new bridge is built 5 if no bridge is built
	19	Change in aesthetics	1	2	4	3	5	1 will restore aesthetics of Bridge Street Bridge 5 indicates the most change to original aesthetics

Table 1 - Evaluation of Alternatives Continued (part 3 of 4)

Criteria Group	No.	Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Repair Existing Bridge)	Alternative 3 (Replace Superstructure)	Alternative 4 (Replace with Single Span Steel Truss Bridge)	Alternative 5 (Replace with Multi Span Slab-on-Girder Bridge)	Comment
Cultural Environment	20	Potential impacts to archeological resources or areas of archeological potential within or adjacent to the study area	1.5	1.5	4	5	3	1 would be no ground disturbance 5 indicates major ground disturbance
	21	Potential impacts to known or potential cultural heritage landscapes	1.5	1.5	4	5	3	1 indicates retention of existing landscape 5 indicates altering current landscape
	22	Potential impacts to known or potential built heritage resources	1.5	1.5	3	4.5	4.5	1 indicates retention of existing resources 5 indicates altering current resources
Technical Considerations	23	Extent the alternative addresses the problem statement	5	4	3	1.5	1.5	1 meets the problem statement 5 does not meet the problem statement
	24	Effect on existing utilities	1.5	1.5	4	5	3	1 indicates least potential to affect utilities 5 indicates most potential to affect utilities
	25	Elimination of height restrictions	4	4	1.5	4	1.5	4 if there is a height limit across the bridge 1.5 if there is no limit
	26	Elimination of Load Posting	4.5	4.5	3	1.5	1.5	2 eliminates load posting 4.5 does not eliminate load posting
	27	Elimination of width restriction	4	4	4	1.5	1.5	4 if the structure is limited in width 1.5 if there is no limit
	28	Ability to improve geometry of roadway	5	4	3	2	1	1 will allow modifications 5 will not allow modifications
	29	Increase of traffic volume and speed due to overall improved geometry	5	4	3	2	1	1 indicates improvement to traffic volume and speed 5 indicates no improvements to traffic speed and volume
	30	Need to reconfigure laneways immediately adjacent to bridge	1.5	1.5	4.5	4.5	3	1 indicates no need for reconfiguration 5 indicates reconfiguration required
	31	Improvements to safety	5	4	3	2	1	1 provides many improvements 5 provides no improvements
	32	Ability to improve hydrology/hydraulic conditions	4	4	4	2	1	1 allows for improvement 5 does not allow improvement
	33	Constructability	1	2	3	5	4	1 is the easiest to construct 5 is the hardest to construct
	34	Construction timeline	1	2	3	5	4	1 is the shortest to construct 5 is the longest to construct
	35	Lifespan	5	4	3	2	1	1 is the longest period prior to reconstruction of the bridge 5 is the shortest period prior to reconstruction of the bridge

Table 1 - Evaluation of Alternatives Continued (part 4 of 4)

Criteria Group	No.	Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Repair Existing Bridge)	Alternative 3 (Replace Superstructure)	Alternative 4 (Replace with Single Span Steel Truss Bridge)	Alternative 5 (Replace with Multi Span Slab-on-Girder Bridge)	Comment
	36	Need for ongoing maintenance	5	4	3	2	1	Assumes replacing the bridge would require little maintenance whereas doing nothing would require frequent maintenance
Cost	37	Purchase of private property	1.5	1.5	3	5	4	1 does not require purchasing property 5 requires purchasing private property
	38	Maintenance costs	5	4	3	2	1	Assumes a new modern bridge requires little or no maintenance and "doing nothing" would require frequent maintenance
	39	Cost to mitigate impacts to the natural environment	1	2.5	2.5	4	5	1 requires no mitigation 5 requires substantial mitigation
	40	Overall construction cost	1	3	2	5	4	1 would be the lowest cost 5 would be the highest cost
		Totals	**116**	**117**	**124**	**131.5**	**111.5**	

Note:
Alternatives are ranked 1 to 5 with 1 having the least disturbance and 5 having the most disturbance except where noted.
Each row totals 15 points to ensure each criterion is weighted the same.

Table 1 – Evaluation of Alternatives summarizes the decision making process. Per Table 1, the following final scores were determined:

Alternative 1 – Do Nothing	116
Alternative 2 – Repair Existing Bridge	117
Alternative 3 – Replace Superstructure	124
Alternative 4 – Replace with Single Span Steel Truss Bridge	131.5
Alternative 5 – Replace with Multi Span Slab-on-Girder Bridge	111.5

From the above listed results, Alternative 5 has the lowest score. Therefore, Alternative 5 is the most viable alternative to address the problem statement. It is recommended to proceed with Alternative 5 – Replace with Multi Span Slab-on-Girder Bridge.

5.

REFINEMENT OF THE PREFERRED ALTERNATIVE

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS & PLANNERS

85 McIntyre Drive
Kitchener, ON N2R 1H6

Tel: 519-748-1199
Fax: 519-748-6100

March 5, 2021
Revised June 21, 2021

File No. 20-145

Mark Jeffery, C.E.T.
Senior Engineering Technologist
Township of Wilmot
60 Snyder's Road West
Baden ON N3A 1A1

RE: BRIDGE 34/B-T9 (BRIDGE STREET BRIDGE)
BRIDGE STREET AT NITH RIVER
DESIGN CRITERIA

Dear Mark,

Enclosed please find one copy of the Design Criteria for the replacement of the above noted structure along with preliminary roadway drawings. Please review the Design Criteria and if you are in agreement, please sign and return to us via email or fax.

If you have any questions or additional information is required, please contact the undersigned.

Yours truly,

Allan Garnham, P. Eng.
Project Manager

encl:

BRIDGE 34/B-T9 (BRIDGE STREET BRIDGE)
TOWNSHIP OF WILMOT
DESIGN CRITERIA

Type of Project:	Bridge replacement and roadway approach construction
Location:	Bridge Street at Nith River Lots 20 and 21, Concessions 3 and 4 Township of Wilmot

Design Element	Present Conditions	Design Standards	Proposed Standards
Highway Classification	RLU 40 ±	RLU 60	RLU 60
Minimum Stopping Sight (m)	45	85	85
Equivalent Minimum "K"	8 (sag) 4 (crest)	18 (sag) 15 (crest)	18 (sag) 15 (crest)
Grades Maximum (%)	8	11-15	8
Minimum Radius (m)	50	50	Not required
Number of Lanes	1 (bridge) 2 (approach)	2	2
Lane Width (m)	4.0 (bridge) 3.65± (approach)	3.0	3.35
Shoulder Width (m)	0.7±	1.0	1.15
Shoulder Rounding (m)	0.5	0.75	0.75
R.O.W. Width (m)	20	20	20
Posted Speed (km/hr)	Not posted	60	60
Traffic	AADT is estimated to be 1000±		

Remarks:

1. Right-of-way (ROW) is 20m (66') based on the legal survey completed by McKechnie Surveying.

2. Bridge Street will be designed for a 60 km/hr design speed and posted for 60 km/hr maximum speed.

3. "K" values provided in the table above are accepted values in common use throughout Ontario.

4. Horizontal curves are not required for deflection angles less than 1°.

5. The work involves the replacement of an existing single span steel truss bridge with a new three span slab-on-girder bridge (prestressed concrete box girder).

6. Railings on structure will be steel box beam type per previous correspondence.

7. Extent of roadwork will be limited to the approaches to the bridge.

8. Traffic will be diverted away from the site during the construction.

9. There are utilities between the proposed limits of construction:

    - Hydro is overhead on the south side of the road;
    - Bell is underground, but stops short of the bridge.

    No utility relocations are anticipated.

10. There are three (3) field entrances and one (1) driveway between the proposed limits of construction. The field entrance west of the bridge will need to be moved further west and reconstructed. The field entrance east of the bridge (on the north side of the road) will only require slight regrading. The driveway on the east side of the bridge (south side of road) will require regrading and construction of a new asphalt apron. A new field entrance will be provided southeast of the bridge to access the property owned by Kitchener-Waterloo Field Naturalists.

11. Steel beam guide rail will be erected adjacent to the shoulders where the vertical drop exceeds 3m or standing water exists.

12. The ends of the steel beam guide rail will be protected with SBEAT end treatments.

Date: ____________________________________

Name: ____________________________________

Title: ____________________________________

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS & PLANNERS

85 McIntyre Drive
Kitchener, ON N2R 1H6

Tel: 519-748-1199
Fax: 519-748-6100

February 25, 2021

File No. 20-145

Mark Jeffery, C.E.T.
Senior Engineering Technologist
Township of Wilmot
60 Snyder's Road West
Baden ON N3A 1A1

RE: BRIDGE 34/B-T9 (BRIDGE STREET BRIDGE)
BRIDGE STREET AT NITH RIVER
RAILING OPTIONS

Dear Mark,

With respect to the replacement of Bridge Street Bridge, we request that the Township of Wilmot review the following railing options and select a preferred option for the new structure.

The railing styles which may be considered for this structure are as follows:

Style 1 – Steel Box Beam (Picture 1)

This railing style is an MTO approved railing system constructed of standard and readily available structural elements. It offers a good performing lightweight and open railing compared to concrete parapet walls. It is well suited for vehicular/pedestrian applications and can be found throughout Ontario on bridges which span watercourses. It can terminate in either concrete end posts (shown on the picture) or transition to steel beam guide rail just off the structure.

Because this railing style is the most "open" type system available, views of the river and landscape will be maintained over that of the existing structure.

Appearance wise, this railing style is usually supplied hot dipped galvanized which is silver/grey in colour. For a modest additional cost, this railing can be supplied painted (red, green, black, etc.) to improve the visual appeal.

Cost wise, this railing style is estimated at $950/m.

Style 2 – Concrete Parapet Wall With Steel Railing (Picture 2)

This railing style is probably MTO's favourite and it is widely used throughout the Province of Ontario. It is normally designed to suit the traffic volumes specific to the site. This railing style is closed in nature, hence not allowing views of the river from the bridge. This railing terminates at the end of the bridge where it must transition into steel beam guide rail. A steel hand rail is added to the top of this railing to provide a grab rail for pedestrians.

Normally this railing style appears with form finish faces (i.e. smooth). To improve the aesthetics, patterns can be applied to the wet concrete during the construction to create different patterns. Most commonly brick or random stone patterns are used. Patterning will increase the price of the wall by a nominal amount.

Cost wise, this railing system is estimated at \$950/m[1]

Style 3 –Concrete Parapet Wall with Double Tube Railing (Picture 3)

This railing type consists of a concrete parapet wall on the bottom with two (2) tubes at the top. Again, the design of the railing can be tailored to the specific requirements of a site by increasing or decreasing the amount of reinforcing steel. This railing style is very common in southern Ontario. It would be classified as a semi-open railing style because only the lower 600mm is solid. This railing style terminates at the end of the bridge where it transitions to steel beam guide rail. Again, steel rails are provided to better facilitate pedestrian movement.

This railing could be modified slightly by switching the two (2) tubes at the top to an aluminum picketed system (coined the Toronto railing system) or rectangular tubes (similar to Region of Waterloo owned bridges located in the Township).

This railing style will appear more open at the top, but will still have smooth faces. Patterns can be applied to the inside faces, but such would increase the cost by a nominal amount.

Cost wise, this railing style is estimated to be \$1,000/m[1].

Style 4 –Safety Shape Barrier with Steel Railing (New Jersey Style) (Picture 4)

This railing type is essentially concrete roadside barrier (similar to highway medians), heavily reinforced with steel rebar, and mounted on the side of the structure. It is generally reserved for high volume structures with no pedestrian traffic. It will terminate at the ends of the bridge and transition to steel beam guide rail. For this application, a steel rail would be added to the top for pedestrian use.

This railing will appear very substantial and utilitarian. It will not offer views of the river or flood plain.

This railing style is estimated to cost \$1,100/m[1].

Recommendation

The railing styles presented above are generally the most common types found within the Province of Ontario and are approved for use on MTO roadways. The Township of Wilmot may select one of these styles or choose a railing style which is not presented above. However, we strongly recommend the Township select a railing style which has prior approval from MTO as these railing have been crash-tested and approved for use on Ontario roadways.

At this time, we are recommending Railing Style 1 as depicted on Picture 1. The openness of this railing system will maintain views of the river and landscape similar to the existing views. This railing style also maintains the use of steel along the edges of the bridge. We believe this particular railing will enhance the look of the new bridge and will be maintenance free for many years.

Please review the options and let us know if the Township agrees with our recommendation. If necessary, we would be happy to meet with you to further discuss railing styles or present additional ideas.

If you have any questions or additional information is required, please contact the undersigned.

Yours truly,

Allan Garnham, P. Eng.
Project Manager

1. Cost provided does not include the cost of premium reinforcement (stainless steel or GFRP) contained within the concrete, but does include the cost of normal (black) reinforcing steel. Should the Township of Wilmot elect to use premium reinforcement, as the railing system is vulnerable to salt-induced corrosion, the additional cost is estimated to be $400/m.

Railing Option 1 – Steel Box Beam

Railing Option 2 – Concrete Parapet Wall with Steel Railing

Railing Option 3 – Concrete Parapet Wall with Double Tube Railing

Railing Option 4 – Safety Shape Barrier with Steel Railing (New Jersey Style)

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MEMORANDUM

To: Mark Jeffery, C.E.T.
Company: Township of Wilmot
From: Allan Garnham, P. Eng.
Dept/Title:
Date: June 25, 2021
cc:
File#: **20-145 Bridge Street Bridge**
Subject: Property Acquisition

Mark,

The following memorandum has been prepared to confirm property acquisition IS NOT required to facilitate the preferred alternative.

Property line data prepared by McKechnie Surveying Ltd., has been inputted into our AutoCAD drawings. Based on modeling completed using AutoCAD Civil3D, match points were determined at routine intervals (stations) along Bridge Street. These match points were then sketched onto the plan views and compared to the property lines.

Overall, the match points are within Township of Wilmot property. Hence no additional property is required to contain the new structure and roadway approaches.

Thanks,

Allan Garnham, P. Eng.

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FAX (519) 748-6100

MEMORANDUM

To:	Mark Jeffery, C.E.T.	**Company:**	Township of Wilmot
From:	Allan Garnham, P. Eng.	**Dept/Title:**	
Date:	June 25, 2021	**cc:**	
File#:	**20-145 Bridge Street Bridge**	**Subject:**	Utility Relocations

Mark,

This memorandum has been prepared to confirm utility relocation IS NOT required to facilitate the preferred alternative.

Thanks,

Allan Garnham, P. Eng.

Bridge Street Bridge Replacement
Preliminary Construction Cost Estimate
Multi Span Slab-on-Girder Bridge

Item No.	SP/ OPSS	Description	Unit	Estimated Quantity	Unit Price	Total Price
1	SP-1	Mobilization/Demobilization	LS	1	$ 75,000	$ 75,000
2	SP-2	Bonding and Insurance	LS	1	$ 50,000	$ 50,000
3	SP-3 MUNI.706	Traffic Control	LS	1	$ 10,000	$ 10,000
4	SP-4 MUNI.206	Excavation for Roadway and Ditching	m^3	2800	$ 25	$ 70,000
5	SP-5 MUNI.212	Earth Borrow	t	5300	$ 15	$ 79,500
6	SP-6 MUNI.310	HL4 Asphalt (Base)	t	450	$ 130	$ 58,500
7	SP-7 MUNI.310	HL3 Asphalt (Surface)	t	350	$ 130	$ 45,500
8	SP-8 MUNI.314	Granular "A" for Road	t	1900	$ 25	$ 47,500
9	SP-9 MUNI.314	Granular "B" for Road	t	5000	$ 20	$ 100,000
10	SP-10 MUNI.405	150mm DIA Perforated Subdrain	m	70	$ 75	$ 5,250
11	SP-11 MUNI.421	450mm DIA CSP Culvert	m	45	$ 250	$ 11,250
12	SP-12 MUNI.422	600mm DIA CSP Culvert	m	25	$ 350	$ 8,750
13	SP-13 MUNI.510	Removal of Existing Wearing Surface	m^2	2700	$ 5	$ 13,500
14	SP-14 MUNI.510	Removal of Existing Structure	LS	1	$ 175,000	$ 175,000
15	SP-15 MUNI.511	Rock Protection	m^3	200	$ 115	$ 23,000
16	SP-16 MUNI.511	Rip Rap Spillways - Provisional	m^2	60	$ 75	$ 4,500
17	SP-17 MUNI.721	Steel Beam Guide Rail with Channel	m	80.01	$ 225	$ 18,002.25
18	SP-18 MUNI.721	Steel Beam Guide Rail Structure Connections	ea	4	$ 2,000	$ 8,000
19	SP-19 MUNI.732	SBEAT End Treatment	ea	3	$ 7,500	$ 22,500
20	SP-20 MUNI.733	Leaving End Treatment	ea	1	$ 5,000	$ 5,000
21	SP-21 MUNI.802	Topsoil from Stockpiles	m^3	400.0	$ 40	$ 16,000
22	SP-22 MUNI.802	Imported Topsoil - Provisional	m^3	130.0	$ 75	$ 9,750
23	SP-23 MUNI.804	Hydroseeding	m^2	5000	$ 2.5	$ 12,500
24	SP-24 MUNI.804	Erosion Control Blanket - Provisional	m^2	1700	$ 5	$ 8,500
25	SP-25 MUNI.805	Light Duty Silt Fence Barrier	m	850	$ 15	$ 12,750
26	SP-26 MUNI.805	Straw Bale Flow Check Dam	ea	10	$ 250	$ 2,500
27	SP-27 MUNI.902	Excavation for New Structure and Dewatering	LS	1	$ 250,000	$ 250,000
28	SP-28 MUNI.902	Granular "B" Backfill to Structure	m^3	430	$ 75	$ 32,250
29	SP-29 MUNI.903	Piling - Mobilization & Demobilization	LS	1	$ 40,000	$ 40,000

Bridge Street Bridge Replacement
Preliminary Construction Cost Estimate
Multi Span Slab-on-Girder Bridge

Item No.	SP/ OPSS	Description	Unit	Estimated Quantity	Unit Price	Total Price
30	SP-30 MUNI.903	Piling - HP310 x 110	m	640.00	$ 300	$ 192,000
31	SP-31 MUNI.904	Concrete Working Slab	m^3	25.0	$ 400	$ 10,000
32	SP-32 MUNI.904	Concrete in Abutment Footings	m^3	122.0	$ 500	$ 61,000
33	SP-33 MUNI.904	Concrete in Abutments and Wingwalls	m^3	120.0	$ 1,000	$ 120,000
34	SP-34 MUNI.904	Concrete in Pier Footings	m^3	120.0	$ 500	$ 60,000
35	SP-35 MUNI.904	Concrete in Piers	m^3	125.0	$ 1,000	$ 125,000
36	SP-36 MUNI.904	Concrete in Deck	m^3	142.0	$ 1,200	$ 170,400
37	SP-37 MUNI.904	Concrete in Curbs	m^3	25.0	$ 1,500	$ 37,500
38	SP-38 MUNI.904	Concrete in End Posts	m^3	2.0	$ 5,000	$ 10,000
39	SP-39 MUNI.904	Concrete in Approach Slabs	m^3	30.0	$ 750	$ 22,500
40	SP-40 MUNI.904	Steel Cutwater Assembly	each	2	$ 3,500	$ 7,000
41	SP-41 MUNI.905	Reinforcing Steel Bar - Black	t	56.0	$ 3,500	$ 196,000
42	SP-42 MUNI.905	Reinforcing Steel Bar - Stainless	t	2.6	$ 12,500	$ 32,500
43	SP-43 MUNI.908	Steel Box Beam Railing	m	163.0	$ 900	$ 146,700
44	SP-44 MUNI.909	Prestressed Concrete Box Beams	m^2	700	$ 1,200	$ 840,000
45	SP-45 MUNI.914	Bridge Deck Waterproofing	m^2	660.0	$ 60	$ 39,600
46	SP-46 MUNI.914	Form and Fill Grooves	m	20.0	$ 200	$ 4,000
47	SP-47 MUNI.922	Plain and Laminated Natural Rubber Bearings	each	96	$ 750	$ 72,000
48	SP-48	Locate Existing Buried Utility - Provisional	ea	10	$ 1,000	$ 10,000
49	SP-49	Assist Owner With Fish Salvage and Transfer	LS	1	$ 4,500	$ 4,500
50	--	Contingencies	allow	1	$ 150,000	$ 150,000

Total	$ 3,525,702

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MEMORANDUM

To:	Mark Jeffery, C.E.T.	**Company:**	Township of Wilmot
From:	Allan Garnham, P. Eng.	**Dept/Title:**	
Date:	November 24, 2021	**cc:**	
File#:	**20-145 Bridge Street Bridge**	**Subject:**	Repurposing of Existing Truss Bridge

Mark,

With respect to repurposing the existing Bridge Street Bridge truss structure, we feel salvaging the old bridge and moving it to another site is viable.

Whether this structure is to be salvaged or demolished, the removal procedure is relatively the same. The first task would be to remove the concrete deck. The next task would be to use a large crane to remove the bridge from its current supports and place the bridge on the roadway. Once the bridge is on the roadway, it could either be cut up for recycling or transported to a new site. If the existing bridge is salvaged, the relocation would need to be completed by a Sub-contractor with experience in moving oversize machinery/equipment.

It is understood that if the truss were to be repurposed, temporary storage at the Public Works yard is not an option. As such, a temporary storage location would need to be found. Pending the approval of the respective property owner, the bridge might be able to be stored on the adjacent property northwest of the site.

Based on the condition of this bridge, we recommend this bridge only be repurposed for an “at grade” crossing for pedestrians only (i.e. decorate only and not intended to span any sort of distance). This would most likely be on a local walking trail. We do not recommend repurposing this bridge for vehicular traffic. In addition, we do not recommend placing this bridge over any sort of watercourse.

The following cost estimates could be considered if the relocation option is selected:

Item	Cost
Relocate Bridge During Construction	$ 125,000
Land Rental Cost (if a Township owned property cannot be located)	$375 / month
Transportation of Bridge to New Site Once One is Chosen	$ 190,000
Foundations to Support Bridge	$ 125,000
New Timber Deck	$ 65,000
Engineering	$ 115,000

TOTAL:	$ 620,000 + $375 / month storage

These costs assume the Township will endorse vehicle overload permits and close the required roads while the bridge is being transported. These costs also assume that permanent utility relocations (such as overhead power lines or phone lines) do not require permanent relocation.

Thanks,

Allan Garnham, P. Eng.

6.

CULTURAL HERITAGE EVALUATION REPORT (CHER)

AND

HERITAGE IMPACT ASSESSMENT (HIA)

- Cultural Heritage Evaluation Report (CHER) and Heritage Impact Assessment (HIA) prepared by CHC Limited dated November 1, 2021

Cultural Heritage Evaluation Report (CHER) and Heritage Impact Assessment (HIA)

for

Bridge 34/B-T9 (Bridge Street Bridge)
Township of Wilmot, Regional Municipality of Waterloo

prepared by

CHC Limited
87 Liverpool Street, Guelph, ON N1H 2L2
(519) 824-3210
email oscott87@rogers.com

October 20, 2020
revised June 28, 2021
updated November 11, 2021

Table of Contents

all photographs by Owen R. Scott of CHC Limited, September 14, 2020 unless otherwise noted.

EXECUTIVE SUMMARY

The Bridge Street Bridge is an eight-panel, riveted, single-span, 46 m long x 4.08 m wide, Parker (camelback) truss bridge, crossing the Nith River, a tributary of the Grand River, midway between Haysville and Plattsville. It was built by the Hamilton Bridge Company in 1913 and is part of a group of steel truss bridges in Wilmot Township. It is posted with a weight limit of 11 tonnes.

The bridge is not listed on the Township's Heritage Register of Non-Designated Properties, nor is it designated under the *Ontario Heritage Act*, and it is not listed on the *Ontario Bridge Inventory*. It is described and evaluated in *Arch, Truss & Beam: The Grand River Watershed Heritage Bridge Inventory* and featured in *Spanning the Generations: A Study of Old Bridges in Waterloo Region*.

The structure was evaluated using the criteria of *Ontario Heritage Act Regulation 9/06*. The Bridge Street Bridge meets at three of the criteria of *Regulation 9/06*, including 'design value or physical value' and 'contextual value' criteria, having artistic merit and being physically, functionally, visually and historically linked to its surroundings and a familiar structure in the context of the area. The view of bridge from the west is dramatic and is considered a landmark. It does not meet the 'historical value or associative value' criterion.

Major repairs to the bridge have been carried out over the years, with the most recent in 2011. A 2019 Municipal Structural Inspection found the bridge to be in generally in poor condition with a recommendation to replace it due to its deteriorated condition, its deficient loading capacity, and deficient width.

While the bridge is considered to be worthy of designation under the *Ontario Heritage Act*, it is in such poor condition that it requires many replacement elements. If that were accomplished it would still not meet the performance requirements of a river crossing in this location. A replacement bridge is required. The preferred alternative is documenting the bridge and commemorating it with a plaque on the new structure, and should a need be found, salvaged elements/members of the bridge could be retained for future conservation work.

1.0 BACKGROUND - CULTURAL HERITAGE EVALUATION REPORT

This Cultural Heritage Evaluation Report (CHER) has been conducted following the *Municipal Heritage Bridges Cultural, Heritage and Archaeological Resources Assessment Checklist Revised April 11, 2014* (MEA) and the Ministry of Tourism, Culture & Sport's *Standards & Guidelines for Conservation of Provincial Heritage Properties, Heritage Identification & Evaluation Process, Sept. 1, 2014*.

CHC Limited was contracted by K. Smart Associates Limited, on behalf of the Township of Wilmot[1], to conduct this heritage assessment of the Bridge Street Bridge, Township of Wilmot, Regional Municipality of Waterloo, Ontario. The bridge crosses the Nith River, a tributary of the Grand River, a Canadian Heritage River, midway between Haysville and Plattsville. The Bridge Street Bridge, Bridge #34/BT-9, is described and evaluated in *Arch, Truss & Beam: The Grand River Watershed Heritage Bridge Inventory*.[2] It is also featured in *Spanning the Generations: A Study of Old Bridges in Waterloo Region*, two phases of which 1) inventories and ranks more than 100 bridges based on their heritage attributes; and 2) reports on the ten most historically significant bridges[3]. The third phase focuses on steel truss bridges, of which the Bridge Street Bridge is one. The bridge is slated for replacement.[4]

A CHER is required as the first phase of the work to identify the degree of heritage significance of a bridge as information for the Class Environmental Assessment (EA) process.

This report is presented as part of the planning and design process for municipal roads projects subject to a Schedule "B" Municipal Class Environmental Assessment. The Municipal Class EA provides a decision-making process to ensure that all relevant engineering and environmental features are considered in the planning and design of municipal infrastructure. The Bridge Street Bridge is posted with a weight limit of 11 tonnes. This Class EA study is intended to address its:

1. deficient loading capacity (Figure 2);
2. existing bridge conditions;
3. deficient width (one lane - Figure 1)
4. options of:
   - do nothing,
   - repair the structure,
   - replace the structure,
   - relocate the structure.

Figure 1

Figure 2

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[1] K. Smart Associates Limited, File 20-145, July 27, 2020

[2] Lindsay Benjamin *et. al.*, *Arch, Truss & Beam: The Grand River Watershed Heritage Bridge Inventory*, Heritage Resources Centre, University of Waterloo, March 2013, pp. 138-139

[3] *Spanning the Generations, A Study of Old Bridges in Waterloo Region*, Region of Waterloo, October 2007, pp 1.13-1.14 (*Phase 1*), pp., 52-58 (*Phase 3*)

[4] $3.5M replacement on the way for bridge near New Hamburg, *NewHamburgIndependent.ca*, Namish Modi, July 8, 2020

The objectives of this report are to: provide an historical overview of the bridge within the broader context of Wilmot Township and the Region of Waterloo; describe existing conditions and heritage integrity; evaluate the bridge within Ontario's MEA and Ministry of Heritage, Sport, Tourism and Culture Industries guidelines (referencing *Ontario Regulation 9/06*) and draw conclusions about the heritage attributes of the structure; and ascertain sensitivity to change in the context of identified heritage attributes and present and evaluate alternatives. Appropriate mitigation measures are recommended where adverse effects are anticipated.

2.0 THE CULTURAL HERITAGE EVALUATION REPORT

2.1 Description of the Property

The bridge is located on Wilmot Township Road 9 (now Bridge Street), Lot 21, Concessions 3 & 4, Block A south of Haysville (Figure 3).

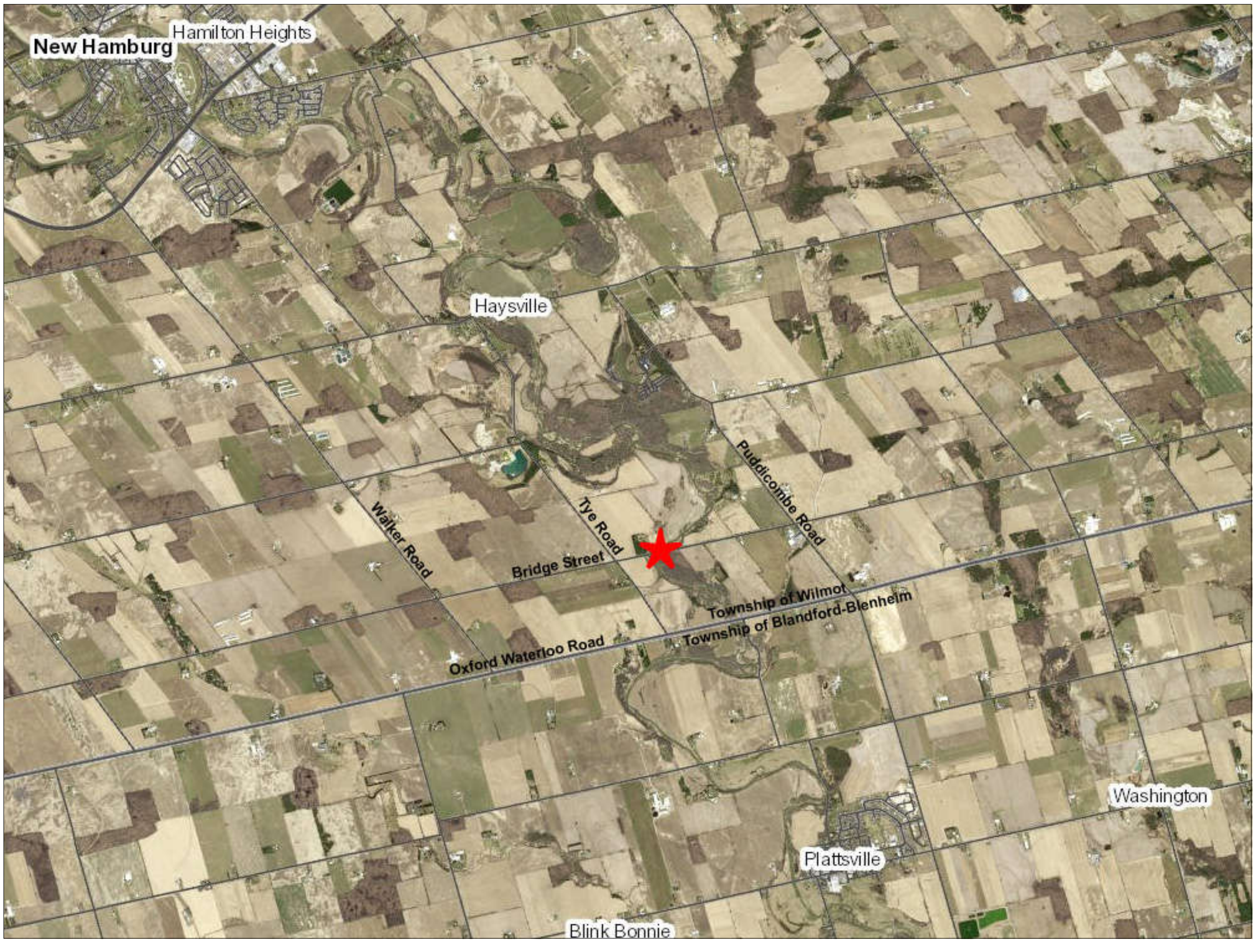

Figure 3 location of Bridge Street Bridge, Wilmot Township - *GRCA mapping*

The Bridge Street Bridge (Figure 4) is an eight-panel, riveted, single-span, 46 m long x 4.08 m wide, Parker (camelback) truss bridge with a clearance height of 3.8 metres. It was built by the Hamilton Bridge Company in 1913. The Bridge Street Bridge - 1913, is part of a group of steel truss bridges in Wilmot Township. The other bridges are Shade Street Bridge - 1953, Hartman Bridge - 1936 - (Part V designated *OHA*), Holland Mills Bridge -

c. 1910 (demolished)[5], Haysville Bridge - 1930 (demolished), and Oxford-Waterloo Bridge - 1912. This group of bridges is/was of an era and symbolized Wilmot's farming community.[6]

Figure 4 Bridge Street Bridge looking south - *K. Smart & Associates photo*

The bridge is not listed on the Township's Heritage Register as either a non-designated property of cultural heritage value or interest, or as a designated property under the *Ontario Heritage Act*. It is a single property within the a parcel of land that is in a Canadian Heritage River watershed, the Grand River watershed.

2.2 Research

In the conduct of this CHER, CHC Limited:

- researched archival and published sources relevant to the history and geographic context of the Bridge;
- conducted a site investigation to inventory and document the Bridge and its surrounding context; and
- evaluated the structure and its context using the criteria prescribed in *Regulation 9/06*.

Primary and secondary sources, including historic maps, aerial photographs, photographs, newspaper articles,

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[5] *Cultural Heritage Evaluation Report (CHER) & Heritage Impact Assessment (HIA), Bridge No. 17/B-T13, 'Holland Mills Road Bridge', Township of Wilmot*, CHC Limited, November 28, 2016

[6] *Spanning the Generations, A Study of Old Bridges in Waterloo Region*, *Phase 2 Heritage Assessment*, Region of Waterloo, October 2007, p. 50 and *Phase 3 Heritage Assessment of Truss Bridges of Waterloo Region*, p. 32

online sources, local histories, and research publications, and volumes related to evaluating heritage value were reviewed (see References section).

A site investigation was conducted by Owen R. Scott, CAHP of CHC Limited on September 14, 2020 where numerous photographs were taken as well as notes on observations. Consultations were conducted on several occasions with Pedram Yazdan, E.I.T. and Allan Garnham, P.Eng. of K. Smart Associates Limited, the EA project lead consultant, regarding the structure, the Township's plans, archaeological investigations and the history of the bridge.

Wilmot Township is located on the traditional territory of the Neutral, Anishnaabeg, Haudenosaunee, and Mississauga peoples.

It was designated a Crown Reserve following the *Canada Act* of 1791 which created Upper and Lower Canada. Following a government survey in 1824, Mennonites from Waterloo Township and Amish from Europe claimed lots and began clearing roadways and farms.
The topographical features of Wilmot are of a generally regular and inviting order, the principal part of the township having just sufficient roll to facilitate drainage, though toward the south and south-east more pronounced undulations are observable ; but at no portion of its area is there any near approach to roughness. For the varied purposes of agriculture, Wilmot has no superior among the townships of Canada; its favorable climate, its fertile soil, its almost unexceptionable surface and numerous streams rendering it one of the most advantageous locations for the husbandman to be found on the continent. The founder of the first Wilmot community was Christian Naffziger, a Dutchman, who had come to America not later than 1820, in search of a location to plant a colony of Amish Mennonites.

The settlement of Wilmot lagged much behind that of not only Waterloo, but also Woolwich and Dumfries, and not until 1824 was there any considerable inroad upon the forests of this township effected by the axe of the sturdy pioneer.

The four most southerly concessions of Wilmot, (within which Bridge 34/BT-9 lies) *constituting Block A, were granted to the Canada Company as compensation for a considerable area of swampland which was included in their original grant. Between the first and second concessions the so-called Dundas Road was cut out by the Canada Company in 1828, as an avenue to their lands in the Huron Tract farther west ; and along this road, the first settlers began to locate in 1832, or the succeeding year.*[7]

The Canada Land Company opened the Huron Road through the southern part of Wilmot Township in 1828. Soon after, Roman Catholics and Lutherans from Alsace and Germany, Anglicans from the British Isles and others joined the initial settlers in clearing land and building roads, mills, shops, churches, schools and villages. Along the settlements three main roads were cleared for passage from one to the other. They named the roads Oberstrasse (Upper Street), Mittlestrasse (Middle Street) and Unterstrasse (Lower Street). These roads are now known as Erb's Road, Snyder's Road and Bleams Road.[8]

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[7] *Illustrated Historical Atlas of Waterloo & Wellington Counties Ontario*, H. Parsell & Co. 1881, p. 9

[8] History of Wilmot Township, https://www.wilmot.ca/en/living-here/History-of-Wilmot-Township.aspx

Likely to have been the first settler in what has been called Hamburgh or New Hamburg circa 1840, millwright Josiah Cushman arrived from Germany in the early 1830s. He dammed Smith's Creek and built a sawmill that helped attract others. William Scott, (Lord Campfield in Scotland), now considered to be the founder of New Hamburg, arrived in 1838, after Cushman's death. He renamed Smith's Creek the Nith River, built a new dam and constructed a new lumber sawmill. The mill continued to plane lumber until 1902 when it burned down.[9]

In 1840, Wilmot Township became part of the District of Wellington. On January 21, 1850, the first elected Council of the Township of Wilmot met in Wilmot Centre.[10]

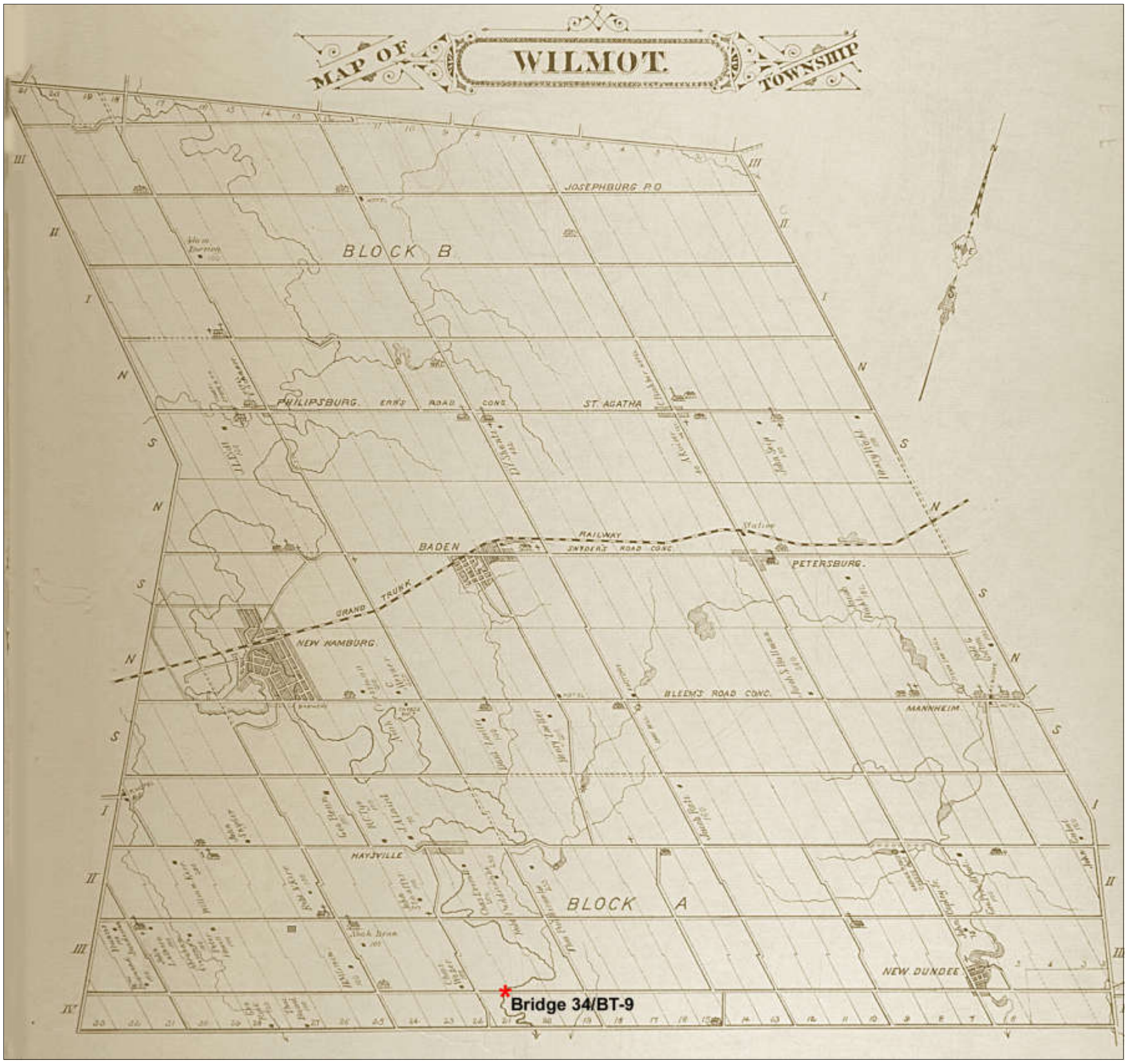

Figure 4Township of Wilmot 1881 - *Illustrated Historical Atlas of Waterloo & Wellington Counties Ontario*

The Nith river, named by Scott after the Nith River in Scotland, begins in a woodland northwest of Crosshill and west of Waterloo Regional Road 5 in the township of Wellesley. It heads north into Perth County, then turns sharply southwest and passes through the communities of Fernbank and Millbank in Perth East. It continues south,

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[9] https://en.wikipedia.org/wiki/Wilmot,_Ontario

[10] History of Wilmot Township, https://www.wilmot.ca/en/living-here/History-of-Wilmot-Township.aspx

takes in the right tributary Smith Creek and arrives at the community of Nithburg. The river flows east back into Waterloo Region, takes in the right tributary Silver Creek, and then the left tributary Firella Creek south of the community of Wellesley in the township of Wellesley. The river turns south into the township of Wilmot, takes in the left tributary Bamberg Creek and passes through the communities of Phillipsburg and New Hamburg. The Nith continues south, takes in the left tributaries Baden Creek and Hunsburger Creek, enters into Blandford-Blenheim, Oxford County and reaches the community of Plattsville. The river turns east, takes in the right tributary Black Creek, and left tributaries Hiller Creek, Alder Creek and Eden Creek, passes back into Waterloo Region, and reaches the community of Ayr in the township of North Dumfries, where it takes in the left tributary Cedar Creek. It then turns sharply west, flows back into Oxford County, then turns southeast passing through the communities of Wolverton and Canning. The Nith then flows into Brant County, takes in the right tributary Mud Creek and left tributary Charlie Creek, passing Barker's Bush and reaching its mouth at the Grand River in Paris.[11]

Setting/Environs: A series of airphotos (Figure 5) show Bridge Street and the bridge from 1946 through 2015.

Figure 5 Bridge Street & Nith River crossing,
1946-1966 *University of Waterloo Geospatial Centre*, 2015, *GRCA mapping*

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[11] https://en.wikipedia.org/wiki/Nith_River

In spite of a hurricane and devastating flood (Hazel 1954) and numerous storms and spring floods, the landscape environs of the bridge have remained markedly similar for nearly 75 years and perhaps longer.

Figure 6 meadow and crop land looking north from Bridge 34/BT-9

Figure 7 old field vegetation, typical of river valley south of Bridge 34/BT-9, southwest of bridge

Bridge Street is an asphalt surfaced road. Approaching the bridge from the east, it runs through a topographically flat valley landscape (Figure 8).

Figure 8 looking east from the bridge

The approach from the west, in contrast, is dramatic, with a steep hill from the tableland to the valley below (Figures 9 and 10).

Figure 9 looking west from the bridge

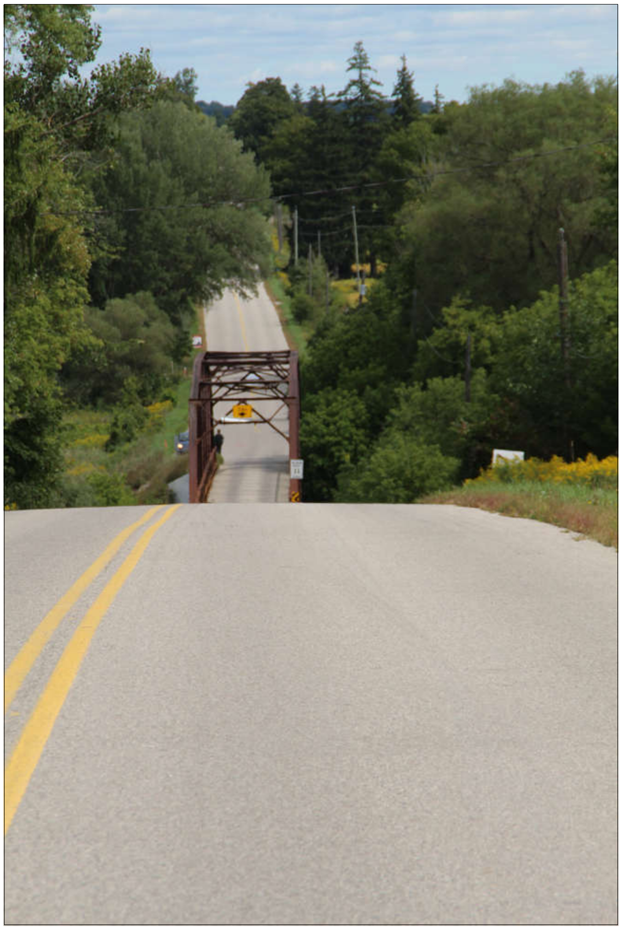

Figure 10 approach from the west

The Bridge:

On February 22, 1870, Charles H. Parker, a mechanical engineer with the National Bridge and Iron Works of Boston, Massachusetts, was awarded a patent (#100,185) for what was essentially, according to most bridge historians, a Pratt truss with a polygonal or inclined top chord. Parker, it is claimed, recognizing that the depth of truss required at the ends was less than that required at mid-span, simply inclined the top chord, thus also progressively shortening the vertical and diagonal members from the center to the ends of the truss. The Parker truss therefore uses less metal than a parallel chord Pratt truss of equal length, and the longer the span the greater the economy of materials. Unlike the parallel chord Pratt, however, the Parker required different length verticals and diagonals at each panel. This increased fabrication and erection costs. Because bridge prices were usually driven by the weight of the materials used to construct the superstructure, the lighter weight of the polygonal chord truss tended to offset the increased labor costs for spans over a certain length.

In the highly competitive bridge market, the economy of materials directly affected profit, and the Parker trusses superseded Pratt trusses for long span bridges after the turn of the century, as less materials were needed in their construction. The form was adopted by highway departments as standard designs for pony trusses (30 to 60 feet) and through trusses (100 to 300 feet). The camelback is a variation of the Parker truss. Most camelback trusses are essentially Parker trusses with exactly five slopes in the upper chord and end posts.[12]

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[12] *A Context For Common Historic Bridge Types*, Chapter 3 - Historic Context for Common Historic Bridge Types, Parsons Brinckerhoff and Engineering and Industrial Heritage, October 2005, pp. 3-34 - 3-35

The Bridge Street Bridge is an eight-panel, riveted, single-span, 46 m long x 4.08 m wide, Parker (camelback) truss bridge with a clearance height of 3.8 metres. It was built by the Hamilton Bridge Company in 1913.

Figure 11 Bridge Street Bridge looking south - *K. Smart & Associates photo*

Figure 12 railings

Figure 13 concrete deck

The bridge retains its original railings, while its concrete deck is a 1982 replacement of the original and the concrete abutments were refaced in 2018 (Figures 12, 13 & 15).

Figure 14 Bridge Street Bridge looking north - *Nathan Holth 2006, HistoricBridges.org*

Figure 15 concrete abutment, west end

Over the years, the bridge has been damaged by flood and hurricane (Hazel 1954). In 2018 a tender was issued to effect extensive repairs to the bridge (Appendix 1). The concrete abutments were refaced (Figures 15 & 16); connection plates were replaced, floor beams and chords were reinforced (Figures 16 & 17).

Figure 16 refaced concrete abutment, diagonal chord reinforcement, east end

Figure 17 deteriorated beams, beam reinforcement

Figure 18 west portal - maximum height 3.8 metres

Figure 20 reinforced end post and original railing

Figure 19 west approach - *Nathan Holth 2006, HistoricBridges.org*

Figure 19 is a 2006 photograph that shows the weight limit at 15 tonnes versus today's 11 tonnes and also shows a gravel surfaced Bridge Street in 2006.

Figure 20 railing standoff

Figure 21 top chord connection

Figure 22 deteriorated end post to abutment connection

Figure 23 V-laced vertical member & damaged railing

After completion of the repairs, and in the next year, a Municipal Structural Inspection was carried out on the bridge by AEU Structural Inc., September 17, 2019. According to the Municipal Structure Inspection Form (Appendix 2), *Structural repairs to remaining ends of floor beams; exterior stringers and ends of bottom chords* were made in 2011, *Structural repairs to some ends of floor beams* were made in 2005, and *Deck replacement; rehabilitation of substructure* was performed in 1982 [13]. Specific observations/conclusions/recommendations from the report are:

- *Accessories (Attachments and Signs) - Abrasions and misalignment at hazard signs; Arrows for overhead clearance are damaged and wrapped over bridge bracing*
- *Approaches (Barrier) - A code compliant barrier is required on east approach; Substandard end treatments at northwest and southwest; substandard connection to barrier over structure; Light corrosion; abrasions; Impact damage; dents; Severe rot at base of some posts; some leaning and missing posts*
- *Approaches (Wearing Surface) - Light cracks at west; Medium transverse pattern cracks and at either end of approach slab at east; Settlement*
- *Joints (Armouring/ Retaining Devices) - Abrasions; Armouring at east joint is jammed*
- *Joints (Seals & Sealants) - Backer rod with sealant*

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[13] *Municipal Structure Inspection Form 34/B-T9 - Bridge Street*, Tova Govia, P.Eng.; AUE Structural Inc. September 17, 2019

- *Barriers (Railing Systems) - Existing railing system is substandard and should be replaced with a code compliant railing system; Medium corrosion; Bent top and bottom rails; perforations at bottom rail; Missing rivets; Broken, bent and twisted lattice*
- *Barriers (Posts) - Existing railing system is substandard and should be replaced with a code compliant railing system; Posts are connected to truss; Loose; Twisted*
- *Trusses/Arches (Top Chords) - Light to severe corrosion; Perforations*
- *Trusses/Arches (Bottom Chords) - Medium to severe corrosion; Gravel accumulation; Repairs noted*
- *Trusses/Arches (Verticals/Diagonals) - Twisted and bent steel angles*
- *Trusses/Arches (Connections) - Medium to severe corrosion; Perforations at stiffener plates; Severe loss of rivet materials; Few missing bolts*
- *Bracing - Perforations at some of connections to bottom chords*
- *Decks (Drainage System) - Generally in good repair*
- *Decks (Deck Top/Thin Slab) - Narrow to medium transverse cracks; Localized delamination; Severe abrasions for a 1.00 m wide strip for entire length of deck; Steel channel at sides of deck is severely corroded, perforated and collapsed; Abrasions*
- *Decks (Soffit/Thin Slab) - Localized Wide Cracks; Delamination; Severe corrosion at ends of deck*
- *Beams/Main Longitudinal Elements (MLE's) (Floor Beams) - Medium to severe corrosion and section loss; Perforations at west floor beam; Floor beams ends have all been previously repaired, and some floor beams replaced*
- *Beams/Main Longitudinal Elements (MLE's) (Stringers) - Exterior stringers repaired with new stringers; Medium corrosion; Exterior stringers connected to channel on deck level which is loose and moving*
- *Bracing - Overhead portal frame severely twisted at both ends*
- *Abutments (Ballast Walls) - Wide crack at construction joint; Medium scaling at ends; Severe deterioration from abrasions at top of ballast walls; Severe spall and delamination at southeast; Severe spall at southwest*
- *Abutments (Bearings) - Covered with vegetation and debris; Severe corrosion; Seized bearings; Jammed joint*
- *Abutments (Abutment Walls) - Localized wide crack at bearing seat; Construction joint misaligned up to 20 mm at west abutment; Stains at bearing seat locations at west abutment*
- *Abutments (Wing Walls) - Full height wide crack; Undermining at northeast wingwall; Severe spall at southeast wingwall; Patched areas*
- *Foundations (Foundation Below Ground Level) - No visible evidence of foundation instability was noted during the inspection*
- *Embankments & Streams (Embankments) - Medium erosion was noted embankments*
- *Embankments & Streams (Slope Protection) - Generally in good condition*
- *Embankments & Streams (Streams & Waterway) - High volume and medium flow from south to north with no visible flow obstructions.*[14]

The report concludes that the: *Structure is generally in poor condition. Replacement of the structure is required in the next one (1) to five (5) years. Monitoring of the structure is recommended every three (3) months.*[15] The bridge is slated for replacement at an estimated cost of $3.5 million.

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[14] *Ibid*

[15] *Ibid*

Figure 25 diagonal bracing

Figure 26 looking down river from the bridge

Figure 27 looking up river from the bridge

Although no builder's name or markings were found by the author; there is documentation that indicates the bridge was built by the Hamilton Bridge Company in 1913[16]. The steel is rusty, with a fair amount of perforation which has been reinforced with new steel. Bridge connections are mostly rivets; bolt and nut connections are used to fashion the recent steel reinforcing plates.

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[16] *Spanning the Generations, A Study of Old Bridges in Waterloo Region*, *Phase 2 Heritage Assessment*, Region of Waterloo, October 2007, p. 50 and *Phase 3 Heritage Assessment of Truss Bridges of Waterloo Region*, p. 32 and Historic Bridges website *https://historicbridges.org/bridges/browser/?bridgebrowser=ontario/bridgest/*

Figure 28 underside of bridge showing extensive repairs - *K. Smart Associates photo*

An archaeological site investigation in 2020 did not result in finding anything of archaeological significance; the report to be issued will be a Stage 1 & Stage 2 Assessment.

2.3 Community Engagement

Consultation on cultural heritage resource considerations was conducted through the Environmental Assessment Public Information Centre (PIC) and by requesting feedback from Indigenous communities, Heritage Wilmot Advisory Committee and The Township of Wilmot. A virtual PIC was held in late October and early November. One comment was received from the public that concerned heritage "The Bridge Street truss bridge is a uniquely sited part of our cultural heritage; here is the perfect opportunity to show that Wilmot is willing to put funds into this ...." (refurbishing the bridge in situ). In addition, the CHER/HIA report was circulated to Heritage Wilmot who provided comments which are attached as Appendix 5. This report was also forwarded to Six Nations of the Grand River First Nation and Mississauga's of the Credit First Nation. They did not provide any response to the report. As a result of distributing this report to various stakeholders, no new historical information has been revealed.

2.4 Evaluation

The structure was evaluated using the criteria of *Ontario Heritage Act Regulation 9/06*. The evaluation based on

Regulation 9/06 criteria is summarized below. To be considered significant and worthy of designation under Part IV of the *Ontario Heritage Act*, the bridge must meet one or more of the criteria grouped into the categories of Design/Physical Value, Historical/Associative Value and Contextual Value.

***Regulation 9/06* criteria**

A property may be designated under section 29 of the *Act* if it meets one or more of the following criteria for determining whether it is of cultural heritage value or interest. The criteria are listed with responses as to whether or not they are met.

1. The property has **design value or physical value** because it,
   - I is a rare, unique, representative or early example of a style, type, expression, material or construction method,

     The bridge is one of two rivet-jointed Parker Camelback through truss bridges in the Township, but not the earliest, and is not unique in the Township or Region - criterion not met.

   - ii displays a high degree of craftsmanship or artistic merit, or

     The bridge is a combination of rivet- & bolt-connected steel with a concrete deck and concrete abutments. It does not exhibit a high degree of craftsmanship, although it does have artistic merit - criterion partially met..

   - iii demonstrates a high degree of technical or scientific achievement,

     The bridge does not meet this criterion; however it is noted that the Parker truss was an improvement over the Pratt truss in terms of cost - criterion not met..

2. The property has **historical value or associative value** because it,

   - I. has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community,

     There is no known association with an historic theme, event, belief, person, activity, organization or institution - criterion not met..

   - ii. yields, or has the potential to yield, information that contributes to an understanding of a community or culture, or

     The bridge does not yield or have the potential to yield information that would contribute to an understanding of the community or culture - criterion not met..

   - iii. demonstrates or reflects the work or ideas of an architect, artist, builder, designer or theorist who is significant to a community.

     The bridge was built by a known, prolific Hamilton, Ontario builder of steel bridges in the late 19th to early 20th century. The builder is not significant to the community - criterion not met..

3. The property has **contextual value** because it,

   I. has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community,

      The bridge has no direct associations with a theme, event, belief, person, activity, organization or institution - criterion not met.

   ii is physically, functionally, visually or historically linked to its surroundings, or

      The bridge is physically, functionally, visually and historically linked to its surroundings - criterion is met.

   iii. is a landmark.

      The bridge is a familiar structure in the context of the area. The view of bridge from the west is dramatic, and is considered a landmark - criterion is met.

2.5 Conclusion

The Bridge Street Bridge (Bridge No. 34/B-T9) meets three of the criteria of *Regulation 9/06*, namely it has artistic merit; it is physically, functionally, visually and historically linked to its surroundings; and it is a landmark. It is considered significant and worthy of designation under the *Ontario Heritage Act*.

2.6 Draft Statement of Cultural Heritage Value

Description of Property - Bridge No. 34/B-T9 is set in a picturesque, rural, agricultural landscape. It is located midway between Haysville and Plattsville just east of Tye Road on Bridge Street where it crosses the Nith River. It is a 46 m long x 4.08 m wide, with a clearance height of 3.8 metres, concrete-decked, 8 panel, rivet-connected, Parker (camelback) through truss bridge. It was built in 1913 by the Hamilton Bridge & Tool Company of Hamilton, Ontario. There is no visible identification of the builder on the bridge. The bridge has been modified over time with reinforced steel plates, rivet replacement, *etc.*

Cultural Heritage Value or Interest - The bridge is not listed on the Township's Heritage Register of Non-Designated Properties, nor is it designated under the *Ontario Heritage Act*, and it is not listed on the *Ontario Bridge Inventory.* It is part of a group of steel truss bridges in Wilmot Township which include Shade Street Bridge, Hartman Bridge, and Oxford-Waterloo Bridge . Two other steel truss bridges, Holland Mills Bridge and Haysville Bridge have been demolished in recent years. The nearby Oxford-Waterloo Road Bridge is its twin. There are approximately 15 through truss bridges in the Grand River watershed of which 11 are in the Region of Waterloo.[17] & [18] Three similar steel through truss bridges were located in the neighbouring municipality of Blandford-Blenheim Bridges #20, #24 & #25. Bridge #20 was recently replaced, Bridge #24 is slated for replacement, and Bridge #25 was permanently closed to traffic.

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[17] *Grand Old Bridges: The Grand River Watershed Bridge Inventory*, April 6, 2004, pp. 21-22

[18] *Spanning the Generations, A Study of Old Bridges in Waterloo Region*, *Phase 3 Heritage Assessment of Truss Bridges of Waterloo Region*, Region of Waterloo, October 2007, p. 2

The Bridge Street Bridge (Bridge No. 34/B-T9) meets three of the criteria of *Regulation 9/06*, namely it has artistic merit; it is physically, functionally, visually and historically linked to its surroundings; and it is a landmark.

Description of Heritage Attributes - Consideration can be given to the bridge's:
- retention of its original railings;
- popular fishing location adding to the ambience of a fishing experience;
- proportions with a general massing that is appropriate to the landscape in which it is situated;
- dramatic view from the westerly approach making it a landmark in the community.

Key heritage attributes that embody the contextual heritage value of the bridge include:
- its contribution to the character of the Nith River valley part of the Canadian Heritage Grand River.

3.0 HERITAGE IMPACT ASSESSMENT

3.1 Description of the Proposed Undertaking

This heritage impact assessment is part of the planning and design process for a municipal roads project subject to a Class Environmental Assessment. Due to the existing bridge conditions, loading, width and height deficiency issues the Township of Wilmot is looking at improvements to the crossing. The existing steel truss bridge of 1913 is not listed on the Township's Heritage Register of Non-Designated Properties, nor is it designated under the *Ontario Heritage Act*. Neither is it on Ontario's Heritage Bridge List. The bridge replacement cost is estimated at $3.5 million.[19] The options are:
- do nothing,
- repair the bridge,
- replace the bridge superstructure,
- replace the bridge in current location,
- replace the bridge in new location.

3.2 Impact Assessment

The proposal is to replace the existing Bridge Street Bridge because it is in very poor and unsafe condition and would require extensive repair work to make it safe for vehicular travel. However, width, height and load issues would remain.

Replacing the structure in the current location will have a negative impact on the heritage resource as it has been determined to be a significant cultural heritage resource under *Regulation 9/06*. The demolition and removal of the bridge will result in the complete loss of all physical elements that reflected the cultural heritage value or interest of the property.

3.3 Considered Alternatives and Mitigating Measures

Doing nothing is not an option as the condition of the bridge is deficient and will continue to deteriorate.

Repairing the bridge will not overcome the load, width and height deficiencies. Repairs would also be extensive, requiring much of the original structure to be replaced.

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[19] $3.5M replacement on the way for bridge near New Hamburg, *NewHamburgIndependent.ca*, Namish Modi, July 8, 2020

Replacing the bridge superstructure would remove the integrity of the original bridge.

Replacing it in a new location and re-purposing the bridge for pedestrian use by repairing it, would have a minor negative impact on the resource, should that option be viable.

The Bridge Street Bridge is in very poor and unsafe condition and would require extensive repair work to make it safe for vehicular travel. However, width, height and load issues would remain. When retention of a span *in situ* is practically untenable from transportation, engineering or safety perspectives this is an appropriate conservation alternative that can satisfy the intent of retaining the span. Adoption of such an option is feasible if:

- the condition of the bridge is sufficiently good or can be made good at reasonable cost to warrant relocation;
- a site can be found where the bridge could be placed as a useful structure, or as a replacement for a bridge in poor condition; and
- this can be accomplished at a reasonable cost.

Should a replacement in a new location be feasible, and if a repaired Bridge Street Bridge could serve a useful purpose as a pedestrian crossing in its current location, the heritage impact would be minimal. If retaining the bridge *in situ* is not practical, relocating the steel truss span of the structure would have a lesser negative impact on the heritage resource than demolition or scrap salvage. A relocation to a use that requires a weight limit that does not exceed the repaired bridge's capacity and would not require a wider roadbed would be required. A farm lane creek crossing, or a pedestrian park bridge, for example, might be ideal uses, should something be found within a reasonable proximity. Relocating the bridge to another place is only feasible, if the bridge condition is such that it can be dismantled, repaired, and re-decked. A site where the bridge could be placed as a useful structure with new abutments would also be required. All of this would need to be accomplished at a reasonable cost.

The preferred alternative at this juncture would appear to be replacement of the bridge in the current location. The impact on the heritage resource will depend on the potential for relocating the existing structure.

With respect to the environs, the CHER identifies the cultural heritage resources associated with the project. None needs to be impacted by the replacement of the bridge if the design of the replacement and especially its relationship to the immediate Nith River landscape is sensitive to the character of the adjacent landscape, the historic crossing, and the current recreational use of the immediate environs (fishing).

In the opinion of this author, the Bridge Street Bridge meets the criteria of *Regulation 9/06* for designation under the *Ontario Heritage Act*. Therefore, alternatives / mitigation options need to be considered. The following options in rank order of preference, based on the Ontario Heritage Bridge Guidelines (MTO, 2008) - Section 4.3 are provided for context.

1. *retention of existing bridge with no major modifications undertaken;*
   not a reasonable alternative as the bridge is structurally unsound and deficient in capacity, width and height.

2. *restoration of missing or deteriorated elements where physical or documentary evidence (e.g. photographs or drawings) exists for their design;*
   feasible, but requires extensive replacement of original fabric without resolving load, width and height issues.

3. *retention of existing bridge with sympathetic modification;*
   feasible, but requires extensive replacement of original fabric without resolving load, width and height issues.

4. *retention of existing bridge with sympathetically designed new structure in proximity;*
   considering the course of the Nith River, the associated extensive floodplain, and the steep approach from the west at this location (Figure 29), this may not be feasible.

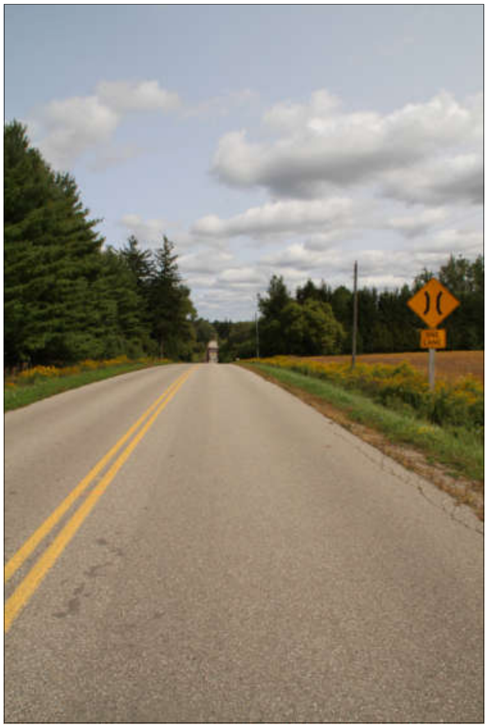

Figure 29 westerly approach

5. *retention of existing bridge no longer in use for vehicular purposes but adapted for a new use, for example, prohibiting vehicle or restricting truck traffic or adapting for pedestrian walkways, cycle paths, scenic viewing, etc.;*
   Where retention of a span for vehicular use is practically untenable from engineering or safety perspectives this is an appropriate conservation alternative that would satisfy the intent of retaining the span. This option is not feasible considering the need for a vehicular crossing at this location.

6. *retention of bridge as heritage monument for viewing purposes only;*
   not feasible (see notes 4 & 5).

7. *relocation of smaller, lighter single span bridges to an appropriate new site for continued use or adaptive re-use;*
   Where retention of a span *in situ* is practically untenable from transportation, engineering or safety perspectives this is an appropriate conservation alternative that would satisfy the intent of retaining the span. Adoption of such an option is feasible if:
   - the condition of the bridge is sufficiently good or can be made good at reasonable cost to warrant relocation;
   - a site can be found where the bridge could be placed as a useful structure, or as a replacement for a bridge in poor condition; and
   - this can be accomplished at a reasonable cost.

   It is unknown if there is an appropriate site and the bridge would still require extensive replacement of the original fabric to be sound. This option does not appear to be feasible.

8. *bridge removal and replacement with a sympathetically designed structure:*
   a. *where possible, salvage elements/members of bridge for incorporation into new structure or for future conservation work or displays; and*
   b. *undertake full recording and documentation of existing structure.*[20]

   Replacement is planned by the Township. However, should a need be found, salvaged elements/members of the bridge could be retained for future conservation work and a recording and documentation of the existing structure undertaken. Photographs and descriptions gathered during the course of this CHER/HIA and previous documentation by the Region of Waterloo and *historicbridges.org* could be utilized for that

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[20] *Ontario Heritage Bridge Guidelines (Interim) – Jan 11, 2008,* Ontario Ministry of Transportation

purpose. As well, the existing structure could be commemorated with a plaque mounted on the replacement bridge.

4.0 RECOMMENDATION

After garnering input from the Public Information Centres (community consultation), the foregoing mitigating measures should be taken into consideration during the selection of the preferred alternative in the EA process. Because the bridge is in such poor condition and requires many replacement elements, the preferred alternative is documenting the bridge and commemorating it with a plaque on the new structure, and should a need be found, salvaged elements/members of the bridge could be retained for future conservation work.

This is considered the minimal acceptable level of mitigation.

This revised draft CHER and HIA is respectfully submitted

CHC Limited

per: Owen R. Scott, CAHP

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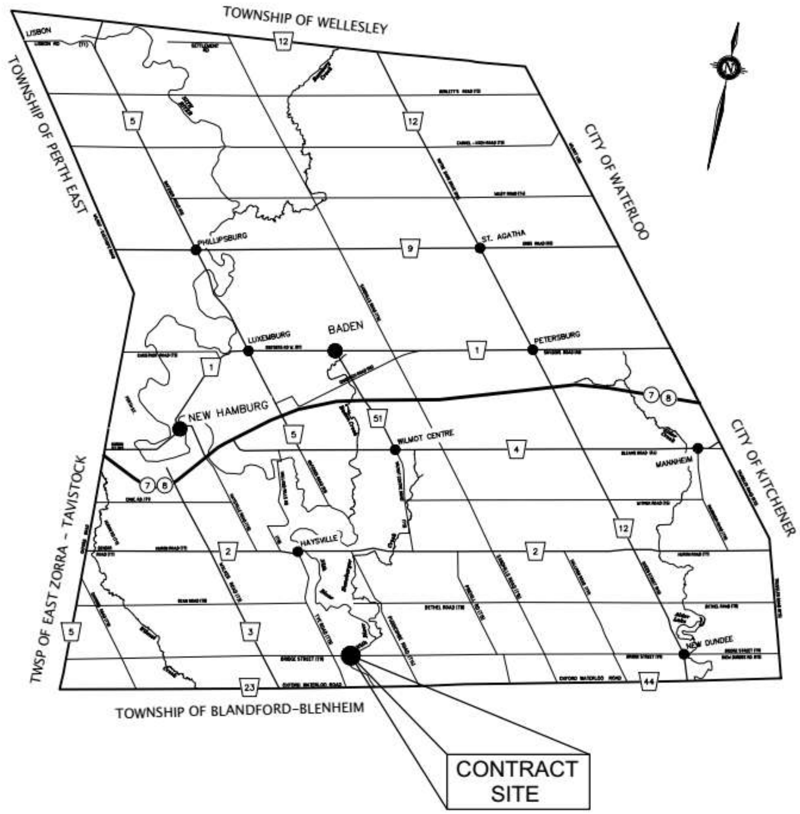
Wikipedia website, Wilmot Township https://en.wikipedia.org/wiki/Wilmot,_Ontario

STRUCTURE 34/B–T9 REPAIRS

(BRIDGE STREET BRIDGE)

TOWNSHIP OF WILMOT
REGION OF WATERLOO

APPROVED FOR CONSTRUCTION SEPT. 17, 2018



KEY PLAN
N.T.S.

LIST OF DRAWINGS

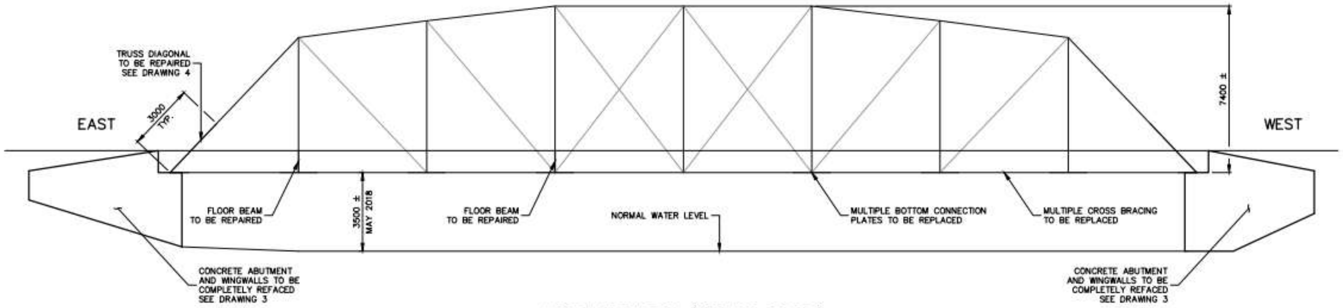
1. GENERAL ARRANGEMENT
2. EROSION & SEDIMENT CONTROL
3. DETAILS 1
4. DETAILS 2

CONTRACT DRAWINGS

TENDER No. 2018–23

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

Appendix 1 - Structure 34/B-T9 Repairs (Bridge Street Bridge)



NORTH ELEVATION (LOOKING SOUTH)
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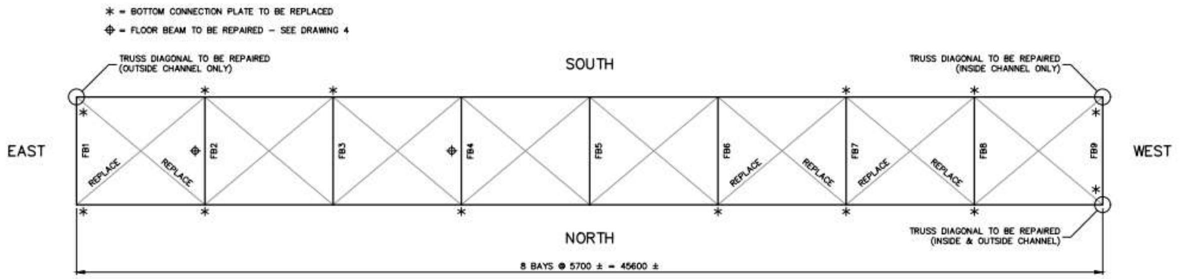

PLAN
SCALE 1:100

NOTES:

1. THE CONTRACTOR SHALL ENSURE THE STABILITY AND STRUCTURAL INTEGRITY OF THE STRUCTURE AT ALL TIMES.
2. NO VEHICULAR TRAFFIC (INCLUDING CONSTRUCTION VEHICLES) ARE PERMITTED ON THE STRUCTURE DURING THE REPAIRS.
3. ALL DIMENSIONS SHOWN ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM ALL RELEVANT DIMENSIONS IN THE FIELD PRIOR TO PURCHASING OR FABRICATING MATERIALS.
4. ALL CONCRETE SHALL BE PLACED IN THE DRY.
5. NO CONCRETE SHALL BE PLACED BEFORE MATERIALS, FORMWORK AND REINFORCING STEEL HAVE BEEN CHECKED BY THE CONTRACT ADMINISTRATOR.
6. CONCRETE SHALL BE 35 MPa C–1 MIX MINIMUM STRENGTH AT 28 DAYS. ALL CONCRETE SHALL INCLUDE AN APPROVED AIR ENTRAINING AGENT.
7. CLEAR COVER TO REINFORCING STEEL SHALL BE 70 ± 20mm.
8. REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. UNLESS OTHERWISE SHOWN, TENSION LENGTH LAPS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS B. BAR HOOKS SHALL BE MINIMUM LENGTH AND STIRRUPS SHALL HAVE MINIMUM HOOKS, UNLESS INDICATED OTHERWISE.
9. MINIMUM LAP OF REINFORCING STEEL SHALL BE IN ACCORDANCE WITH THE C.H.B.D.C.
10. ALL EXPOSED EDGES TO BE CHAMFERED 25mm UNLESS OTHERWISE NOTED. ALL ACUTE ANGLES SHALL BE FILLETED AS NOTED.
11. CONSTRUCTION JOINTS NOT SHOWN ON PLANS MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR.
12. ALL STEEL SHALL BE NEW AND SHALL CONFORM TO CSA STANDARD CAN/CSA G40.21–M92 GRADE 350W.
13. ALL NEW STEEL SHALL BE GIVEN ONE COAT OF MARINE PRIMER AND ONE FINISH COAT.
14. BOLTS SHALL BE ASTM A325. BOLT THREAD SHALL BE EXCLUDED FROM THE SHEAR PLANES. NEW BOLTS TO BE 7/8" DIAMETER UNLESS NOTED OTHERWISE.
15. THE REPAIRS SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 906 AND THE CONTRACT ADMINISTRATORS SPECIFICATIONS.
16. NO WELDING IS PERMITTED UNLESS APPROVED BY THE CONTRACT ADMINISTRATOR. UNDER NO CIRCUMSTANCES SHALL ORIGINAL STEEL BE WELDED.
17. EXISTING STEEL SHALL BE THOROUGHLY CLEANED WITH A STEEL BRUSH AT ALL BOLT CONNECTIONS.

NAVIGATION

1. SIGNS TO BE PLACED 50M UPSTREAM AND DOWNSTREAM WARNING BOATERS OF THE OVERHEAD WORK DURING THE REHABILITATION.
2. SILT CURTAINS OR DEWATERING BERMS, INSTALLED DURING NAVIGATION SEASON, ARE TO BE MARKED WITH YELLOW BUOYS AND/OR YELLOW LIGHTS.
3. NO PERSON SHALL PERMIT ANY TOOLS, EQUIPMENT, VEHICLES, TEMPORARY STRUCTURES OR PARTS THEREOF USED OR MAINTAINED FOR THE PURPOSE OF BUILDING OR PLACING A WORK IN A NAVIGABLE WATER TO REMAIN IN SUCH WATER AFTER THE COMPLETION OF THE PROJECT.
4. WHERE A WORK OR PORTION OF A WORK THAT IS BEING CONSTRUCTED OR MAINTAINED IN A NAVIGABLE WATER CAUSES DEBRIS OR OTHER MATERIAL TO ACCUMULATE ON THE BED OR ON THE SURFACE OF THE WATER, THE OWNER OF THAT WORK OR PORTION OF THAT WORK SHALL CAUSE THE DEBRIS OR OTHER MATERIAL TO BE REMOVED TO THE SATISFACTION OF THE MINISTER OF TRANSPORT, INFRASTRUCTURE AND COMMUNITIES.

SCOPE OF WORK

1. CLOSE BRIDGE TO ALL VEHICULAR TRAFFIC INCLUDING CONSTRUCTION VEHICLES.
2. REFACE BOTH CONCRETE ABUTMENTS AND WINGWALLS.
3. COMPLETE REMAINING REPAIRS AS SHOWN ON THESE DRAWINGS AND AS DIRECTED BY THE CONTRACT ADMINISTRATOR.
4. RE–OPEN BRIDGE TO VEHICULAR TRAFFIC.

No.	REVISION	DATE
1.	ISSUED FOR TENDER	JUNE 27/18
2.	ISSUED FOR CONSTRUCTION	SEPT. 17/18

DESIGNED BY: A.G.
CHECKED BY: D.H.
DRAWN BY: D.S.
CHECKED BY: A.G.
FIELD BOOK:

SCALE
AS NOTED

A. L. GARNHAM
100123077
SEPT. 06/18

DAVID A. HARSCH
SEPT. 06/18

BRIDGE 34/B–T9 REPAIRS
TOWNSHIP OF WILMOT REGION OF WATERLOO
GENERAL ARRANGEMENT

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

JOB NUMBER
18–158
DATE
MAY 2018
DRAWING NUMBER
1

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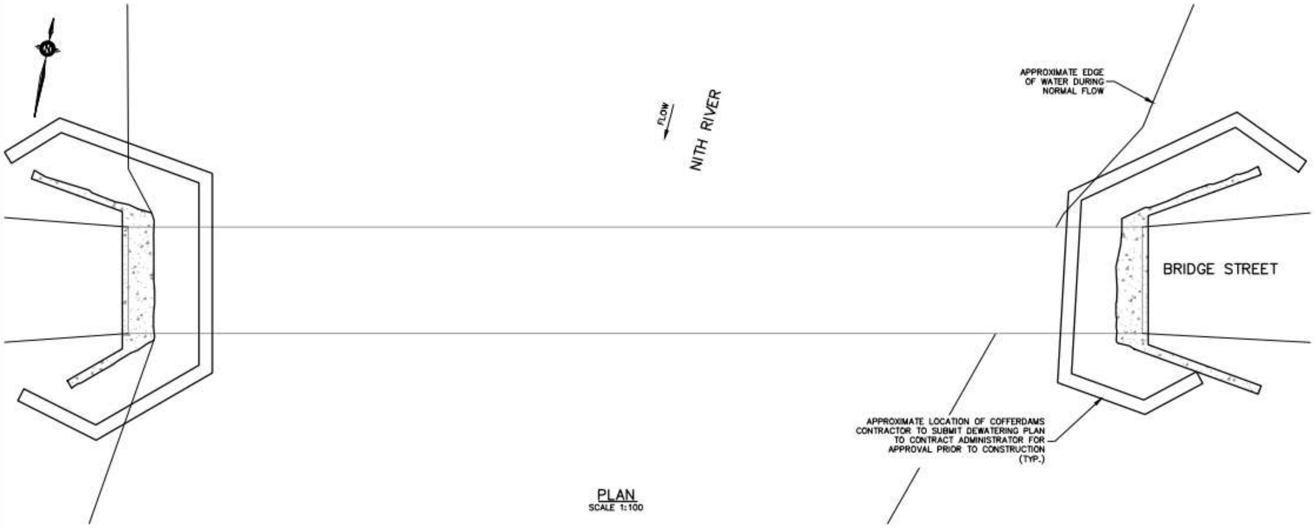

PLAN
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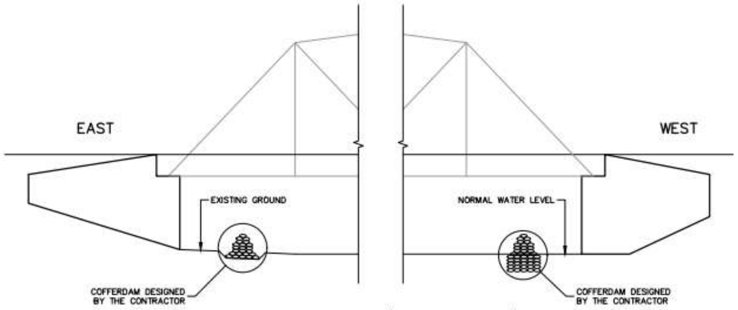

NORTH ELEVATION (LOOKING SOUTH)
SCALE 1:100

EROSION CONTROL – BRIDGE RECONSTRUCTION

1. ALL WORK SHALL BE DONE IN THE DRY.
2. NO IN-WATER WORK SHALL TAKE PLACE BETWEEN MARCH 15 AND JULY 15.
3. DEWATERING OF THE SITE SHALL BE ACHIEVED BY THE INSTALLATION OF COFFERDAMS TO ISOLATE THE WORKING AREA, AND THE PLACEMENT OF CONVENTIONAL SUMP PUMPS WHERE REQUIRED. THE CONTRACTOR'S SPECIFIC METHOD SHALL BE APPROVED BEFOREHAND BY THE CONTRACT ADMINISTRATOR. ALTERNATIVE METHODS OF DEWATERING MAY BE POSSIBLE PENDING THE WRITTEN APPROVAL OF THE CONTRACT ADMINISTRATOR.
4. THE CONTRACTOR SHALL APPLY AND OBTAIN A PERMIT TO TAKE WATER (PTTW) SHOULD PUMPING EXCEEED 50,000 LITRES PER DAY.
5. DISCHARGE FROM PUMPING OPERATIONS SHALL FIRST OUTLET INTO A SILTING POND OR SEDIMENT TRAP BEFORE THE WATER IS ALLOWED TO RE-ENTER THE RIVER OR ANOTHER WATERCOURSE.
6. COFFERDAMS SHALL BE DESIGNED BY THE CONTRACTOR AND SUBMITTED TO THE CONTRACT ADMINISTRATOR FOR APPROVAL.
7. ALL DISTURBED AREAS INCLUDING BANKS ABOVE WATER LEVEL SHALL BE REGRADED, TOPSOILED AND SEEDED TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AS SOON AS POSSIBLE.
8. ALL EROSION CONTROL MEASURES (SILT FENCE, ROCK DAMS, SILTATION POND/DEWATERING TRAP, ETC.) SHALL BE CHECKED DAILY DURING ON-SITE WORK AND BE MAINTAINED IN GOOD STATE SO THAT THEY ARE FUNCTIONING PROPERLY. SILT FENCE AND STRAW BALE CHECK DAMS TO BE LEFT IN PLACE FOR 12 MONTHS OR UNTIL SUCH TIME AS THE SITE STABILIZES (THESE ARE LOCATED ABOVE HIGH WATER LEVEL).
9. NO MACHINERY SHALL CROSS THE RIVER AT ANY TIME. ANY MACHINERY THAT IS REQUIRED ON THE OTHER SIDE OF THE RIVER WHILE THE BRIDGE IS DISMANTLED OR UNDER CONSTRUCTION SHALL BE HAULED BY FLOAT OR DRIVEN AROUND ON ROADS. MACHINERY, VEHICLES, EQUIPMENT PUMPS, ETC., WILL NOT BE REFUELED WITHIN 30 METRES OF THE WATERCOURSE. MACHINERY SHALL NOT BE CLEANED WITHIN 30 METRES OF THE RIVER.
10. ALL WASTE MATERIAL FROM CONSTRUCTION SHALL BE STORED AWAY AND ABOVE THE HIGH WATERMARK AND AT NO TIME SHALL SUCH MATERIAL ENTER IN THE WATER.
11. FOR TYPICAL CHECK DAMS REFER TO OPSD 219.210
12. FOR SILT FENCE REFER TO OPSD 219.110.

ADDITIONAL ENVIRONMENTAL MEASURES TO BE ADHERED TO:

1. SEDIMENT AND EROSION CONTROL MEASURES SHOULD BE IMPLEMENTED PRIOR TO WORK, AND MAINTAINED DURING THE WORK PHASE, TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATER OR THE MOVEMENT OF RE-SUSPENDED SEDIMENT.
2. A FLOATING TURBIDITY CURTAIN OR SILT FENCE SHOULD BE PLACED IMMEDIATELY AROUND THE WORK SITE PRIOR TO THE INSTALLATION OF COFFERDAMS.
3. ALL DISTURBED WORK AREAS SHOULD BE STABILIZED AND RE-VEGETATED AS REQUIRED UPON THE COMPLETION OF WORK AND RESTORED TO A PRE-DISTURBED STATE OR BETTER.
4. SEDIMENT AND EROSION CONTROL MEASURES SHOULD BE LEFT IN PLACE UNTIL ALL DISTURBED AREAS HAVE BEEN STABILIZED.
5. EXISTING STREAM FLOWS SHOULD BE MAINTAINED DOWNSTREAM OF THE DE-WATERED WORK AREA WITHOUT INTERRUPTION, DURING ALL STAGES OF WORK. THERE SHOULD BE NO INCREASE IN WATER LEVELS UPSTREAM OF THE DE-WATERED WORK AREA.
6. FISH SHOULD BE REMOVED FROM THE WORK AREA PRIOR TO DE-WATERING AND RELEASED ALIVE IMMEDIATELY DOWNSTREAM.
7. SILT OR DEBRIS THAT HAS ACCUMULATED AROUND THE TEMPORARY COFFERDAMS SHOULD BE REMOVED PRIOR TO THE WITHDRAWAL.
8. NATURAL STRUCTURES SUCH AS LOGJAMS AND IN-STREAM WOODY COVER SHOULD NOT BE REMOVED UNLESS THEY REPRESENT A BARRIER TO FLOWS OR FISH MOVEMENT.
9. OPERATE HEAVY MACHINERY ON LAND AND IN A MANNER THAT MINIMIZES DISTURBANCE TO THE BANKS OR BED OF THE RIVER.
10. ENSURE THAT MACHINERY ARRIVES ON SITE IN A CLEAN, WASHED CONDITION AND IS MAINTAINED FREE OF FLUID LEAKS.
11. WASH, REFUEL AND SERVICE MACHINERY AND STORE FUEL AND OTHER MATERIALS FOR THE MACHINERY AWAY FROM THE WATER TO PREVENT ANY DELETERIOUS SUBSTANCE FROM ENTERING THE WATER OR SPREADING ONTO THE ICE SURFACE.
12. KEEP AN EMERGENCY SPILL KIT ON SITE IN CASE OF FLUID LEAKS OR SPILLS FROM MACHINERY.
13. STABILIZE ANY WASTE MATERIALS REMOVED FROM THE WORK SITE TO PREVENT IT FROM ENTERING THE WATERBODY. THIS COULD INCLUDE COVERING STOCKPILES WITH BIODEGRADABLE MATS OR TARPS, OR PLANTING STOCKPILES WITH GRASS OR SHRUBS.
14. ALL UNSTABLE BANKS OF THE WATERCOURSE SHOULD BE STABILIZED AND SIDE RUN-OFF DITCHES SHOULD BE CONSTRUCTED TO DIVERT ROAD RUN-OFF THROUGH THE GREENBELT BEFORE ENTERING THE STREAM.
15. VEGETATE AND STABILIZE ANY DISTURBED AREAS BY SEEDING AND PLANTING TREES, SHRUBS, OR GRASSES.
16. STREAM CROSSINGS SHOULD ALLOW FOR UNIMPEDED UPSTREAM AND DOWNSTREAM MOVEMENT OF FISH.
17. CONCRETE LEACHATE IS ALKALINE AND HIGHLY TOXIC TO FISH AND AQUATIC LIFE AND MEASURES MUST BE TAKEN TO PREVENT ANY INCIDENCE OF CONCRETE OR CONCRETE LEACHATE FROM ENTERING THE WATERCOURSE. ALL CAST-IN-PLACE CONCRETE, GROUT, MORTARS, ETC. SHOULD BE TOTALLY ISOLATED FROM PRECIPITATION AND THE WATERS OF THE CANAL FOR A MINIMUM 48 HOUR PERIOD OR UNTIL SIGNIFICANTLY CURED TO ALLOW THE pH TO REACH NEUTRAL LEVELS. CONTAINMENT FACILITIES SHOULD BE PROVIDED AT THE SITE FOR THE WASH-DOWN FROM CONCRETE DELIVERY TRUCKS, CONCRETE PUMPING EQUIPMENT, AND OTHER TOOLS AND EQUIPMENT AS REQUIRED.

DEWATERING SEQUENCE

1. INSTALL SILT FENCE, STRAW BALE CHECK DAMS AND ANY OTHER EROSION CONTROL MEASURES WHICH MAY BE REQUIRED.
2. INSTALL COFFERDAMS AS REQUIRED TO ISOLATE THE WORKING AREA.
3. REMOVE ALL LOOSE CONCRETE FROM THE EXISTING ABUTMENTS. COLLECT SUCH DEBRIS AND STORE AT ROADWAY APPROACHES (ABOVE HIGH WATER LEVEL).
4. COMPLETE RE-FACING OF THE EXISTING CONCRETE ABUTMENTS.
5. REMOVE COFFERDAMS.

ISSUED FOR CONSTRUCTION DRAWING SET

No.	REVISION	DATE
1.	ISSUED FOR TENDER	JUNE 27/18
2.	ISSUED FOR CONSTRUCTION	SEPT. 17/18

DESIGNED BY: A.G.
CHECKED BY: D.H.
DRAWN BY: D.S.
CHECKED BY: A.G.
FIELD BOOK:

SCALE
AS NOTED

A. L. GARNHAM
100123077
SEPT. 06/18

DAVID A. HARSCH
SEPT. 06/18

BRIDGE 34/B–T9 REPAIRS

TOWNSHIP OF WILMOT
REGION OF WATERLOO

EROSION & SEDIMENT CONTROL

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER
SUDBURY

JOB NUMBER
18–158
DATE
MAY 2018
DRAWING NUMBER
2

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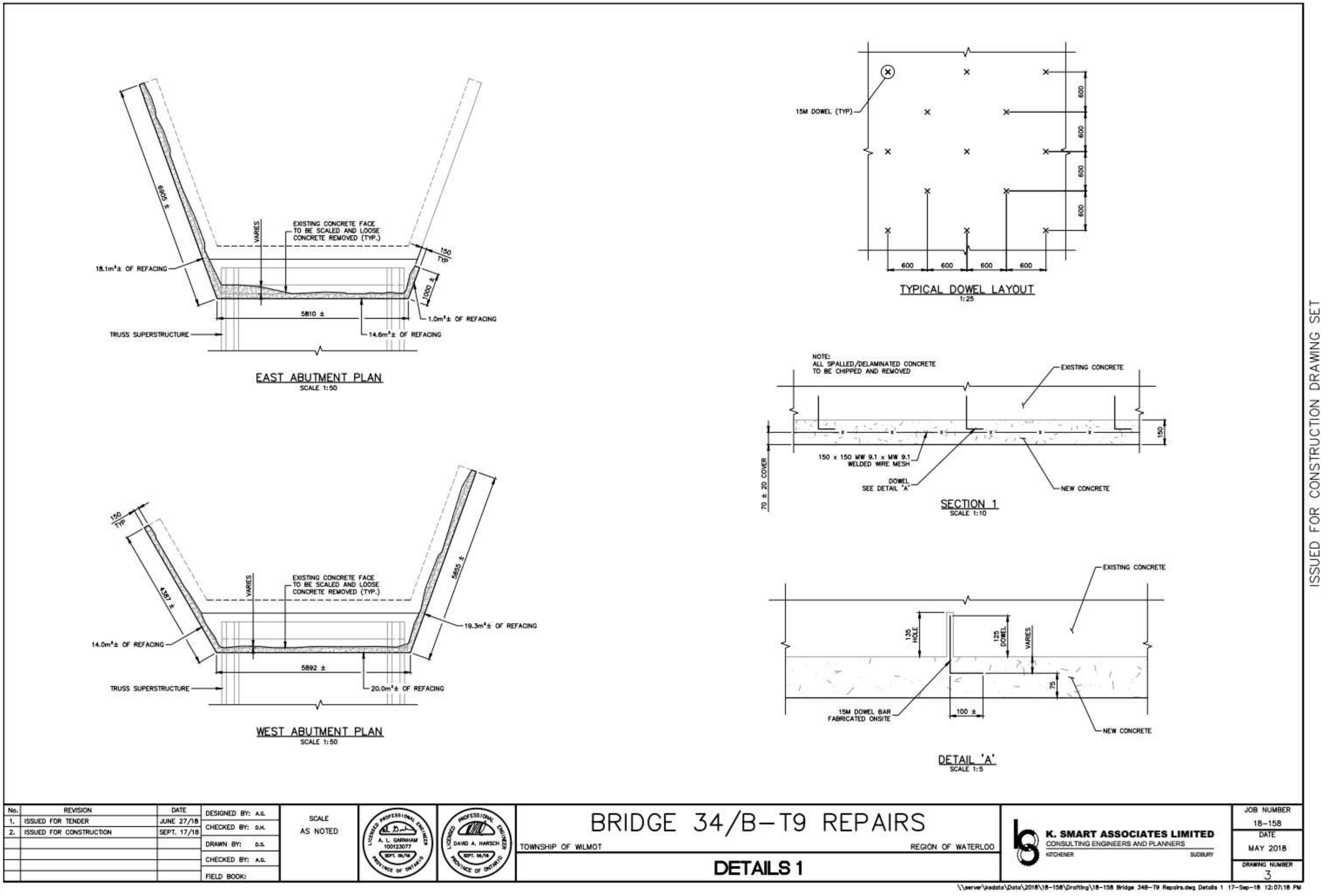
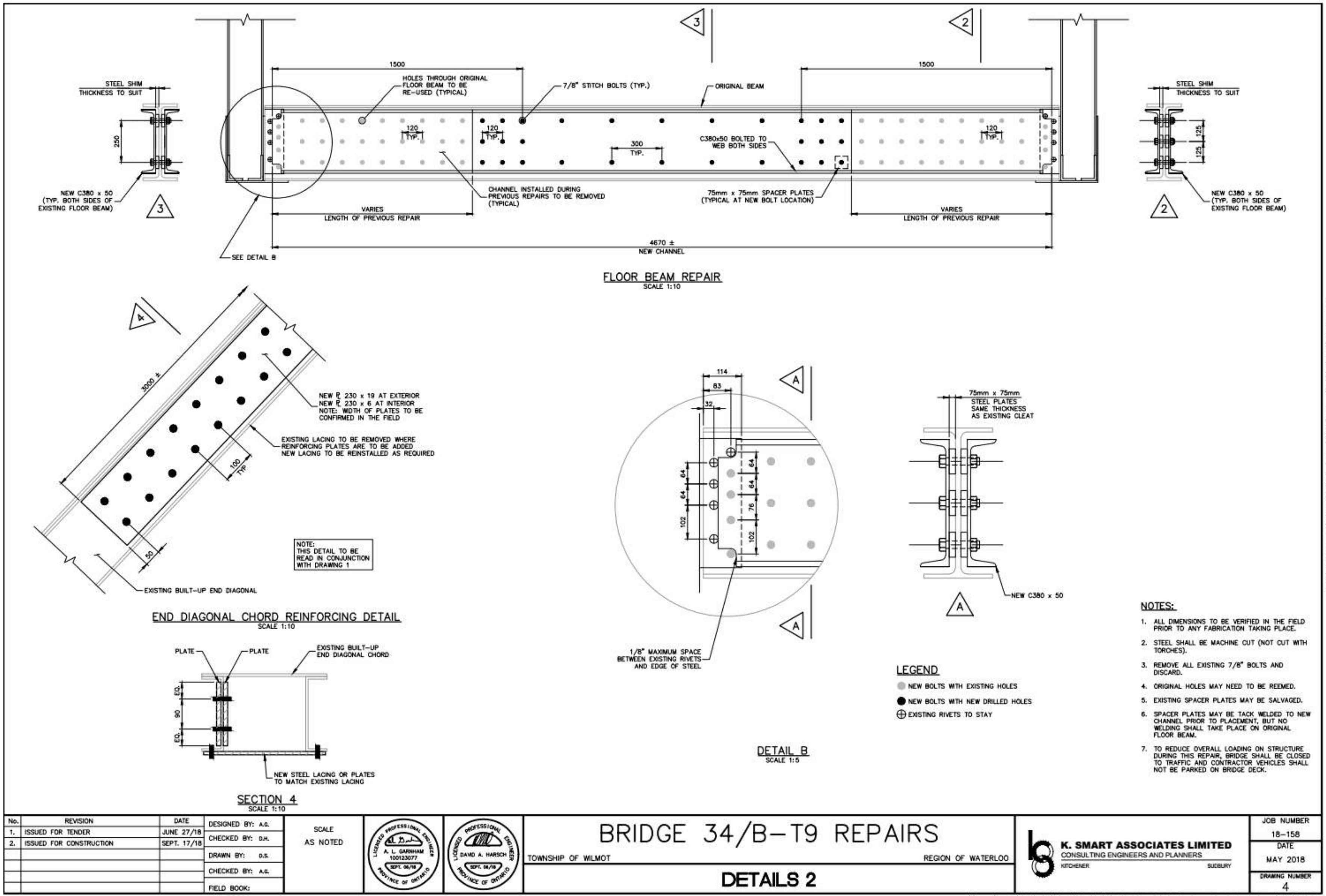

6905 ±
VARIES
EXISTING CONCRETE FACE TO BE SCALED AND LOOSE CONCRETE REMOVED (TYP.)
150 TYP
18.1m²± OF REFACING
1000 ±
5810 ±
1.0m²± OF REFACING
TRUSS SUPERSTRUCTURE
14.6m²± OF REFACING
EAST ABUTMENT PLAN
SCALE 1:50
150 TYP
4387 ±
VARIES
EXISTING CONCRETE FACE TO BE SCALED AND LOOSE CONCRETE REMOVED (TYP.)
5665 ±
19.3m²± OF REFACING
14.0m²± OF REFACING
5892 ±
TRUSS SUPERSTRUCTURE
20.0m²± OF REFACING
WEST ABUTMENT PLAN
SCALE 1:50
15M DOWEL (TYP)
600
600
600
600
600
600
600
600
TYPICAL DOWEL LAYOUT
1:25
NOTE:
ALL SPALLED/DELAMINATED CONCRETE TO BE CHIPPED AND REMOVED
EXISTING CONCRETE
150
150 x 150 MW 9.1 x MW 9.1 WELDED WIRE MESH
DOWEL SEE DETAIL 'A'
NEW CONCRETE
70 ± 20 COVER
SECTION 1
SCALE 1:10
EXISTING CONCRETE
135 HOLE
125 DOWEL
VARIES
75
100 ±
15M DOWEL BAR FABRICATED ONSITE
NEW CONCRETE
DETAIL 'A'
SCALE 1:5
ISSUED FOR CONSTRUCTION DRAWING SET
No.
REVISION
DATE
1. ISSUED FOR TENDER JUNE 27/18
2. ISSUED FOR CONSTRUCTION SEPT. 17/18
DESIGNED BY: A.G.
CHECKED BY: D.H.
DRAWN BY: D.S.
CHECKED BY: A.G.
FIELD BOOK:
SCALE AS NOTED
A. L. GARNHAM 100123077 SEPT. 06/18
DAVID A. HARSCH SEPT. 06/18
BRIDGE 34/B-T9 REPAIRS
TOWNSHIP OF WILMOT
REGION OF WATERLOO
DETAILS 1
K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER
SUDBURY
JOB NUMBER 18-158
DATE MAY 2018
DRAWING NUMBER 3
\\server\ksdata\Data\2018\18-158\Drafting\18-158 Bridge 34B-T9 Repairs.dwg Details 1 17-Sep-18 12:07:18 PM

Appendix 1 - Structure 34/B-T9 Repairs (Bridge Street Bridge)



NOTES:

1. ALL DIMENSIONS TO BE VERIFIED IN THE FIELD PRIOR TO ANY FABRICATION TAKING PLACE.
2. STEEL SHALL BE MACHINE CUT (NOT CUT WITH TORCHES).
3. REMOVE ALL EXISTING 7/8" BOLTS AND DISCARD.
4. ORIGINAL HOLES MAY NEED TO BE REEMED.
5. EXISTING SPACER PLATES MAY BE SALVAGED.
6. SPACER PLATES MAY BE TACK WELDED TO NEW CHANNEL PRIOR TO PLACEMENT, BUT NO WELDING SHALL TAKE PLACE ON ORIGINAL FLOOR BEAM.
7. TO REDUCE OVERALL LOADING ON STRUCTURE DURING THIS REPAIR, BRIDGE SHALL BE CLOSED TO TRAFFIC AND CONTRACTOR VEHICLES SHALL NOT BE PARKED ON BRIDGE DECK.

LEGEND

- ● NEW BOLTS WITH EXISTING HOLES
- ● NEW BOLTS WITH NEW DRILLED HOLES
- ⊕ EXISTING RIVETS TO STAY

No.	REVISION	DATE
1.	ISSUED FOR TENDER	JUNE 27/18
2.	ISSUED FOR CONSTRUCTION	SEPT. 17/18

DESIGNED BY: A.G.
CHECKED BY: D.H.
DRAWN BY: D.S.
CHECKED BY: A.G.
FIELD BOOK:

SCALE
AS NOTED

A. L. GARNHAM
100123077
SEPT. 06/18

DAVID A. HARSCH
SEPT. 06/18

BRIDGE 34/B–T9 REPAIRS

TOWNSHIP OF WILMOT
REGION OF WATERLOO

DETAILS 2

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

JOB NUMBER
18–158
DATE
MAY 2018
DRAWING NUMBER
4

\\server\ksdata\Data\2018\18-158\Drafting\18-158 Bridge 34B-T9 Repairs.dwg Details 2 17-Sep-18 12:07:28 PM

MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

INVENTORY DATA:

Structure Name: 34/B-T9 - Bridge Street

Main Highway #: -

On ☒ or Under ☐ Structure

Service on Structure: Navigable Water ☐ Non- Navigable Water ☐ Rail ☐ Road ☒ Pedestrian ☐ Other ☐

Service Under: Navigable Water ☒ Non- Navigable Water ☐ Rail ☐ Road ☐ Pedestrian ☐ Other ☐

Location Description: 0.45 km East of Tye Road

Owner / Custodian: Township of Wilmot

LHRS: -

LHRS Offset: -

MTO Region: Southwestern

Latitude: 43.33292

Longitude: -80.64342

Regional Engineer: -

Heritage Designation: Not Cons. ☒ Cons./Not App. ☐ List/Not Desig. ☐ Desig. ☐ Desig./not List ☐ Desig. & List ☐

MTO Area: London / Stratford

Hwy Class: Freeway ☐ Arterial ☐ Collector ☐ Local ☐

Old County: Waterloo

Posted Speed: -

No. of Lanes: 1

Township: Wilmot

AADT: -

% Trucks: -

Structure Type 1: Through Truss

Travel Stream: -

Structure Material 1: Steel

Traffic Directional Bound: East / West

Structure Type 2: -

Inspection Route Sequence: -

Structure Material 2: -

Inspection Frequency: 2 (years)

Total Deck Length: 45.70 (m)

Inspection Year: 2019

Overall Str. Width: 4.80 (m)

Inspection Duration: 2.50 (hrs)

Culvert Length: - (m)

Interchange Number: -

Total Deck Area: 219.36 (sq. m)

Interchange Structure Number: -

Roadway Width: 4.00 (m)

Min. Vertical Clearance: - (m)

Skew Angle: 0 (Degree)

Detour Distance: - (km)

No. of Spans: 1

Fill on Structure: - (m)

Span Lengths: 45.10 (m)

For Retaining Walls:

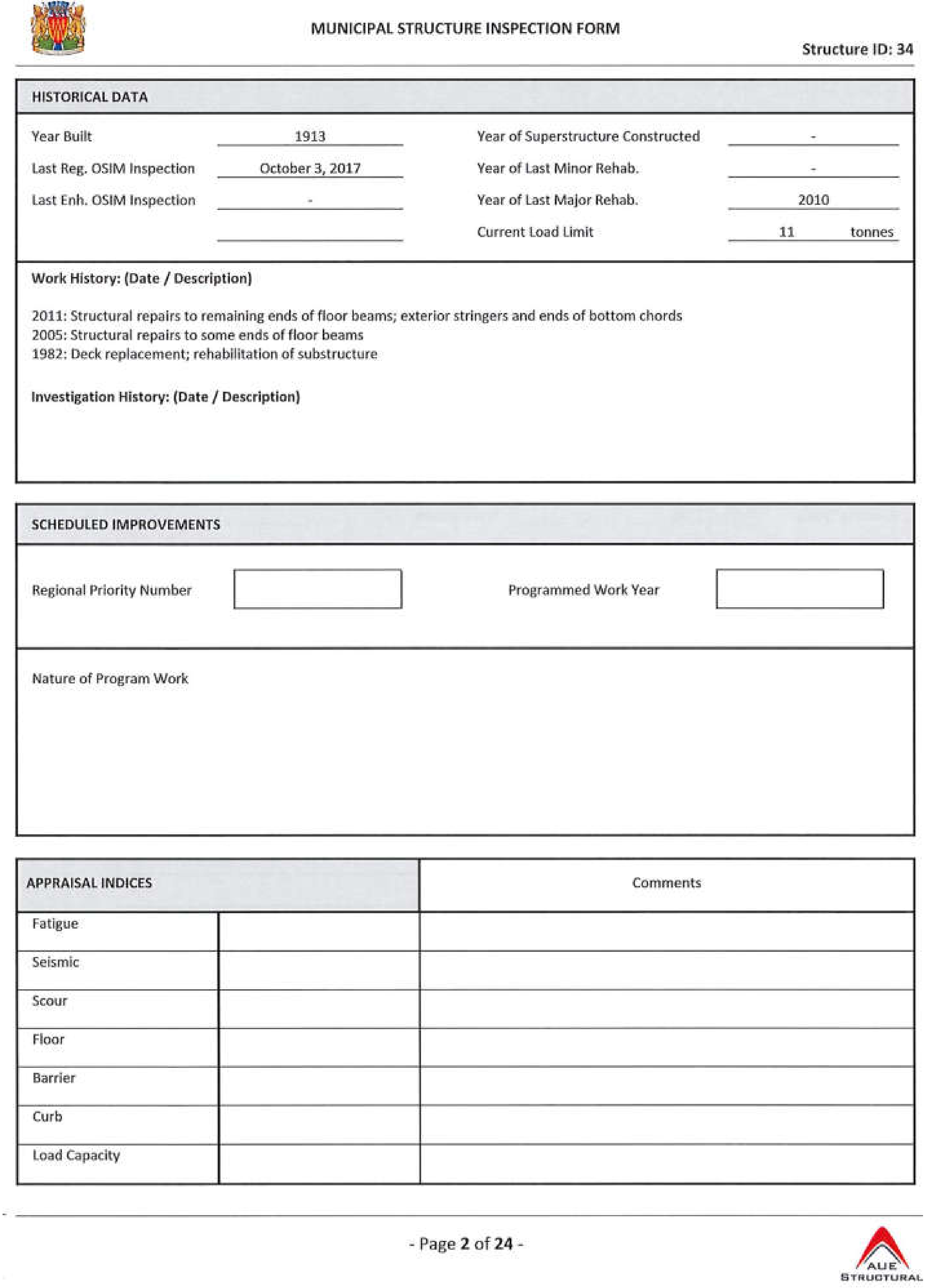
Total Wall Length: - (m)

Max. Wall Height: - (m)

Total Wall Area: - (sq. m)

Ave. Wall Height: - (m)

Angle of Backfill: - (Degree)



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

HISTORICAL DATA

Year Built	1913	Year of Superstructure Constructed	-
Last Reg. OSIM Inspection	October 3, 2017	Year of Last Minor Rehab.	-
Last Enh. OSIM Inspection	-	Year of Last Major Rehab.	2010
		Current Load Limit	11 tonnes

Work History: (Date / Description)

2011: Structural repairs to remaining ends of floor beams; exterior stringers and ends of bottom chords
2005: Structural repairs to some ends of floor beams
1982: Deck replacement; rehabilitation of substructure

Investigation History: (Date / Description)

SCHEDULED IMPROVEMENTS

Regional Priority Number ☐

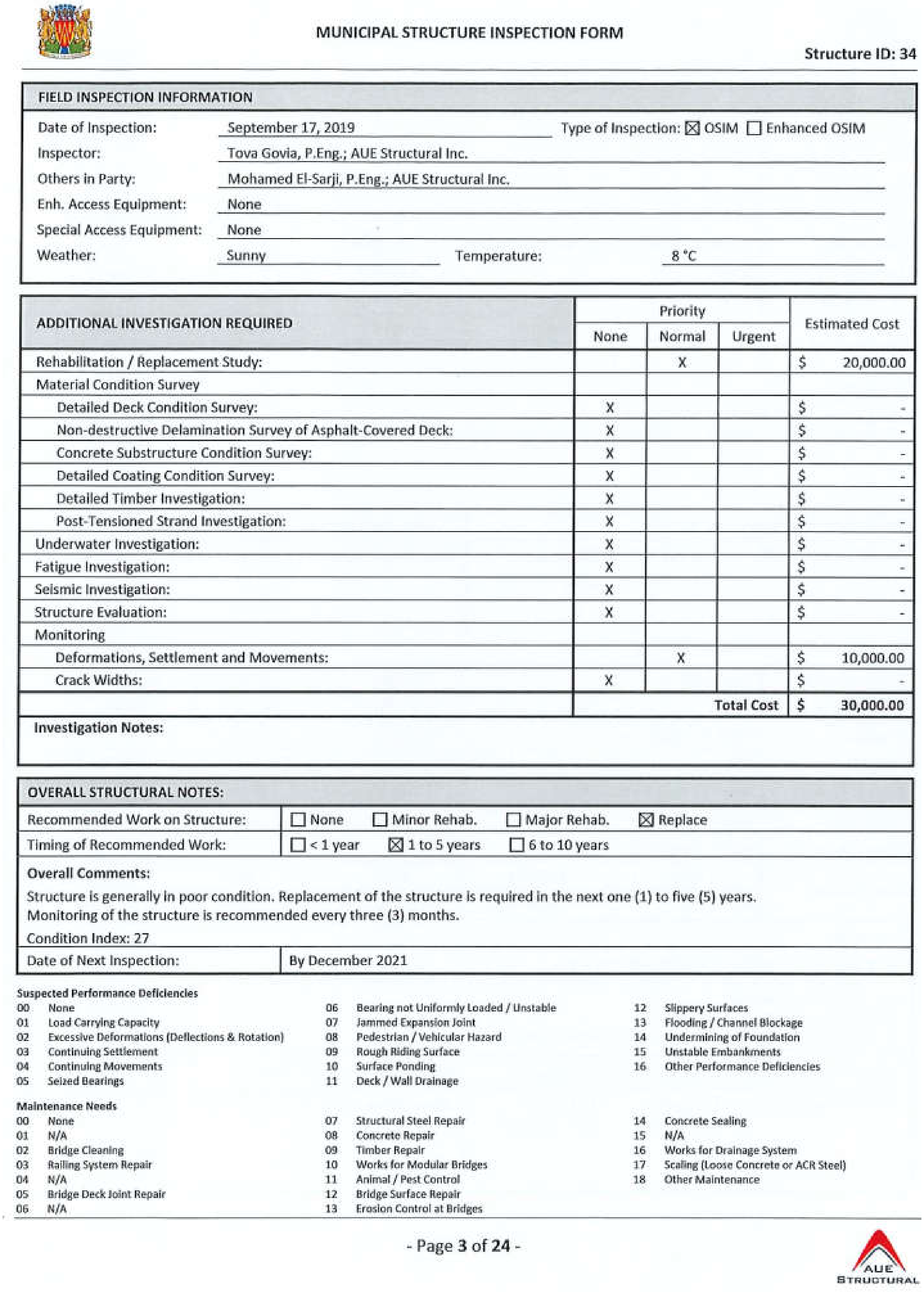
Programmed Work Year ☐

Nature of Program Work

APPRAISAL INDICES		Comments
Fatigue		
Seismic		
Scour		
Floor		
Barrier		
Curb		
Load Capacity		

AUE STRUCTURAL

Appendix 2 - Municipal Structure Inspection Form (Bridge Street Bridge)



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

FIELD INSPECTION INFORMATION

Date of Inspection: September 17, 2019 Type of Inspection: ☒ OSIM ☐ Enhanced OSIM
Inspector: Tova Govia, P.Eng.; AUE Structural Inc.
Others in Party: Mohamed El-Sarji, P.Eng.; AUE Structural Inc.
Enh. Access Equipment: None
Special Access Equipment: None
Weather: Sunny Temperature: 8 °C

ADDITIONAL INVESTIGATION REQUIRED	Priority			Estimated Cost
	None	Normal	Urgent	
Rehabilitation / Replacement Study:		X		$ 20,000.00
Material Condition Survey				
Detailed Deck Condition Survey:	X			$ -
Non-destructive Delamination Survey of Asphalt-Covered Deck:	X			$ -
Concrete Substructure Condition Survey:	X			$ -
Detailed Coating Condition Survey:	X			$ -
Detailed Timber Investigation:	X			$ -
Post-Tensioned Strand Investigation:	X			$ -
Underwater Investigation:	X			$ -
Fatigue Investigation:	X			$ -
Seismic Investigation:	X			$ -
Structure Evaluation:	X			$ -
Monitoring				
Deformations, Settlement and Movements:		X		$ 10,000.00
Crack Widths:	X			$ -
			Total Cost	$ 30,000.00

Investigation Notes:

OVERALL STRUCTURAL NOTES:

Recommended Work on Structure: ☐ None ☐ Minor Rehab. ☐ Major Rehab. ☒ Replace
Timing of Recommended Work: ☐ < 1 year ☒ 1 to 5 years ☐ 6 to 10 years

Overall Comments:

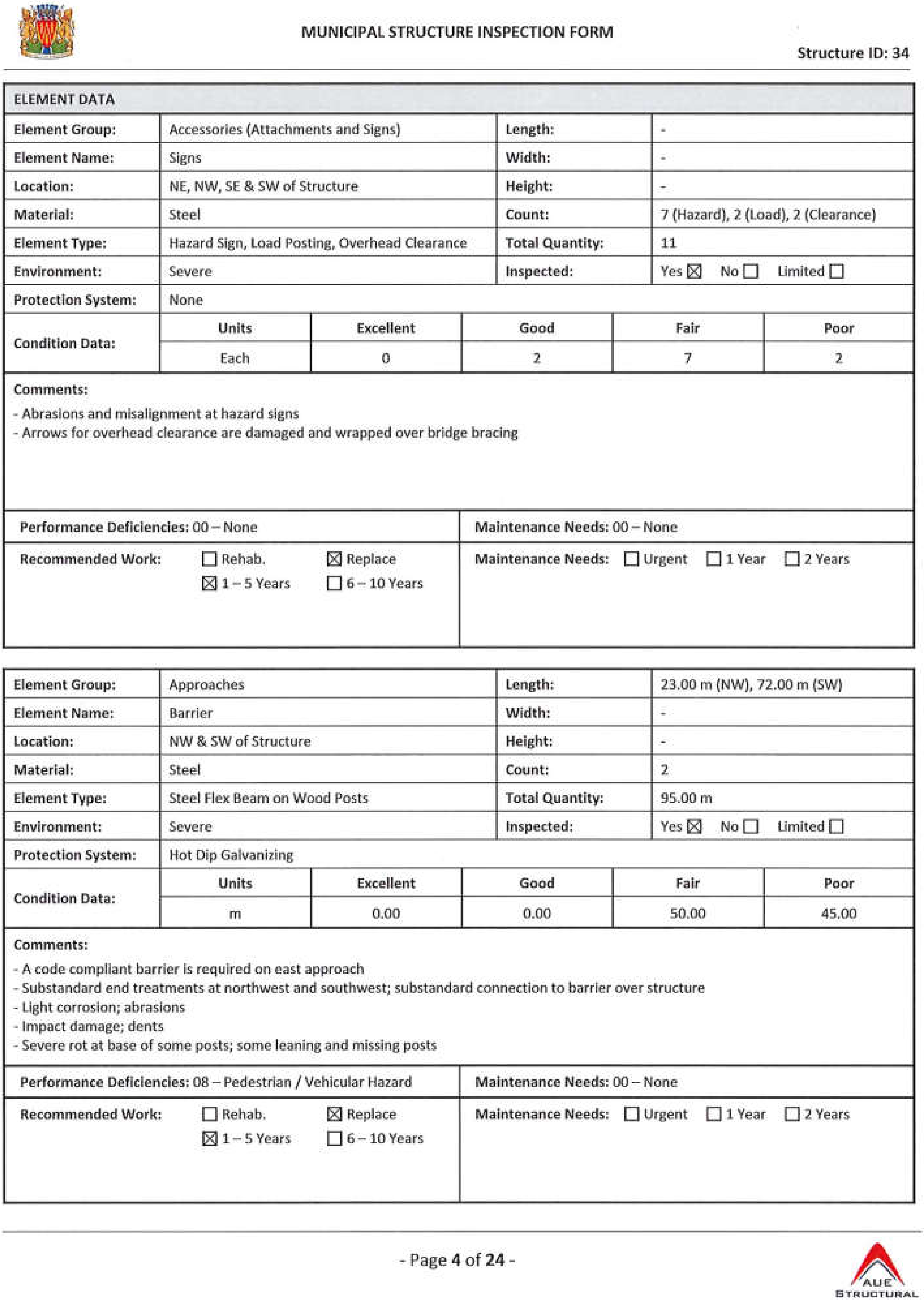
Structure is generally in poor condition. Replacement of the structure is required in the next one (1) to five (5) years.
Monitoring of the structure is recommended every three (3) months.
Condition Index: 27

Date of Next Inspection: By December 2021

Suspected Performance Deficiencies
00 None
01 Load Carrying Capacity
02 Excessive Deformations (Deflections & Rotation)
03 Continuing Settlement
04 Continuing Movements
05 Seized Bearings
06 Bearing not Uniformly Loaded / Unstable
07 Jammed Expansion Joint
08 Pedestrian / Vehicular Hazard
09 Rough Riding Surface
10 Surface Ponding
11 Deck / Wall Drainage
12 Slippery Surfaces
13 Flooding / Channel Blockage
14 Undermining of Foundation
15 Unstable Embankments
16 Other Performance Deficiencies

Maintenance Needs
00 None
01 N/A
02 Bridge Cleaning
03 Railing System Repair
04 N/A
05 Bridge Deck Joint Repair
06 N/A
07 Structural Steel Repair
08 Concrete Repair
09 Timber Repair
10 Works for Modular Bridges
11 Animal / Pest Control
12 Bridge Surface Repair
13 Erosion Control at Bridges
14 Concrete Sealing
15 N/A
16 Works for Drainage System
17 Scaling (Loose Concrete or ACR Steel)
18 Other Maintenance

- Page 3 of 24 -



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA

Element Group:	Accessories (Attachments and Signs)	**Length:**	-
Element Name:	Signs	**Width:**	-
Location:	NE, NW, SE & SW of Structure	**Height:**	-
Material:	Steel	**Count:**	7 (Hazard), 2 (Load), 2 (Clearance)
Element Type:	Hazard Sign, Load Posting, Overhead Clearance	**Total Quantity:**	11
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	2	7	2

Comments:
- Abrasions and misalignment at hazard signs
- Arrows for overhead clearance are damaged and wrapped over bridge bracing

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Approaches	**Length:**	23.00 m (NW), 72.00 m (SW)
Element Name:	Barrier	**Width:**	-
Location:	NW & SW of Structure	**Height:**	-
Material:	Steel	**Count:**	2
Element Type:	Steel Flex Beam on Wood Posts	**Total Quantity:**	95.00 m
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	Hot Dip Galvanizing		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	m	0.00	0.00	50.00	45.00

Comments:
- A code compliant barrier is required on east approach
- Substandard end treatments at northwest and southwest; substandard connection to barrier over structure
- Light corrosion; abrasions
- Impact damage; dents
- Severe rot at base of some posts; some leaning and missing posts

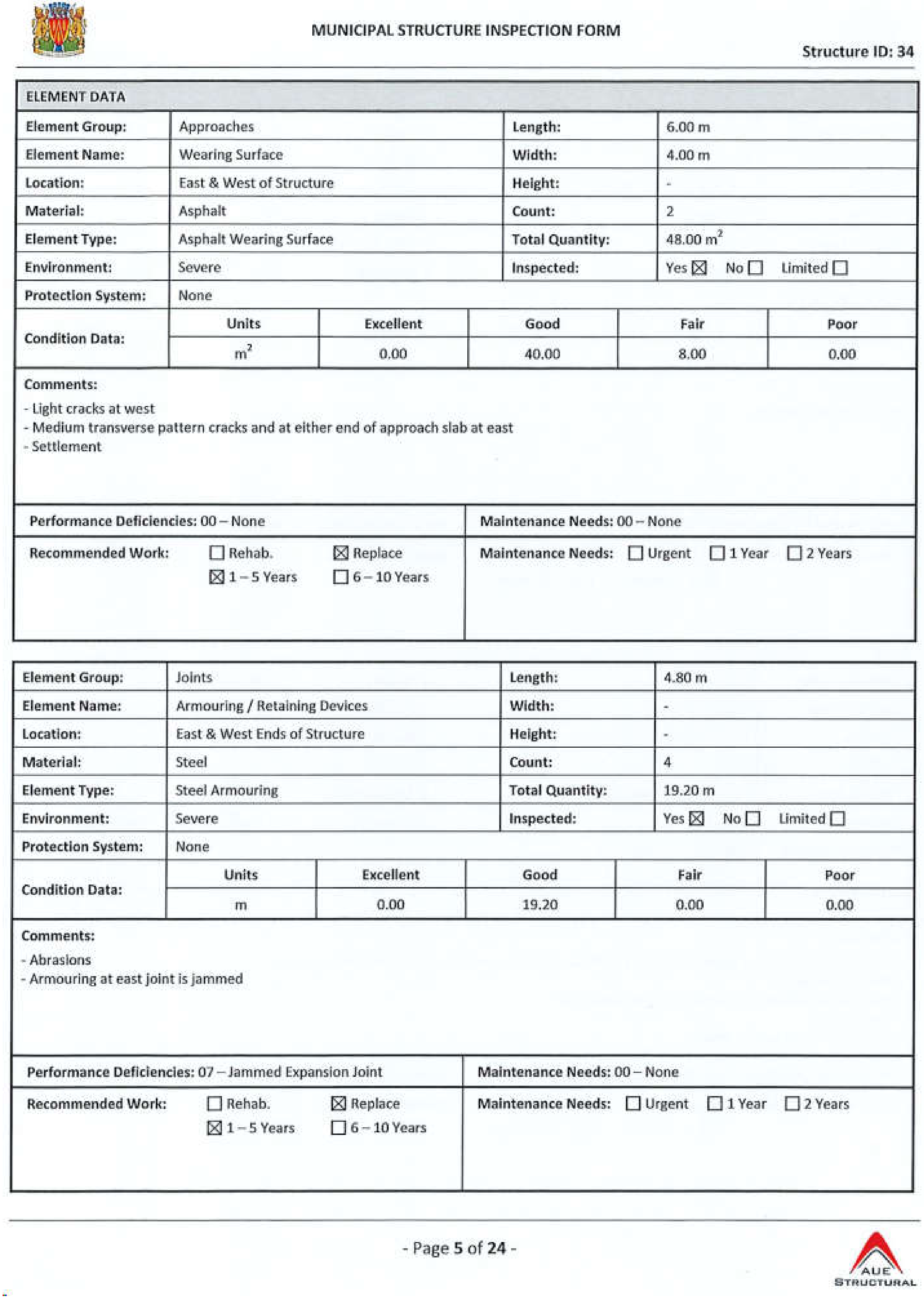
Performance Deficiencies: 08 – Pedestrian / Vehicular Hazard

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

AUE STRUCTURAL



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA

Element Group:	Approaches	**Length:**	6.00 m
Element Name:	Wearing Surface	**Width:**	4.00 m
Location:	East & West of Structure	**Height:**	-
Material:	Asphalt	**Count:**	2
Element Type:	Asphalt Wearing Surface	**Total Quantity:**	48.00 m^2
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	m^2	0.00	40.00	8.00	0.00

Comments:
- Light cracks at west
- Medium transverse pattern cracks and at either end of approach slab at east
- Settlement

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Joints	**Length:**	4.80 m
Element Name:	Armouring / Retaining Devices	**Width:**	-
Location:	East & West Ends of Structure	**Height:**	-
Material:	Steel	**Count:**	4
Element Type:	Steel Armouring	**Total Quantity:**	19.20 m
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	m	0.00	19.20	0.00	0.00

Comments:
- Abrasions
- Armouring at east joint is jammed

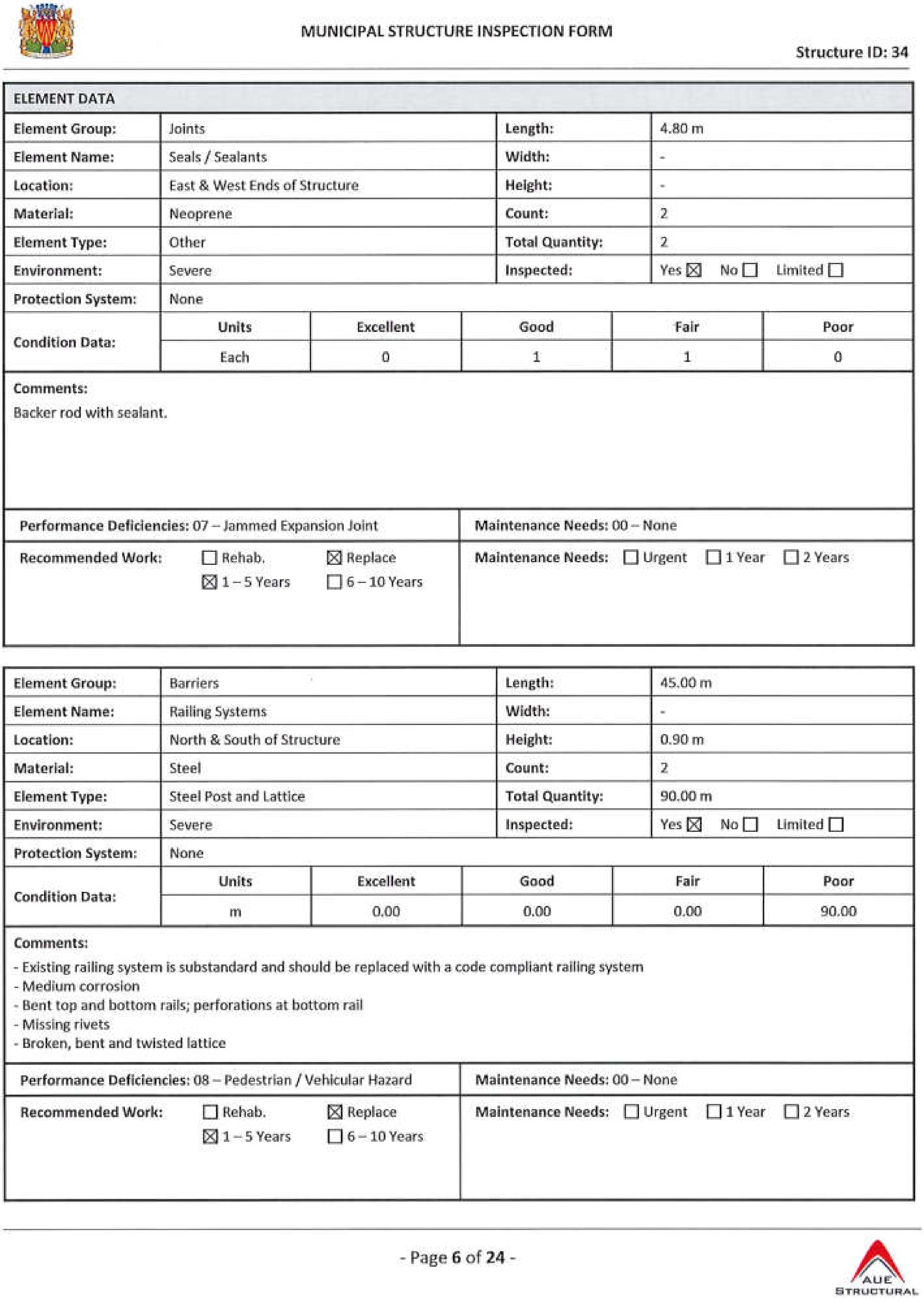
Performance Deficiencies: 07 – Jammed Expansion Joint

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

- Page **5** of **24** -



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA

Element Group:	Joints	**Length:**	4.80 m
Element Name:	Seals / Sealants	**Width:**	-
Location:	East & West Ends of Structure	**Height:**	-
Material:	Neoprene	**Count:**	2
Element Type:	Other	**Total Quantity:**	2
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	1	1	0

Comments:
Backer rod with sealant.

Performance Deficiencies: 07 – Jammed Expansion Joint

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Barriers	**Length:**	45.00 m
Element Name:	Railing Systems	**Width:**	-
Location:	North & South of Structure	**Height:**	0.90 m
Material:	Steel	**Count:**	2
Element Type:	Steel Post and Lattice	**Total Quantity:**	90.00 m
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	m	0.00	0.00	0.00	90.00

Comments:
- Existing railing system is substandard and should be replaced with a code compliant railing system
- Medium corrosion
- Bent top and bottom rails; perforations at bottom rail
- Missing rivets
- Broken, bent and twisted lattice

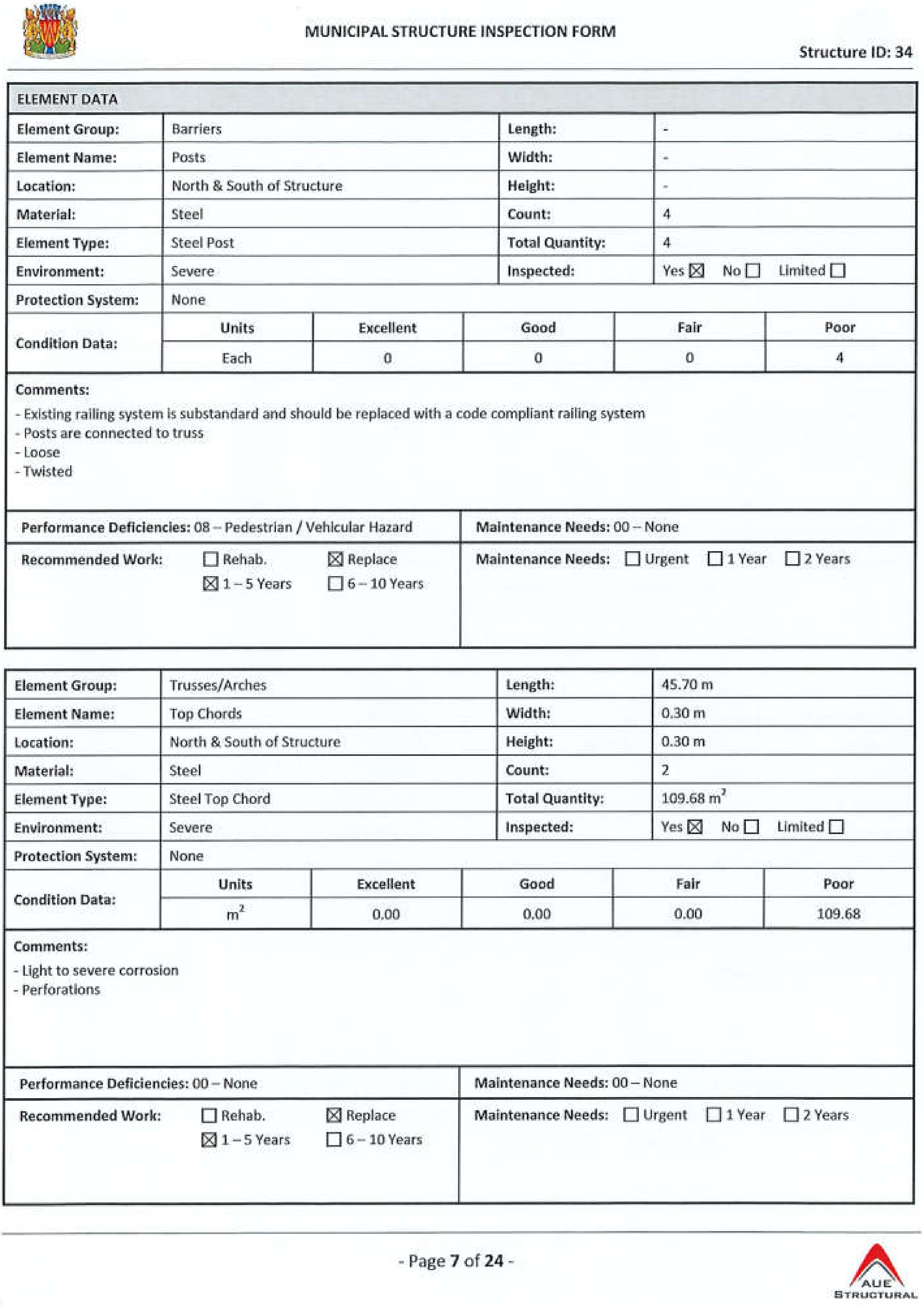
Performance Deficiencies: 08 – Pedestrian / Vehicular Hazard

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

AUE STRUCTURAL



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA			
Element Group:	Barriers	**Length:**	-
Element Name:	Posts	**Width:**	-
Location:	North & South of Structure	**Height:**	-
Material:	Steel	**Count:**	4
Element Type:	Steel Post	**Total Quantity:**	4
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	0	0	4

Comments:

- Existing railing system is substandard and should be replaced with a code compliant railing system
- Posts are connected to truss
- Loose
- Twisted

Performance Deficiencies: 08 – Pedestrian / Vehicular Hazard

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Trusses/Arches	**Length:**	45.70 m
Element Name:	Top Chords	**Width:**	0.30 m
Location:	North & South of Structure	**Height:**	0.30 m
Material:	Steel	**Count:**	2
Element Type:	Steel Top Chord	**Total Quantity:**	109.68 m^2
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	m^2	0.00	0.00	0.00	109.68

Comments:

- Light to severe corrosion
- Perforations

Performance Deficiencies: 00 – None

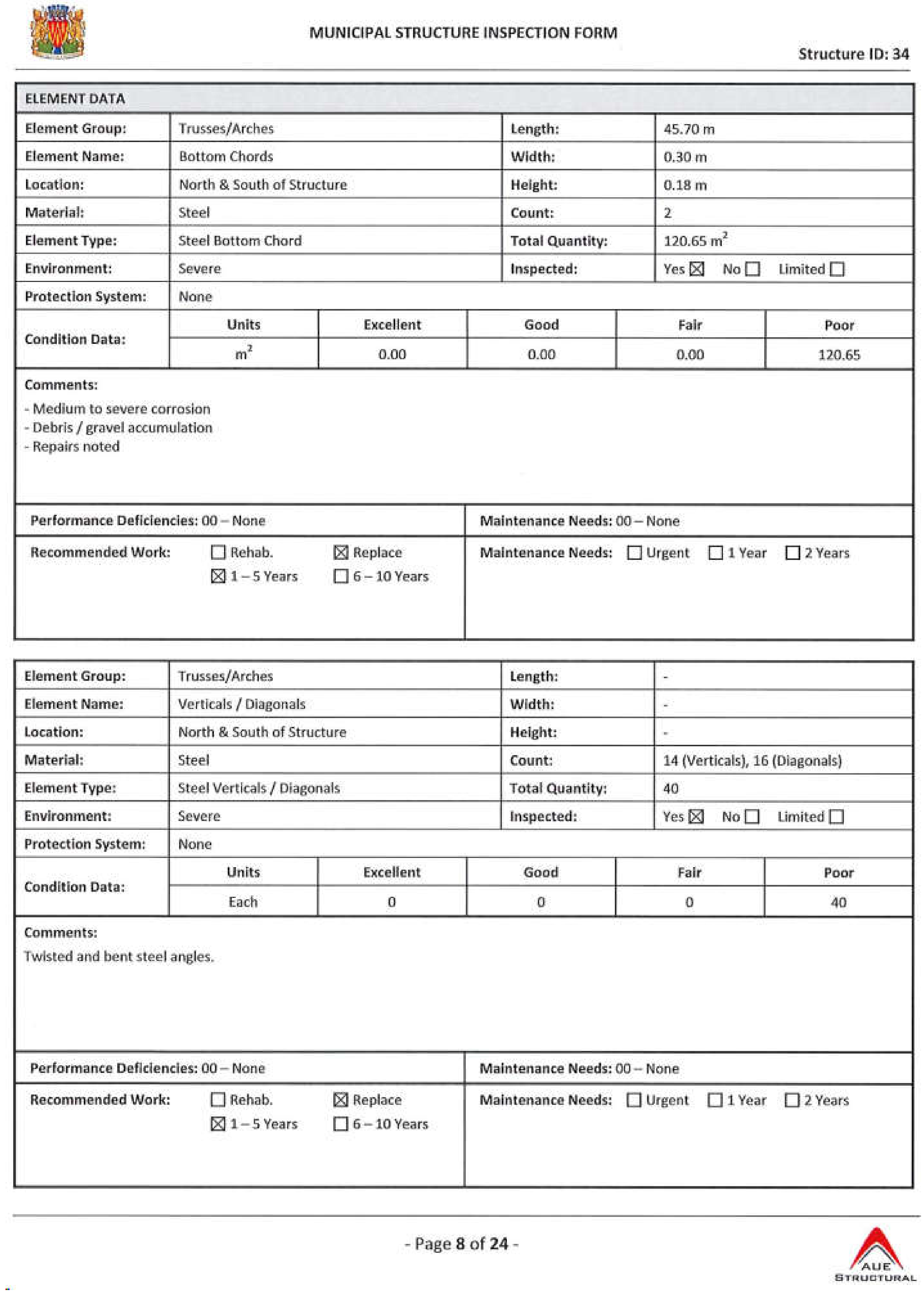
Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

- Page 7 of 24 -

AUE STRUCTURAL



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA			
Element Group:	Trusses/Arches	**Length:**	45.70 m
Element Name:	Bottom Chords	**Width:**	0.30 m
Location:	North & South of Structure	**Height:**	0.18 m
Material:	Steel	**Count:**	2
Element Type:	Steel Bottom Chord	**Total Quantity:**	120.65 m^2
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	m^2	0.00	0.00	0.00	120.65

Comments:

- Medium to severe corrosion
- Debris / gravel accumulation
- Repairs noted

Performance Deficiencies: 00 – None	**Maintenance Needs:** 00 – None
Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years	**Maintenance Needs:** ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Trusses/Arches	**Length:**	-
Element Name:	Verticals / Diagonals	**Width:**	-
Location:	North & South of Structure	**Height:**	-
Material:	Steel	**Count:**	14 (Verticals), 16 (Diagonals)
Element Type:	Steel Verticals / Diagonals	**Total Quantity:**	40
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

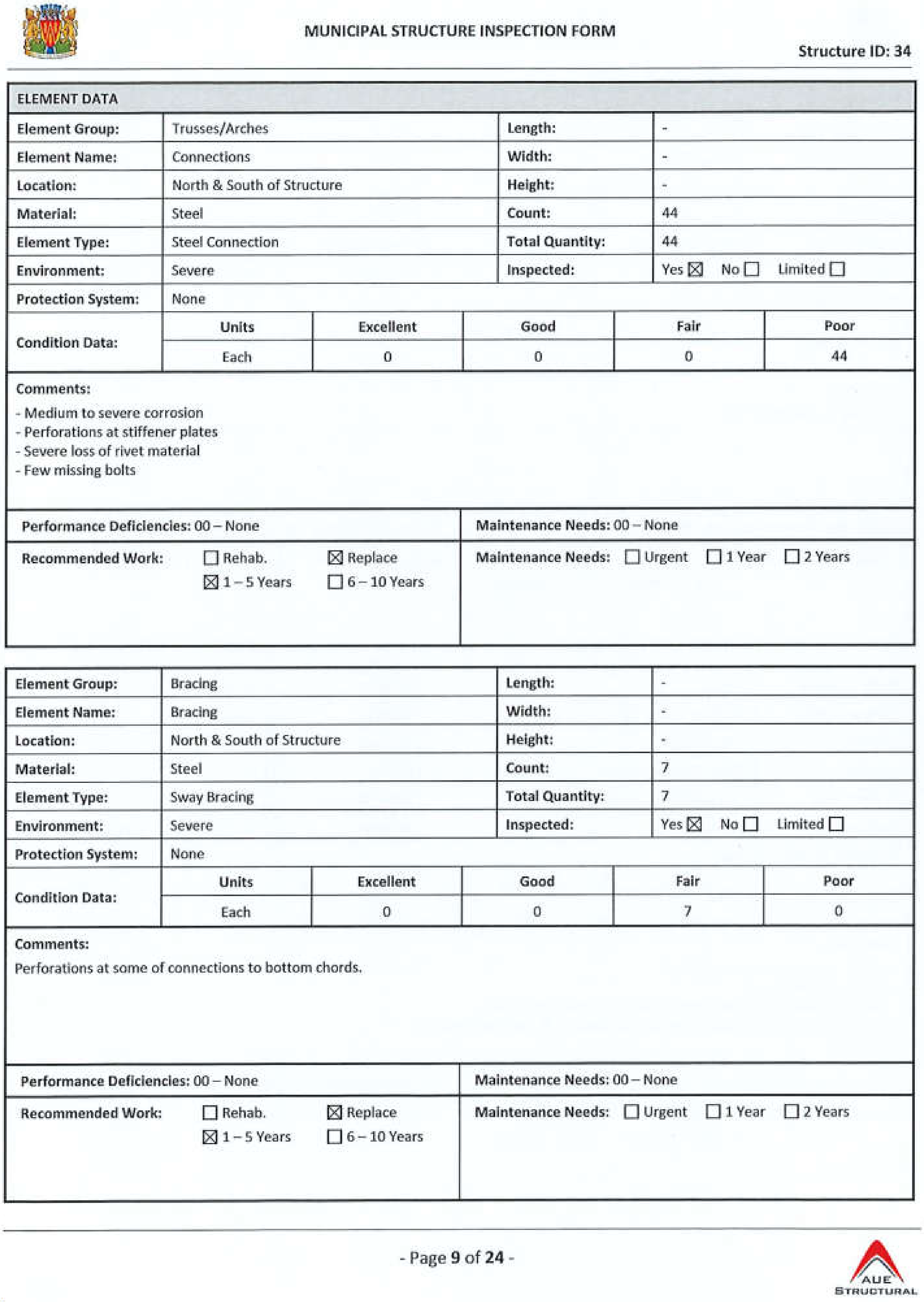
Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	0	0	40

Comments:

Twisted and bent steel angles.

Performance Deficiencies: 00 – None	**Maintenance Needs:** 00 – None
Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years	**Maintenance Needs:** ☐ Urgent ☐ 1 Year ☐ 2 Years

AUE STRUCTURAL



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA

Element Group:	Trusses/Arches	**Length:**	-
Element Name:	Connections	**Width:**	-
Location:	North & South of Structure	**Height:**	-
Material:	Steel	**Count:**	44
Element Type:	Steel Connection	**Total Quantity:**	44
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	0	0	44

Comments:

- Medium to severe corrosion
- Perforations at stiffener plates
- Severe loss of rivet material
- Few missing bolts

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace
☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Bracing	**Length:**	-
Element Name:	Bracing	**Width:**	-
Location:	North & South of Structure	**Height:**	-
Material:	Steel	**Count:**	7
Element Type:	Sway Bracing	**Total Quantity:**	7
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	0	7	0

Comments:

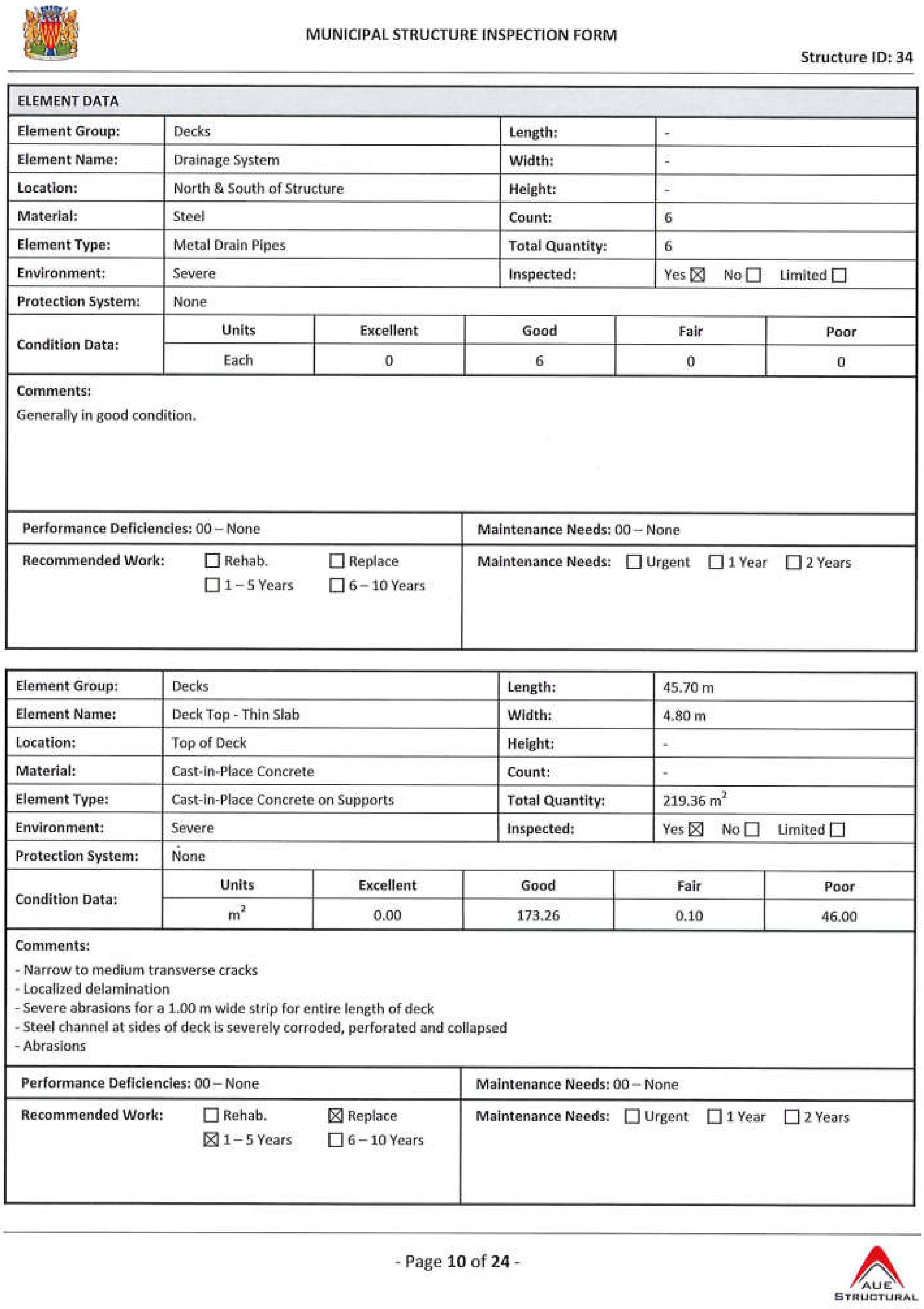
Perforations at some of connections to bottom chords.

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace
☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA			
Element Group:	Decks	**Length:**	-
Element Name:	Drainage System	**Width:**	-
Location:	North & South of Structure	**Height:**	-
Material:	Steel	**Count:**	6
Element Type:	Metal Drain Pipes	**Total Quantity:**	6
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	6	0	0

Comments:

Generally in good condition.

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☐ Replace ☐ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Decks	**Length:**	45.70 m
Element Name:	Deck Top - Thin Slab	**Width:**	4.80 m
Location:	Top of Deck	**Height:**	-
Material:	Cast-in-Place Concrete	**Count:**	-
Element Type:	Cast-in-Place Concrete on Supports	**Total Quantity:**	219.36 m^2
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	m^2	0.00	173.26	0.10	46.00

Comments:

- Narrow to medium transverse cracks
- Localized delamination
- Severe abrasions for a 1.00 m wide strip for entire length of deck
- Steel channel at sides of deck is severely corroded, perforated and collapsed
- Abrasions

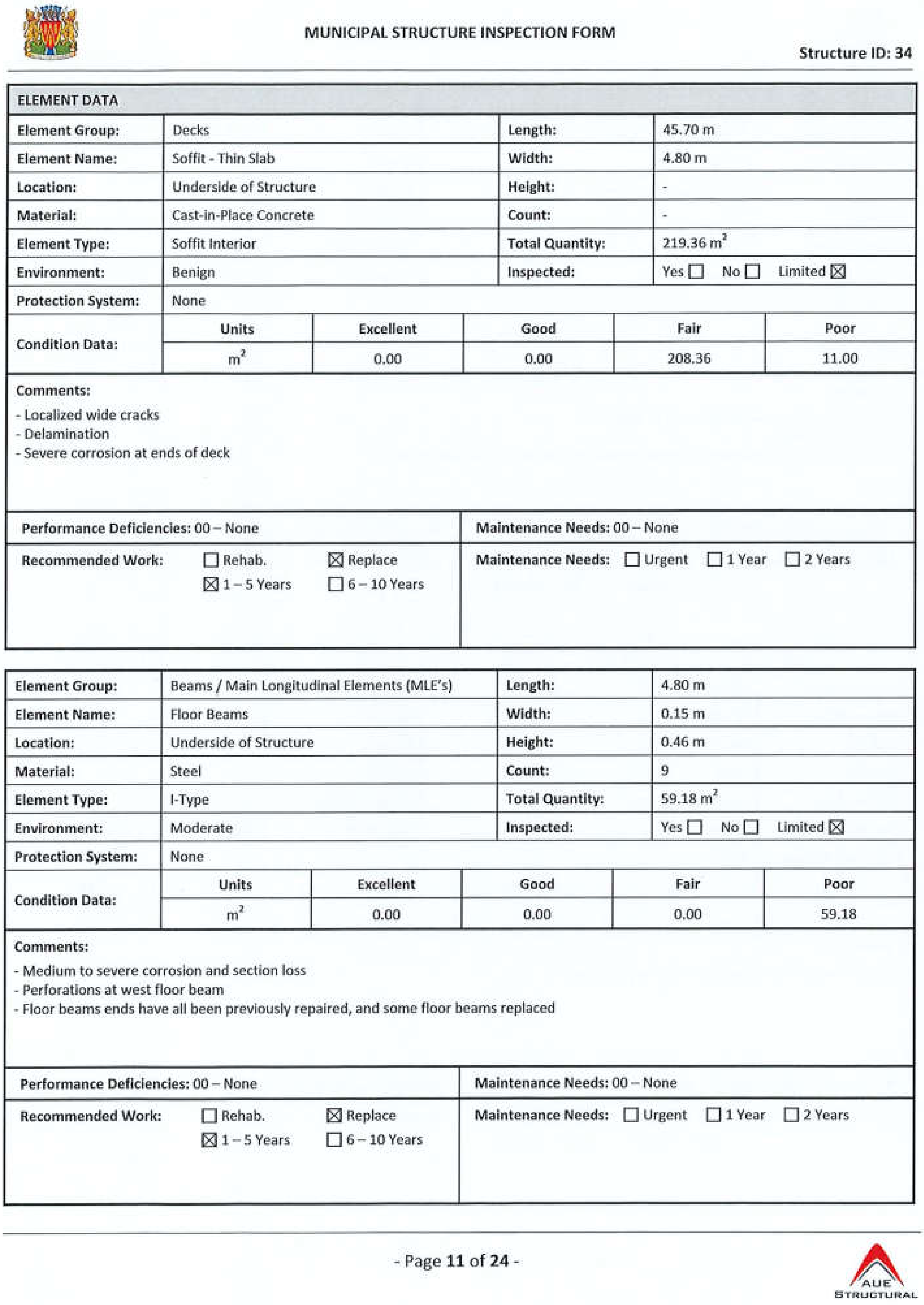
Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

- Page **10** of **24** -



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA

Element Group:	Decks	**Length:**	45.70 m
Element Name:	Soffit - Thin Slab	**Width:**	4.80 m
Location:	Underside of Structure	**Height:**	-
Material:	Cast-in-Place Concrete	**Count:**	-
Element Type:	Soffit Interior	**Total Quantity:**	219.36 m^2
Environment:	Benign	**Inspected:**	Yes ☐ No ☐ Limited ☒
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	m^2	0.00	0.00	208.36	11.00

Comments:
- Localized wide cracks
- Delamination
- Severe corrosion at ends of deck

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Beams / Main Longitudinal Elements (MLE's)	**Length:**	4.80 m
Element Name:	Floor Beams	**Width:**	0.15 m
Location:	Underside of Structure	**Height:**	0.46 m
Material:	Steel	**Count:**	9
Element Type:	I-Type	**Total Quantity:**	59.18 m^2
Environment:	Moderate	**Inspected:**	Yes ☐ No ☐ Limited ☒
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	m^2	0.00	0.00	0.00	59.18

Comments:
- Medium to severe corrosion and section loss
- Perforations at west floor beam
- Floor beams ends have all been previously repaired, and some floor beams replaced

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

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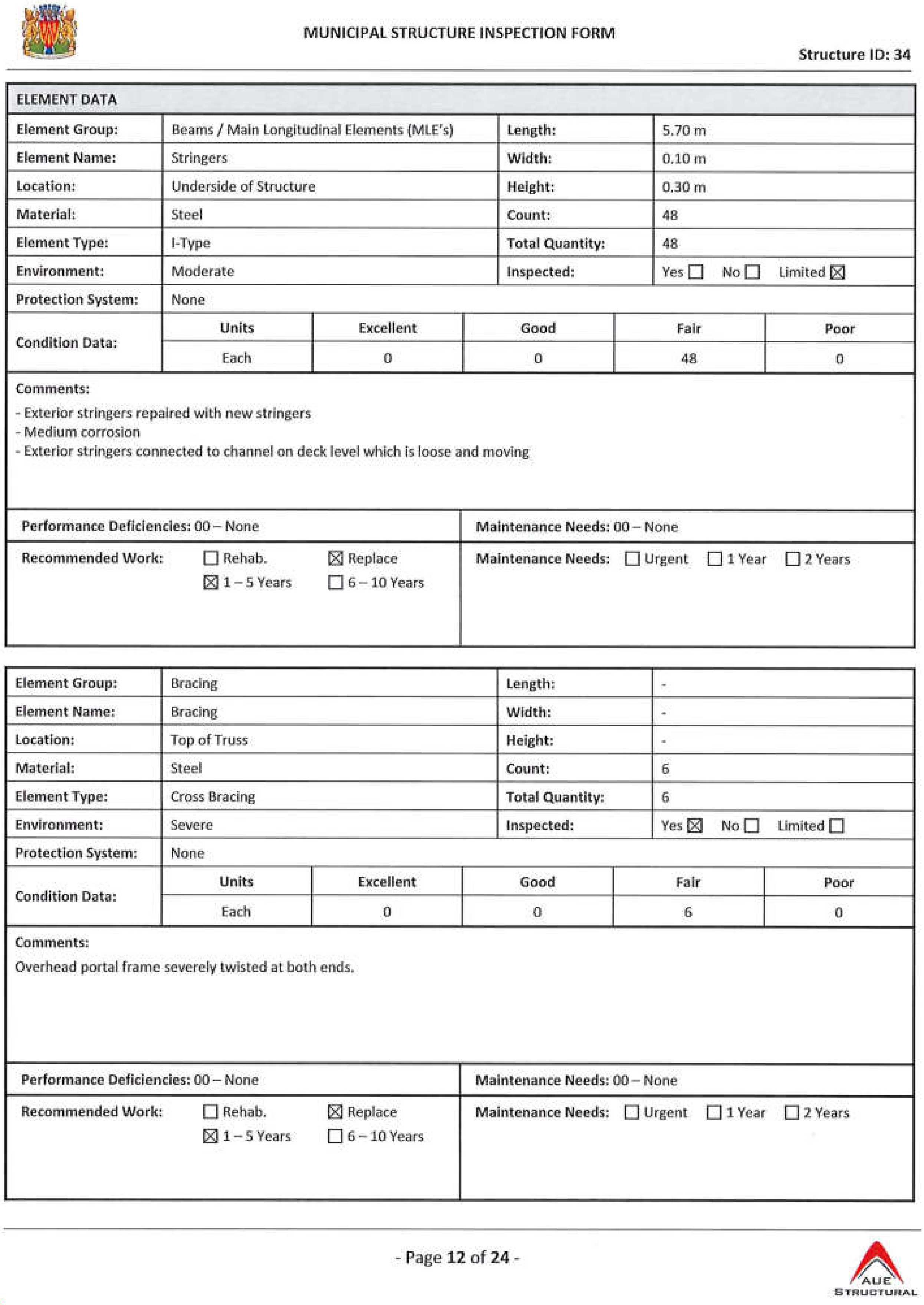
AUE STRUCTURAL

Appendix 2 - Municipal Structure Inspection Form (Bridge Street Bridge)



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA

Element Group:	Beams / Main Longitudinal Elements (MLE's)	**Length:**	5.70 m
Element Name:	Stringers	**Width:**	0.10 m
Location:	Underside of Structure	**Height:**	0.30 m
Material:	Steel	**Count:**	48
Element Type:	I-Type	**Total Quantity:**	48
Environment:	Moderate	**Inspected:**	Yes ☐ No ☐ Limited ☒
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	0	48	0

Comments:

- Exterior stringers repaired with new stringers
- Medium corrosion
- Exterior stringers connected to channel on deck level which is loose and moving

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Bracing	**Length:**	-
Element Name:	Bracing	**Width:**	-
Location:	Top of Truss	**Height:**	-
Material:	Steel	**Count:**	6
Element Type:	Cross Bracing	**Total Quantity:**	6
Environment:	Severe	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	0	6	0

Comments:

Overhead portal frame severely twisted at both ends.

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

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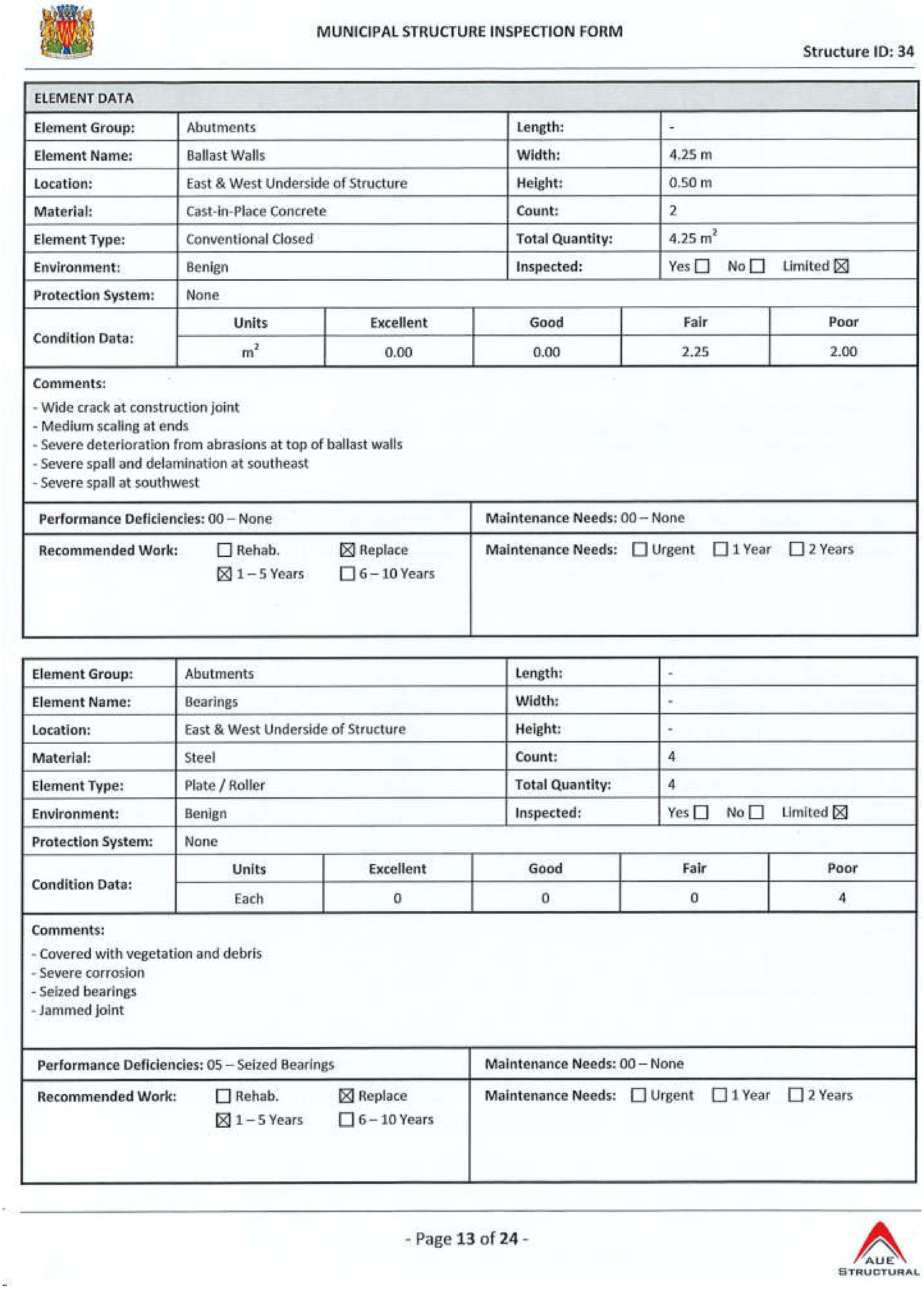
AUE STRUCTURAL

Appendix 2 - Municipal Structure Inspection Form (Bridge Street Bridge)



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA

Element Group:	Abutments	**Length:**	-
Element Name:	Ballast Walls	**Width:**	4.25 m
Location:	East & West Underside of Structure	**Height:**	0.50 m
Material:	Cast-in-Place Concrete	**Count:**	2
Element Type:	Conventional Closed	**Total Quantity:**	4.25 m^2
Environment:	Benign	**Inspected:**	Yes ☐ No ☐ Limited ☒
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	m^2	0.00	0.00	2.25	2.00

Comments:

- Wide crack at construction joint
- Medium scaling at ends
- Severe deterioration from abrasions at top of ballast walls
- Severe spall and delamination at southeast
- Severe spall at southwest

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Abutments	**Length:**	-
Element Name:	Bearings	**Width:**	-
Location:	East & West Underside of Structure	**Height:**	-
Material:	Steel	**Count:**	4
Element Type:	Plate / Roller	**Total Quantity:**	4
Environment:	Benign	**Inspected:**	Yes ☐ No ☐ Limited ☒
Protection System:	None		

Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	0	0	4

Comments:

- Covered with vegetation and debris
- Severe corrosion
- Seized bearings
- Jammed joint

Performance Deficiencies: 05 – Seized Bearings

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

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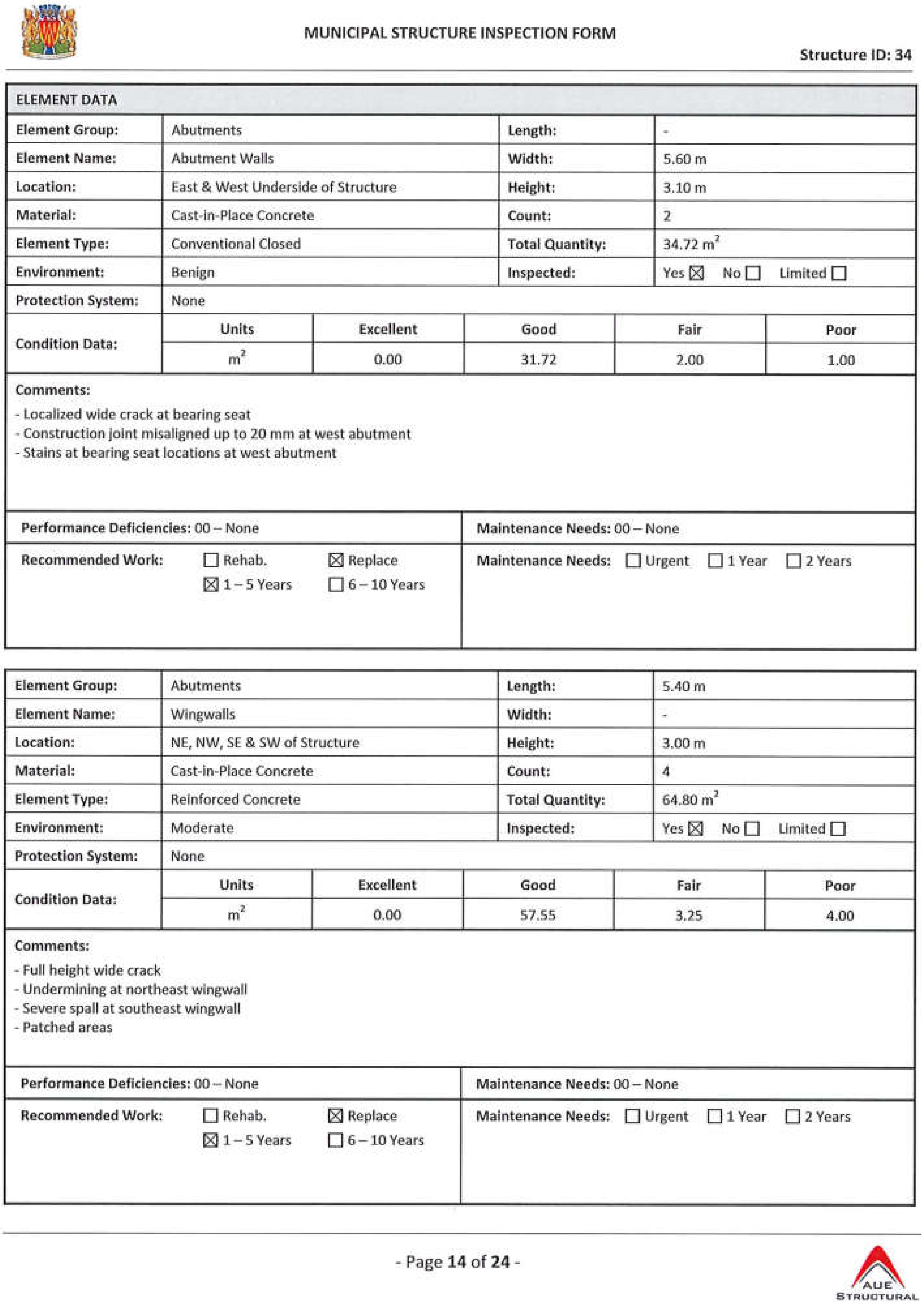
AUE STRUCTURAL



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA

Element Group:	Abutments	**Length:**	-
Element Name:	Abutment Walls	**Width:**	5.60 m
Location:	East & West Underside of Structure	**Height:**	3.10 m
Material:	Cast-in-Place Concrete	**Count:**	2
Element Type:	Conventional Closed	**Total Quantity:**	34.72 m^2
Environment:	Benign	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	Units	Excellent	Good	Fair	Poor
	m^2	0.00	31.72	2.00	1.00

Comments:
- Localized wide crack at bearing seat
- Construction joint misaligned up to 20 mm at west abutment
- Stains at bearing seat locations at west abutment

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Abutments	**Length:**	5.40 m
Element Name:	Wingwalls	**Width:**	-
Location:	NE, NW, SE & SW of Structure	**Height:**	3.00 m
Material:	Cast-in-Place Concrete	**Count:**	4
Element Type:	Reinforced Concrete	**Total Quantity:**	64.80 m^2
Environment:	Moderate	**Inspected:**	Yes ☒ No ☐ Limited ☐
Protection System:	None		

Condition Data:	Units	Excellent	Good	Fair	Poor
	m^2	0.00	57.55	3.25	4.00

Comments:
- Full height wide crack
- Undermining at northeast wingwall
- Severe spall at southeast wingwall
- Patched areas

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☒ Replace ☒ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

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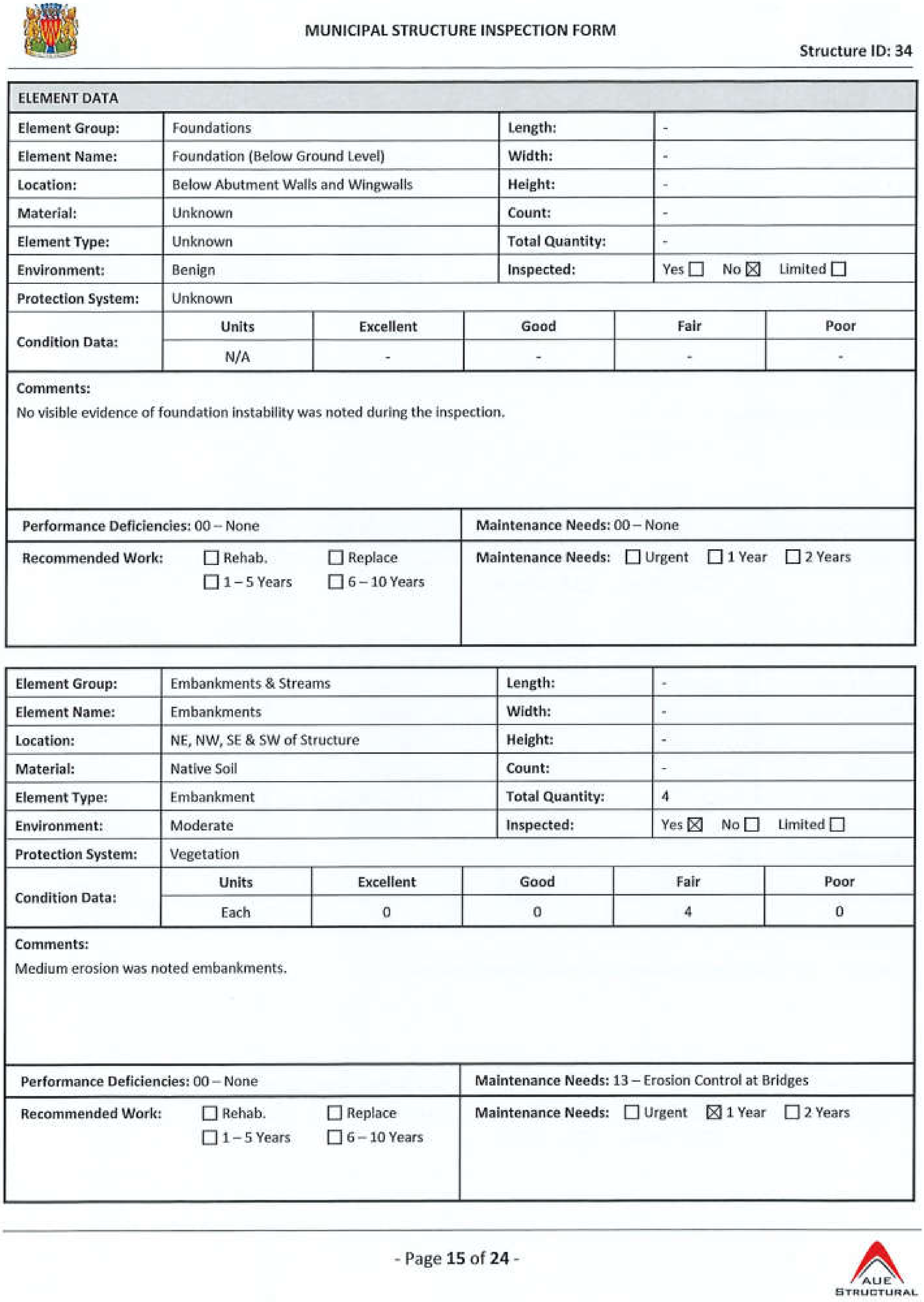
AUE STRUCTURAL



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA					
Element Group:	Foundations	**Length:**	-		
Element Name:	Foundation (Below Ground Level)	**Width:**	-		
Location:	Below Abutment Walls and Wingwalls	**Height:**	-		
Material:	Unknown	**Count:**	-		
Element Type:	Unknown	**Total Quantity:**	-		
Environment:	Benign	**Inspected:**	Yes ☐ No ☒ Limited ☐		
Protection System:	Unknown				
Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	N/A	-	-	-	-

Comments:
No visible evidence of foundation instability was noted during the inspection.

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☐ Replace ☐ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Embankments & Streams	**Length:**	-		
Element Name:	Embankments	**Width:**	-		
Location:	NE, NW, SE & SW of Structure	**Height:**	-		
Material:	Native Soil	**Count:**	-		
Element Type:	Embankment	**Total Quantity:**	4		
Environment:	Moderate	**Inspected:**	Yes ☒ No ☐ Limited ☐		
Protection System:	Vegetation				
Condition Data:	**Units**	**Excellent**	**Good**	**Fair**	**Poor**
	Each	0	0	4	0

Comments:
Medium erosion was noted embankments.

Performance Deficiencies: 00 – None

Maintenance Needs: 13 – Erosion Control at Bridges

Recommended Work: ☐ Rehab. ☐ Replace ☐ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☒ 1 Year ☐ 2 Years

AUE STRUCTURAL

MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

ELEMENT DATA					
Element Group:	Embankments & Streams		**Length:**	-	
Element Name:	Slope Protection		**Width:**	-	
Location:	NE, NW, SE & SW of Structure		**Height:**	-	
Material:	Vegetation		**Count:**	-	
Element Type:	Slope Protection		**Total Quantity:**	4	
Environment:	Moderate		**Inspected:**	Yes ☒ No ☐ Limited ☐	
Protection System:	None				
Condition Data:	Units	Excellent	Good	Fair	Poor
	Each	0	4	0	0

Comments:
Generally in good condition.

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☐ Replace ☐ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years

Element Group:	Embankments & Streams		**Length:**	-	
Element Name:	Streams and Waterway		**Width:**	-	
Location:	Under Structure		**Height:**	-	
Material:	Native		**Count:**	-	
Element Type:	Stream		**Total Quantity:**	All	
Environment:	Benign		**Inspected:**	Yes ☒ No ☐ Limited ☐	
Protection System:	None				
Condition Data:	Units	Excellent	Good	Fair	Poor
	All	0	All	0	0

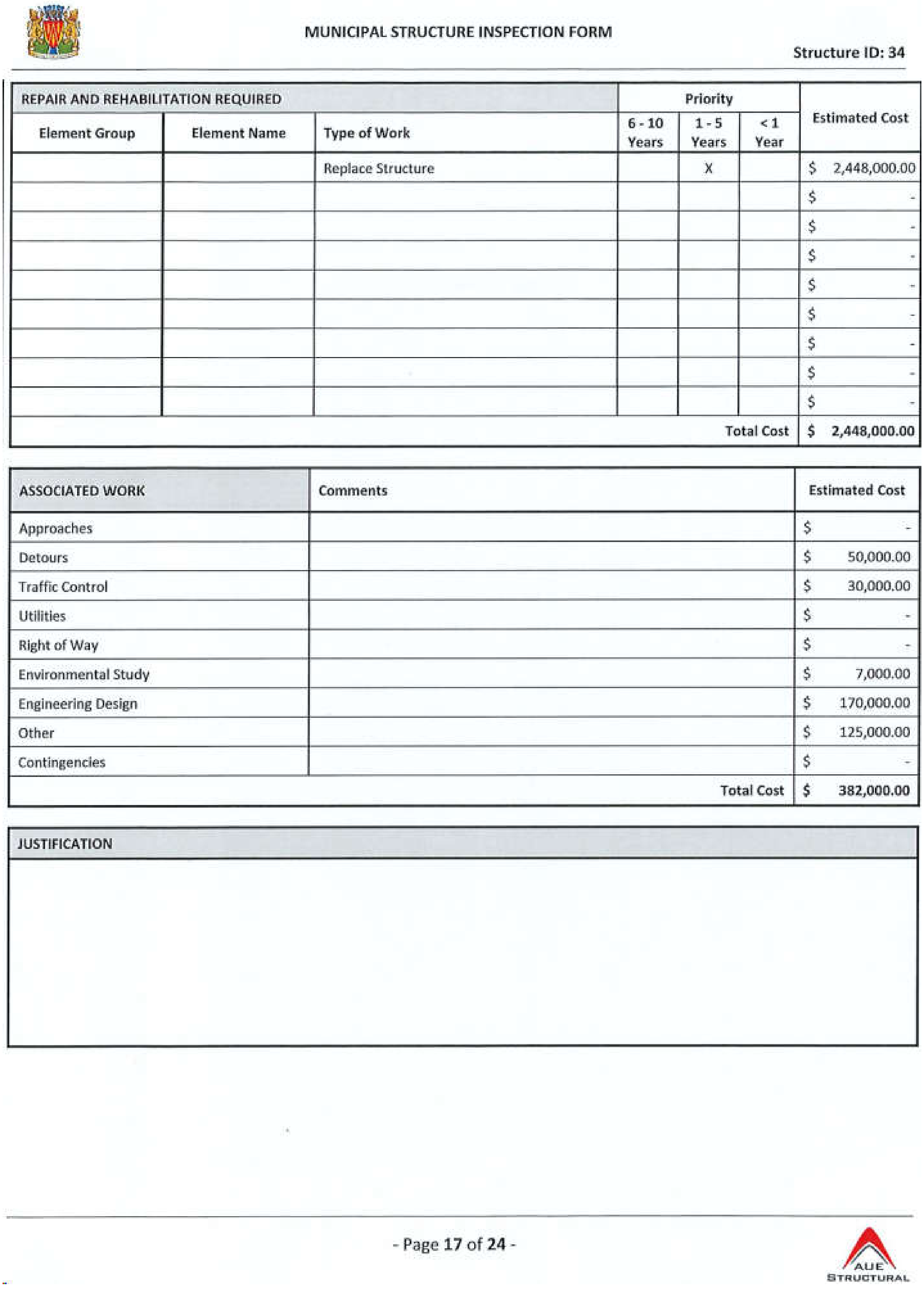
Comments:
High volume and medium flow from south to north with no visible flow obstructions.

Performance Deficiencies: 00 – None

Maintenance Needs: 00 – None

Recommended Work: ☐ Rehab. ☐ Replace ☐ 1 – 5 Years ☐ 6 – 10 Years

Maintenance Needs: ☐ Urgent ☐ 1 Year ☐ 2 Years



MUNICIPAL STRUCTURE INSPECTION FORM

Structure ID: 34

REPAIR AND REHABILITATION REQUIRED			Priority			Estimated Cost
Element Group	Element Name	Type of Work	6 - 10 Years	1 - 5 Years	< 1 Year	
		Replace Structure		X		$ 2,448,000.00
						$ -
						$ -
						$ -
						$ -
						$ -
						$ -
						$ -
						$ -
					Total Cost	$ 2,448,000.00

ASSOCIATED WORK	Comments	Estimated Cost
Approaches		$ -
Detours		$ 50,000.00
Traffic Control		$ 30,000.00
Utilities		$ -
Right of Way		$ -
Environmental Study		$ 7,000.00
Engineering Design		$ 170,000.00
Other		$ 125,000.00
Contingencies		$ -
	Total Cost	$ 382,000.00

JUSTIFICATION

AUE STRUCTURAL

Photo 1: Structure from east approach

Photo 2: Structure from west approach

Photo 3: East approach from structure

Photo 4: West approach from structure

Photo 5: North elevation

Photo 6: Substandard railing system over structure

Photo 7: Repairs at bottom chord

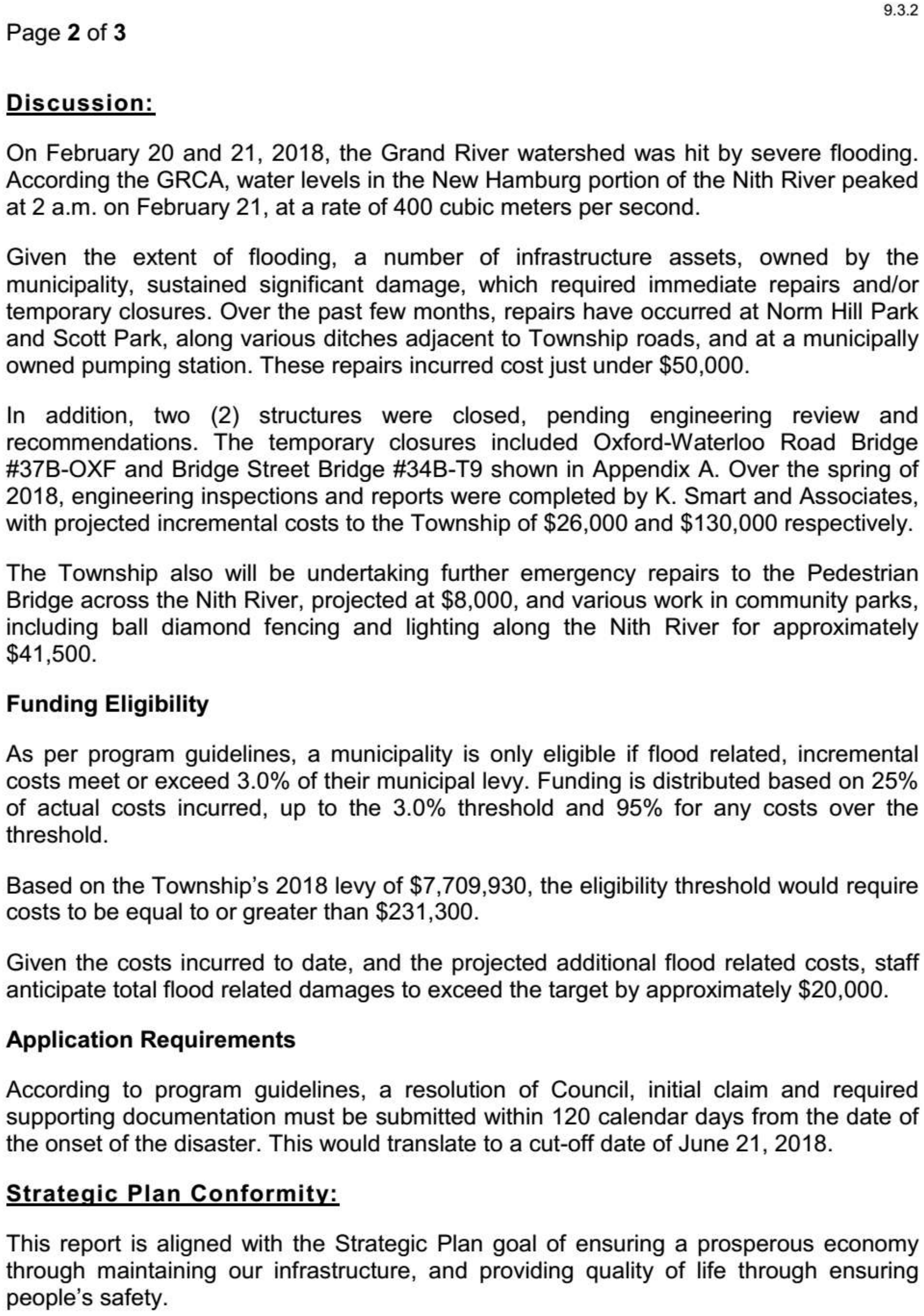
Photo 8: Underside of structure

Photo 9: Severe delamination at soffit interior

Photo 10: Repairs at floor beam

Photo 11: Perforations at stringer

Photo 12: Abutment wall



Discussion:

On February 20 and 21, 2018, the Grand River watershed was hit by severe flooding. According the GRCA, water levels in the New Hamburg portion of the Nith River peaked at 2 a.m. on February 21, at a rate of 400 cubic meters per second.

Given the extent of flooding, a number of infrastructure assets, owned by the municipality, sustained significant damage, which required immediate repairs and/or temporary closures. Over the past few months, repairs have occurred at Norm Hill Park and Scott Park, along various ditches adjacent to Township roads, and at a municipally owned pumping station. These repairs incurred cost just under $50,000.

In addition, two (2) structures were closed, pending engineering review and recommendations. The temporary closures included Oxford-Waterloo Road Bridge #37B-OXF and Bridge Street Bridge #34B-T9 shown in Appendix A. Over the spring of 2018, engineering inspections and reports were completed by K. Smart and Associates, with projected incremental costs to the Township of $26,000 and $130,000 respectively.

The Township also will be undertaking further emergency repairs to the Pedestrian Bridge across the Nith River, projected at $8,000, and various work in community parks, including ball diamond fencing and lighting along the Nith River for approximately $41,500.

Funding Eligibility

As per program guidelines, a municipality is only eligible if flood related, incremental costs meet or exceed 3.0% of their municipal levy. Funding is distributed based on 25% of actual costs incurred, up to the 3.0% threshold and 95% for any costs over the threshold.

Based on the Township's 2018 levy of $7,709,930, the eligibility threshold would require costs to be equal to or greater than $231,300.

Given the costs incurred to date, and the projected additional flood related costs, staff anticipate total flood related damages to exceed the target by approximately $20,000.

Application Requirements

According to program guidelines, a resolution of Council, initial claim and required supporting documentation must be submitted within 120 calendar days from the date of the onset of the disaster. This would translate to a cut-off date of June 21, 2018.

Strategic Plan Conformity:

This report is aligned with the Strategic Plan goal of ensuring a prosperous economy through maintaining our infrastructure, and providing quality of life through ensuring people's safety.

from: Township of Wilmot Report FIN 2018-23 Municipal Disaster Recovery Assistance Program, June 4, 2018

Bridge Street Bridge

Location Wilmot Township Road 9, Lot 21, Concessions 3 & 4 Block A (now Bridge Street), south of Haysville, Township of Wilmot.

General Information

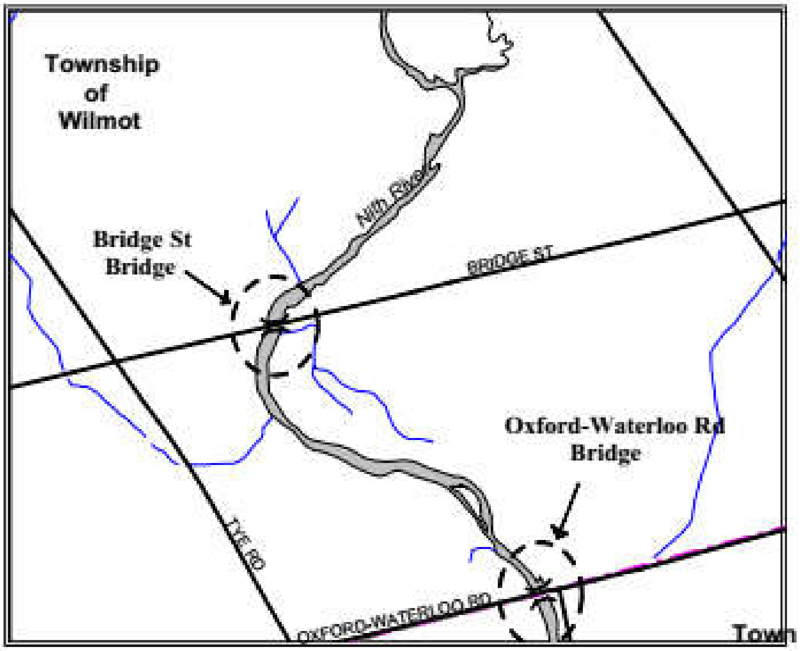
Bridge No.	28
Jurisdiction	Township of Wilmot
Year built	1913
Drawings	Not available

Physical Components

Type	through Truss
Spans	1
Dimensions	Length 45.7 m Width 4.1 m
Load Limit	11 tonnes

Descriptive details

This bridge is identical in design to the Oxford-Waterloo Bridge, except that it has a higher load limit.



Spanning The Generations: Phase 1 Inventory Revised 2004
1.13

from: *Spanning the Generations, A Study of Old Bridges in Waterloo Region,: Phase 1 Inventory*, October 2007

Bridge Street Bridge

South East View

East View

Spanning the Generations: Phase 1 Inventory Revised 2004

1.14

from: *Spanning the Generations, A Study of Old Bridges in Waterloo Region,: Phase 1 Inventory*, October 2007

Revised April 11, 2014, *This checklist was prepared in March 2013 by the Municipal Engineers Association to assist with determining the requirements to comply with the Municipal Class Environmental Assessment. View all 4 parts of the module on Structures Over 40 Years at www.municipalclassea.ca to assist with completing the checklist.*

NOTE: Complete all sections of Checklist. Both Cultural Heritage and Archaeological Sections must be satisfied before proceeding.[21]

Part A - Municipal Class EA Activity Selection

Description	Yes	No
Will the proposed project involve or result in construction of new water crossings? This includes ferry docks.	Schedule B or C	Next
Will the proposed project involve or result in construction of new grade separation?	Schedule B or C	Next
Will the proposed project involve or result in construction of new underpasses or overpasses for pedestrian recreational or agricultural use?	Schedule B or C	Next
Will the proposed project involve or result in construction of new interchanges between any two roadways, including a grade separation and ramps to connect the two roadways?	Schedule B or C	Next
Will the proposed project involve or result in reconstruction of a water crossing where the structure is less than 40 years old and the reconstructed facility will be for the same purpose, use, capacity and at the same location? (Capacity refers to either hydraulic or road capacity.) This includes ferry docks.	Schedule A+	Next
Will the proposed project involve or result in reconstruction of a water crossing, where the reconstructed facility will not be for the same purpose, use, capacity or at the same location? (Capacity refers to either hydraulic or road capacity). This includes ferry docks.	Schedule B or C	Next

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[21] *Municipal Heritage Bridges Cultural, Heritage and Archaeological Resources Assessment Checklist* Revised April 11, 2014, Municipal Engineers Association

Description	Yes	No
Will the proposed project involve or result in reconstruction or alteration of a structure or the grading adjacent to it when the structure is over 40 years old where the proposed work will alter the basic structural system, overall configuration or appearance of the structure?	Next	Assess Archaeological Resources
Will the proposed project involve or result in reconstruction of a water crossing where the structure is less than 40 years old and the reconstructed facility will be for the same purpose, use, capacity and at the same location? (Capacity refers to either hydraulic or road capacity.) This include ferry docks.	Schedule A+	Next
Will the proposed project involve or result in reconstruction of a water crossing, where the reconstructed facility will not be for the same purpose, use, capacity or at the same location? (Capacity refers to either hydraulic or road capacity). This includes ferry docks.	Schedule B or C	Next
Will the proposed project involve or result in reconstruction or alteration of a structure or the grading adjacent to it when the structure is over 40 years old where the proposed work will alter the basic structural system, overall configuration or appearance of the structure?	Schedule B or C	Assess Archaeological Resources

Part B - Cultural Heritage Assessment

Description	Yes	No
Does the proposed project involve a bridge constructed in or after 1956?	Next	Prepare CHER Undertake HIA
Does the project involve one of these four bridge types?	Rigid frame Next Precast with Concrete Deck Next Culvert or Simple Span Next Steel Beam/ Concrete Deck Next	Prepare CHER Undertake HIA

Description	Yes	No
Does the bridge or study area contain a parcel of land that is subject of a covenant or agreement between the owner of the property and a conservation body or level of government?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is listed on a register or inventory of heritage properties maintained by the municipality?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is designated under Part IV of the *Ontario Heritage Act*?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is subject to a notice of intention to designate issued by a municipality?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is located within a designated Heritage Conservation District?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is subject to a Heritage Conservation District study area by-law?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is included in the Ministry of Tourism, Culture and Sport's list of provincial heritage properties?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is part of a National Historic Site?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is part of a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is designated under the Heritage Railway Station Protection Act?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is identified as a Federal Heritage Building by the Federal Heritage Building Review Office (FHBRO)	Prepare CHER Undertake HIA	Next

Description	Yes	No
Does the bridge or study area contain a parcel of land that is the subject of a municipal, provincial or federal commemorative or interpretive plaque that speaks to the Historical significance of the bridge?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain a parcel of land that is in a Canadian Heritage River watershed?	Prepare CHER Undertake HIA	Next
Will the project impact any structures or sites (not bridges) that are over forty years old, or are important to defining the character of the area or that are considered a landmark in the local community?	Prepare CHER Undertake HIA	Next
Is the bridge or study area adjacent to a known burial site and/or cemetery?	Prepare CHER Undertake HIA	Next
Is the bridge considered a landmark or have a special association with a community, person or historical event in the local community?	Prepare CHER Undertake HIA	Next
Does the bridge or study area contain or is it part of a cultural heritage landscape?	Prepare Cher Undertake HIA	Assess Archaeological Resources

Part C - Heritage Assessment

Description	Yes	No
Does the Cultural Heritage Evaluation Report identify any Heritage Features on the project?	Undertake HIA	Part D - Archaeological Resources
Does the Heritage Impact Assessment determine that the proposed project will impact any of the Heritage Features that have been identified?	Schedule B or C	Part D - Archaeological Resources

Part D - Archaeological Resources Assessment

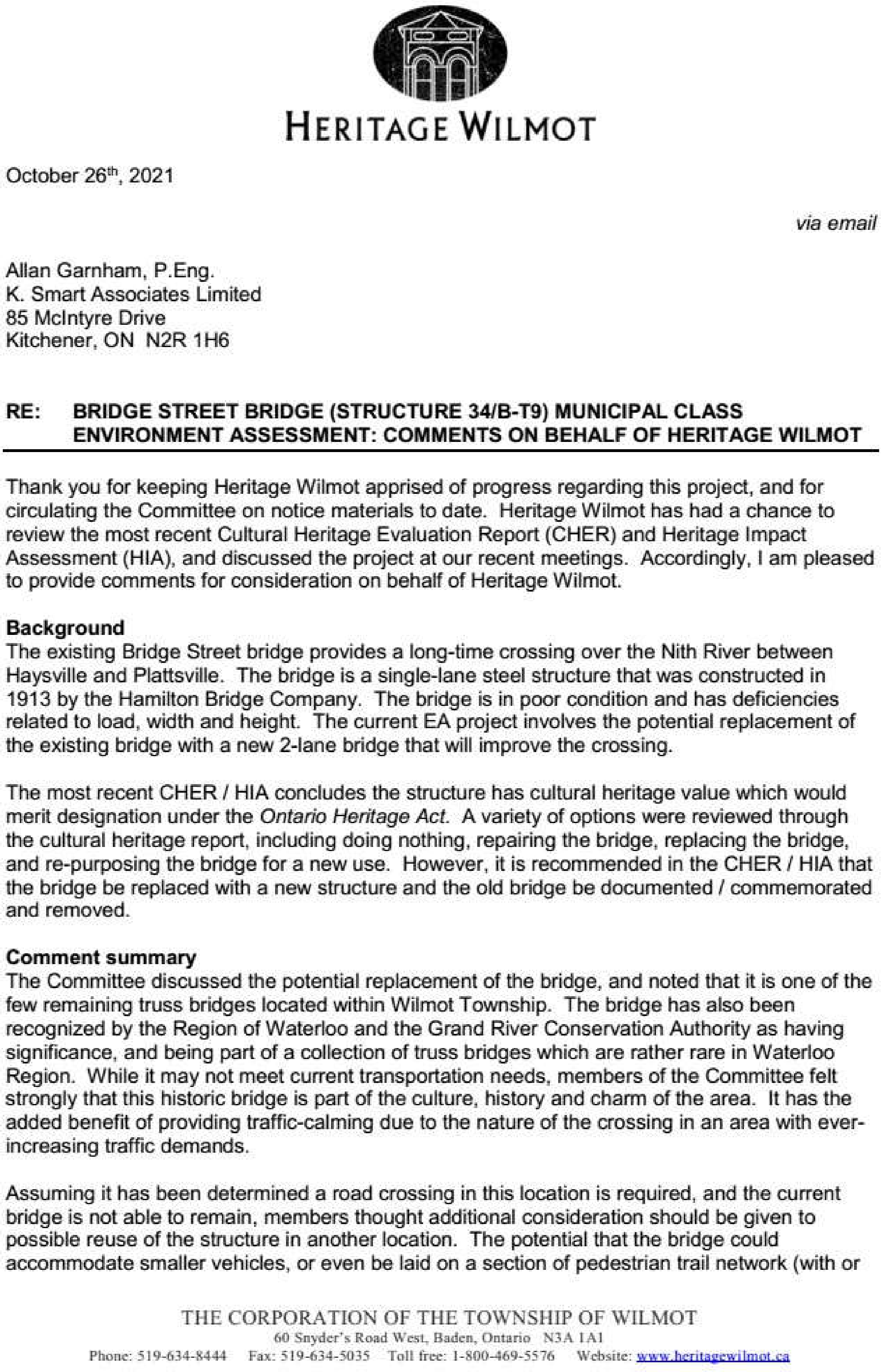
Description	Yes	No
Will any activity, related to the project, result in land impacts/significant ground disturbance?	Next	Schedule A - proceed

Description	**Yes**	**No**
Have all areas, to be impacted by ground disturbing activities, been subjected to recent extensive and intensive disturbances and to depths greater than the depths of the proposed activities?	Schedule A - proceed	Next
Has an archaeological assessment previously been carried out that includes all of the areas to be impacted by this project?	Next	Archaeological Assessment*
Does the report on that previous archaeological assessment recommend that no further archaeological assessment is required within the limits of the project for which that assessment was undertaken, and has a letter been issued by the Ministry of Tourism, Culture and Sport stating that the report has been entered into the Ontario Public Register of Archaeological Reports?	Schedule A - proceed	Obtain satisfaction letter - proceed

* Consultants were engaged in 2020 to conduct a Stage 1 and Stage 2 Archaeological Assessment and found nothing of significance.

Conclusion

The project involves a bridge constructed before 1956, and a bridge type not exempted by the MEA checklist. It does not involve a bridge that is listed on a municipal Heritage Register, or is designated under Part IV or Part V of the *Ontario Heritage Act.* It does involve one meeting the criteria of *Regulation 9/06*; therefore, there is a potential impact on a significant heritage resource. A Heritage Impact Assessment is required.



HERITAGE WILMOT

October 26th, 2021

via email

Allan Garnham, P.Eng.
K. Smart Associates Limited
85 McIntyre Drive
Kitchener, ON N2R 1H6

RE: BRIDGE STREET BRIDGE (STRUCTURE 34/B-T9) MUNICIPAL CLASS ENVIRONMENT ASSESSMENT: COMMENTS ON BEHALF OF HERITAGE WILMOT

Thank you for keeping Heritage Wilmot apprised of progress regarding this project, and for circulating the Committee on notice materials to date. Heritage Wilmot has had a chance to review the most recent Cultural Heritage Evaluation Report (CHER) and Heritage Impact Assessment (HIA), and discussed the project at our recent meetings. Accordingly, I am pleased to provide comments for consideration on behalf of Heritage Wilmot.

Background

The existing Bridge Street bridge provides a long-time crossing over the Nith River between Haysville and Plattsville. The bridge is a single-lane steel structure that was constructed in 1913 by the Hamilton Bridge Company. The bridge is in poor condition and has deficiencies related to load, width and height. The current EA project involves the potential replacement of the existing bridge with a new 2-lane bridge that will improve the crossing.

The most recent CHER / HIA concludes the structure has cultural heritage value which would merit designation under the *Ontario Heritage Act*. A variety of options were reviewed through the cultural heritage report, including doing nothing, repairing the bridge, replacing the bridge, and re-purposing the bridge for a new use. However, it is recommended in the CHER / HIA that the bridge be replaced with a new structure and the old bridge be documented / commemorated and removed.

Comment summary

The Committee discussed the potential replacement of the bridge, and noted that it is one of the few remaining truss bridges located within Wilmot Township. The bridge has also been recognized by the Region of Waterloo and the Grand River Conservation Authority as having significance, and being part of a collection of truss bridges which are rather rare in Waterloo Region. While it may not meet current transportation needs, members of the Committee felt strongly that this historic bridge is part of the culture, history and charm of the area. It has the added benefit of providing traffic-calming due to the nature of the crossing in an area with ever-increasing traffic demands.

Assuming it has been determined a road crossing in this location is required, and the current bridge is not able to remain, members thought additional consideration should be given to possible reuse of the structure in another location. The potential that the bridge could accommodate smaller vehicles, or even be laid on a section of pedestrian trail network (with or

THE CORPORATION OF THE TOWNSHIP OF WILMOT
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without a crossing) were discussed. These options were preferred to demolishing the bridge entirely.

Heritage Wilmot recognizes the need to upgrade Township infrastructure in order to accommodate modern transportation needs. Should the decision be made to replace the existing structure with a new one, Heritage Wilmot encourages the project team to consider the possible reuse of the bridge span to serve the public, for example, as a section of trail within the Township. Failing the ability to reuse the structure, Heritage Wilmot would support the creation of a commemorative feature utilizing salvage materials from the bridge.

Closing
Heritage Wilmot appreciates the opportunity to provide feedback related to this project. The Committee looks forward to continued involvement as recommendations are finalized and a future plan for the crossing is finalized.

Yours truly,

Nick Bogaert, Chairperson
Heritage Wilmot Advisory Committee

cc: *Jeff Molenhuis, Township of Wilmot*
Tracy Loch, Township of Wilmot

OWEN R. SCOTT, ***OALA, FCSLA, CAHP***

Education:
Master of Landscape Architecture (MLA) University of Michigan, 1967
Bachelor of Science in Agriculture (Landscape Horticulture), (BSA) University of Guelph, 1965

Professional Experience:

1965 - present	President, CHC Limited, Guelph, ON
1977 - 2018	President, The Landplan Collaborative Ltd., Guelph, ON
1977 - 1985	Director, The Pacific Landplan Collaborative Ltd., Vancouver and Nanaimo, BC
1975 - 1981	Editor and Publisher, *Landscape Architecture Canada*, Ariss, ON
1969 - 1981	Associate Professor, School of Landscape Architecture, University of Guelph
1975 - 1979	Director and Founding Principal, Ecological Services for Planning Limited, Guelph, ON
1964 - 1969	Landscape Architect, Project Planning Associates Limited, Toronto, ON

Historical Research, Heritage Planning and Conservation Experience and Expertise

Current Professional and Professional Heritage Associations Affiliations:
Member: Alliance for Historic Landscape Preservation (AHLP) - 1978 -
Member: Canadian Association of Heritage Professionals (CAHP) - 1987 -
Member: Ontario Association of Landscape Architects (OALA) - 1968 - (Emeritus 2016)
Member: Canadian Society of Landscape Architects (FCSLA) - 1969 - (Fellow 1977, Life Member 2016)

Community and Professional Society Service (Heritage):
Director: Canadian Association of Heritage Professionals (CAHP), 2002 - 2003
Member: Advisory Board, Architectural Conservancy of Ontario, 1980 - 2002
Member: City of Guelph Local Architectural Conservation Advisory Committee (LACAC), 1987 - 2000 (Chair 1988 - 1990)
Member: Advisory Council, Centre for Canadian Historical Horticultural Studies, 1985 - 1988

Professional Honours and Awards (Heritage):

Merit Award	2016	Canadian Association of Heritage Professionals Awards, City of Kitchener Cultural Heritage Landscapes
National Award	2016	Canadian Society of Landscape Architects (CSLA), City of Kitchener Cultural Heritage Landscapes
Mike Wagner Award	2013	Heritage Award - Breithaupt Block, Kitchener, ON
People's Choice Award	2012	Brampton Urban Design Awards, Peel Art Gallery, Museum and Archives, Brampton, ON
Award of Excellence	2012	Brampton Urban Design Awards, Peel Art Gallery, Museum and Archives, Brampton, ON
National Award	2009	Heritage Canada Foundation National Achievement, Alton Mill, Alton, ON
Award of Merit	2009	Canadian Association of Heritage Professionals Awards, Alton Mill, Alton, ON
Award	2007	Excellence in Urban Design Awards, Heritage, Old Quebec Street, City of Guelph, ON
Award	2001	Ontario Heritage Foundation Certificate of Achievement
Award	1998	Province of Ontario, Volunteer Award (10 year award)
Award	1994	Province of Ontario, Volunteer Award (5 year award)
Regional Merit	1990	CSLA Awards, Britannia School Farm Master Plan
National Honour	1990	CSLA Awards, Confederation Boulevard, Ottawa
Citation	1989	City of Mississauga Urban Design Awards, Britannia School Farm Master Plan
Honour Award	1987	*Canadian Architect*, Langdon Hall Landscape Restoration, Cambridge, ON
Citation	1986	*Progressive Architecture*, The Ceremonial Routes (Confederation Boulevard), Ottawa,
National Citation	1985	CSLA Awards, Tipperary Creek Heritage Conservation Area Master Plan, Saskatoon, SK

National Merit Award	1984	CSLA Awards, St. James Park Victorian Garden, Toronto, ON
	1982	Ontario Ministry of Municipal Affairs Ontario Renews Awards, Millside, Guelph, ON

Selected Heritage Publications:

Scott, Owen R., The Southern Ontario "Grid", *ACORN* Vol XXVI-3, Summer 2001. *The Journal of the Architectural Conservancy of Ontario*.

Scott, Owen R. *19th Century Gardens for the 20th and 21st Centuries*. Proceedings of "Conserving Ontario's Landscapes" conference of the ACO, (April 1997). Architectural Conservancy of Ontario Inc., Toronto, 1998.

Scott, Owen R. *Landscapes of Memories, A Guide for Conserving Historic Cemeteries.* (19 of 30 chapters) compiled and edited by Tamara Anson-Cartright, Ontario Ministry of Citizenship, Culture and Recreation, 1997.

Scott, Owen R. Cemeteries: A Historical Perspective, *Newsletter, The Memorial Society of Guelph*, September 1993.

Scott, Owen R. The Sound of the Double-bladed Axe, *Guelph and its Spring Festival*. edited by Gloria Dent and Leonard Conolly, The Edward Johnson Music Foundation, Guelph, 1992. 2 pp.

Scott, Owen R. Woolwich Street Corridor, Guelph, *ACORN* Vol XVI-2, Fall 1991. Newsletter of the Architectural Conservancy of Ontario Inc. (ACO)

Scott, Owen R. guest editor, *ACORN*, Vol. XIV-2, Summer 1989. Cultural Landscape Issue, Newsletter of the ACO.

Scott, Owen R. Heritage Conservation Education, Heritage Landscape Conservation, *Momentum 1989*, Icomos Canada, Ottawa, p.31.

Scott, Owen R. Cultivars, pavers and the historic landscape, *Historic Sites Supplies Handbook*. Ontario Museum Association, Toronto, 1989. 9 pp.

Scott, Owen R. Landscape preservation - What is it? *Newsletter,* American Society of Landscape Architects - Ontario Chapter, vol. 4 no.3, 1987.

Scott, Owen R. Tipperary Creek Conservation Area, Wanuskewin Heritage Park. *Landscape Architectural Review*, May 1986. pp. 5-9.

Scott, Owen R. Victorian Landscape Gardening. Ontario Bicentennial History Conference, McMaster University, 1984.

Scott, Owen R. Canada West Landscapes. *Fifth Annual Proceedings Niagara Peninsula History Conference (1983)*. 1983. 22 pp.

Scott, Owen R. Utilizing History to Establish Cultural and Physical Identity in the Rural Landscape. *Landscape Planning*, Elsevier Scientific Press, Amsterdam, 1979. Vol. 6, No. 2, pp. 179-203.

Scott, Owen R. Changing Rural Landscape in Southern Ontario. *Third Annual Proceedings Agricultural History of Ontario Seminar (1978)*. June 1979. 20 pp.

Scott, Owen R., P. Grimwood, M. Watson. George Laing - Landscape Gardener, Hamilton, Canada West 1808-187l. *Bulletin, The Association for Preservation Technology*, Vol. IX, No. 3, 1977, 13 pp. (also published in *Landscape Architecture Canada*, Vol. 4, No. 1, 1978).

Scott, Owen R. The Evaluation of the Upper Canadian Landscape. Department of Landscape Architecture, University of Manitoba. 1978. (Colour videotape).

Following is a **representative listing of some of the heritage consultations undertaken by Owen R. Scott** in his capacity as a principal of The Landplan Collaborative Ltd., and principal of CHC Limited.

<u>Cultural Heritage Evaluation Reports (CHER) and Heritage Impact Assessments (HIA) - Bridges</u>

- Adams Bridge (Structure S20) CHER & HIA, Southgate Township, ON
- Belanger Bridge Cultural Heritage Evaluation Report, Casey Township, ON
- Bridge #9-WG Cultural Heritage Evaluation Report, Township of Centre Wellington, ON
- Bridge #20 CHER & HIA, Blandford-Blenheim Township, ON
- Bridge #25 CHER & HIA, Blandford-Blenheim Township, ON
- Holland Mills Road Bridge CHER & HIA, Wilmot Township, ON
- Irvine Street (Watt) Bridge Cultural Heritage Evaluation Report, Township of Centre Wellington, ON
- Oxford Waterloo Line Bridge, CHER & HIA, Wilmot Township, ON
- Uno Park Road Bridge, Cultural Heritage Evaluation Report, Harley Township, ON

Heritage Master Plans and Landscape Plans

- Alton Mill Landscape, Caledon, ON
- Black Creek Pioneer Village Master Plan, Toronto, ON
- Britannia School Farm Master Plan, Peel Board of Education/Mississauga, ON
- Confederation Boulevard (Sussex Drive) Urban Design, Site Plans, NCC/Ottawa, ON
- Doon Heritage Crossroads Master Plan and Site Plans, Region of Waterloo/Kitchener, ON
- Downtown Guelph Private Realm Improvements Manual, City of Guelph, ON
- Downtown Guelph Public Realm Plan, City of Guelph, ON
- Dundurn Castle Landscape Restoration Feasibility Study, City of Hamilton, ON
- Elam Martin Heritage Farmstead Master Plan, City of Waterloo, ON
- Exhibition Park Master Plan, City of Guelph, ON
- George Brown House Landscape Restoration, Toronto, ON
- *Grand River Corridor Conservation Plan*, GRCA/Regional Municipality of Waterloo, ON
- Greenwood Cemetery Master Plan, Owen Sound, ON
- Hamilton Unified Family Courthouse Landscape Restoration Plan, Hamilton, ON
- John Galt Park, City of Guelph, ON
- Judy LaMarsh Memorial Park Master Plan, NCC/Ottawa, ON
- Langdon Hall Gardens Restoration and Site Plans, Cambridge, ON
- London Psychiatric Hospital Cultural Heritage Stewardship Plan, London, ON
- McKay / Varley House Landscape Restoration Plan, Markham (Unionville), ON
- Museum of Natural Science/Magnet School 59/ Landscape Restoration and Site Plans, City of Buffalo, NY
- Muskoka Pioneer Village Master Plan, MNR/Huntsville, ON
- Peel Heritage Centre Adaptive Re-use, Landscape Design, Brampton, ON
- Phyllis Rawlinson Park Master Plan (winning design competition), Town of Richmond Hill, ON
- Prime Ministerial Precinct and Rideau Hall Master Plan, NCC/Ottawa, ON
- Queen/Picton Streets Streetscape Plans, Town of Niagara-on-the-Lake, ON
- Regional Heritage Centre Feasibility Study and Site Selection, Region of Waterloo, ON
- Rockway Gardens Master Plan, Kitchener Horticultural Society/City of Kitchener, ON
- St. George's Square, City of Guelph, ON
- St. James Cemetery Master Plan, Toronto, ON
- St. James Park Victorian Garden, City of Toronto, ON
- Tipperary Creek (Wanuskewin) Heritage Conservation Area Master Plan, Meewasin Valley Authority, Saskatoon, SK
- Whitehern Landscape Restoration Plan, Hamilton, ON
- Woodside National Historic Park Landscape Restoration, Parks Canada/Kitchener, ON

Cultural Heritage Evaluation Reports (CHER), Cultural Heritage Inventories and Cultural Heritage Landscape Evaluations

- Belfountain Area Heritage Inventory for Environmental Assessment, Peel Region, ON
- Chappell Estate / Riverside / Mississauga Public Garden Heritage Inventory, Mississauga, ON
- 8895 County Road 124 Cultural Heritage Opinion Report, Erin (Ospringe), ON
- County of Waterloo Courthouse Building Cultural Heritage Evaluation Report, Kitchener, ON
- Cruickston Park Farm & Cruickston Hall Cultural Heritage Resources Study, Cambridge, ON
- Doon Valley Golf Course - Cultural Heritage and Archaeological Resources Inventory, Kitchener/Cambridge, ON
- 75 Farquhar Street & 70 Fountain Street Cultural Heritage Evaluation Report, Guelph, ON
- Government of Ontario Light Rail Transit (GO-ALRT) Route Selection, Cultural and Natural Resources Inventory for Environmental Assessment, Hamilton/Burlington, ON
- Hancock Woodlands Cultural Heritage Assessment, City of Mississauga, ON
- Hespeler West Secondary Plan - Heritage Resources Assessment, City of Cambridge, ON
- Highway 400 to 404 Link Cultural Heritage Inventory for Environmental Assessment, Bradford, ON
- Highway 401 to 407 Links Cultural Heritage Inventory for Environmental Assessment, Pickering/Ajax/Whitby/ Bowmanville, ON

- Homer Watson House Cultural Heritage Evaluation Report, Kitchener, ON
- Lakewood Golf Course Cultural Landscape Assessment, Tecumseh, ON
- Landfill Site Selection, Cultural Heritage Inventory for Environmental Assessment, Region of Halton, ON
- Niska Road Cultural Heritage Landscape Addendum, City of Guelph, ON
- 154 Ontario Street, Historical - Associative Evaluation, Guelph, ON
- 35 Sheldon Avenue North, Cultural Heritage Evaluation Report, Kitchener, ON
- 43 Sheldon Avenue North, Cultural Heritage Evaluation Report, Kitchener, ON
- Silvercreek (LaFarge Lands) Cultural Landscape Assessment, Guelph, ON
- South Kitchener Transportation Study, Heritage Resources Assessment, Region of Waterloo, ON
- 53 Surrey Street East and 41, 43, 45 Wyndham Street South Cultural Heritage Evaluation Guelph, ON
- Swift Current CPR Station Gardens condition report and feasibility study for rehabilitation/reuse, Swift Current, SK
- University of Guelph, McNaughton Farm House, Cultural Heritage Resource Assessment, Puslinch Township, ON
- University of Guelph, Trent Institute Cultural Heritage Resource Assessment, Guelph, ON
- University of Guelph, 1 and 10 Trent Lane Cultural Heritage Resource Assessments, Guelph, ON
- 2007 Victoria Road South Heritage Evaluation, Guelph, ON
- Waterloo Valleylands Study, Heritage and Recreational Resources mapping and policies, Region of Waterloo
- 69 Woolwich Street (with references to 59, 63-67, 75 Woolwich Street) Cultural Heritage Evaluation Report, Guelph, ON

Cultural Heritage Resource Impact Assessments (CHRIA/CHIA/HIS/HIA) and Cultural Landscape Heritage Impact Statements

- 33 Arkell Road Heritage Impact Assessment, Guelph, ON
- 86 Arthur Street, Heritage Impact Assessment, Guelph, ON
- William Barber House, 5155 Mississauga Road , Heritage Impact Assessment, Mississauga, ON
- Barra Castle Heritage Impact Assessment, Kitchener, ON
- 72 Beaumont Crescent Heritage Impact Assessment, Guelph, ON
- Biltmore Hat Factory Heritage Impact Assessment, Guelph, ON
- 140 Blue Heron Ridge Heritage Impact Assessment, Cambridge, ON
- 25 Breithaupt Street Heritage Impact Assessment, Kitchener, ON
- 51 Breithaupt Street Heritage Impact Assessment, Kitchener, ON
- 215 Broadway Street Heritage Impact Statement, Mississauga, ON
- Cambridge Retirement Complex on the former Tiger Brand Lands, Heritage Impact Assessment, Cambridge, ON
- Cambridge Retirement Complex on the former Tiger Brand Lands, Heritage Impact Assessment Addendum, Cambridge, ON
- 27-31 Cambridge Street, Heritage Impact Assessment, Cambridge, ON
- 3075 Cawthra Road Heritage Impact Statement, Mississauga, ON
- 58 Church Street Heritage Impact Assessment, Churchville Heritage Conservation District, Brampton, ON
- City Centre Heritage Impact Assessment, Kitchener, ON
- 175 Cityview Drive Heritage Impact Assessment, Guelph, ON
- 12724 Coleraine Drive Cultural Heritage Impact Statement, Caledon (Bolton), ON
- 12880 Coleraine Drive Cultural Heritage Impact Statement, Caledon (Bolton), ON
- Cordingly House Heritage Impact Statement, Mississauga, ON
- 264 Crawley Road Heritage Impact Assessment (farmstead, house & barn), Guelph, ON
- 31-43 David Street (25 Joseph Street) Heritage Impact Assessment, Kitchener, ON
- 35 David Street (Phase II) Heritage Impact Assessment, Kitchener, ON
- 75 Dublin Street Heritage Impact Assessment, Guelph, ON
- 24, 26, 28 and 32 Dundas Street East Heritage Impact Statement, Mississauga, (Cooksville), ON
- 1261 Dundas Street South Heritage Impact Assessment, Cambridge, ON
- 172 - 178 Elizabeth Street Heritage Impact Assessment, Guelph, ON
- 19 Esandar Drive, Heritage Impact Assessment, Toronto, ON
- 75 Farquhar Street & 70 Fountain Street, Heritage Impact Assessment, Guelph, ON
- 14 Forbes Avenue Heritage Impact Assessment, Guelph, ON
- 369 Frederick Street Heritage Impact Assessment, Kitchener, ON

- 42 Front Street South Heritage Impact Assessment, Mississauga, ON
- Grey Silo Golf Course/Elam Martin Farmstead Heritage Impact Assessment, City of Waterloo, ON
- GRCA Lands, 748 Zeller Drive Heritage Impact Assessment Addendum, Kitchener, ON
- Hancock Woodlands Heritage Impact Statement, City of Mississauga, ON
- 132 Hart's Lane, Hart Farm Heritage Impact Assessment, Guelph, ON
- 9675, 9687, 9697 Keele Street Heritage Impact Assessment, City of Vaughan (Maple) ON
- 13165 Keele Street Cultural Heritage Resource Impact Assessment, King Township (King City), ON
- 151 King Street North Heritage Impact Assessment, Waterloo, ON
- Kip Co. Lands Developments Ltd. Cultural Heritage Resource Impact Assessment - Woodbridge Heritage Conservation District, City of Vaughan (Woodbridge) ON
- 20415 Leslie Street Heritage Impact Assessment, East Gwillimbury, ON
- 117 Liverpool Street Heritage Impact Assessment, Guelph, ON
- 36-46 Main Street Heritage Impact Assessment, Mississauga, ON
- 30 - 40 Margaret Avenue Heritage Impact Assessment, Kitchener, ON
- 19 - 37 Mill Street Scoped Heritage Impact Assessment, Kitchener, ON
- 2610, 2620 and 2630 Mississauga Road, Cultural Landscape Heritage Impact Statement, Mississauga, ON
- 4067 Mississauga Road, Cultural Landscape Heritage Impact Statement, Mississauga, ON
- 1142 Mona Road, Heritage Impact Assessment, Mississauga, ON
- 1245 Mona Road, Heritage Impact Statement, Mississauga, ON
- 15 Mont Street, Heritage Impact Assessment, Guelph, ON
- Proposed Region of Waterloo Multimodal Hub at 16 Victoria Street North, 50 & 60 Victoria Street North, and 520 & 510 King Street West, Heritage Study and Heritage Impact Assessment, Kitchener, ON
- 6671 Ninth Line Heritage Impact Statement, Cordingley House Restoration & Renovation, Mississauga, ON
- 266-280 Northumberland Street (The Gore) Heritage Impact Assessment, North Dumfries (Ayr), ON
- 324 Old Huron Road Heritage Impact Assessment, Kitchener, ON
- 40 Queen Street South Heritage Impact Statement, Mississauga, (Streetsville), ON
- Rockway Holdings Limited Lands north of Fairway Road Extension Heritage Impact Assessment, Kitchener, ON
- 259 St. Andrew Street East Cultural Heritage Assessment, Fergus, ON
- 35 & 43 Sheldon Avenue, Heritage Impact Assessment, Kitchener, ON
- 2300 Speakman Drive Heritage Impact Assessment, Mississauga, ON
- 10431 The Gore Road Heritage Impact Assessment, Brampton, ON
- Thorny-Brae Heritage Impact Statement, Mississauga, ON
- 7 Town Crier Lane, Heritage Impact Assessment, Markham, ON
- University of Guelph, 3 - 7 Gordon Street Houses, Heritage Impact Assessment, Guelph, ON
- University of Guelph, Harrison House, Heritage Impact Assessment, Guelph, ON
- Victoria Park Proposed Washroom Cultural Heritage Impact Assessment, Kitchener, ON
- 927 Victoria Road South (barn) Heritage Impact Assessment, Guelph, ON
- 272-274 Victoria Street Heritage Impact Assessment, Mississauga, ON
- 26 - 32 Water Street North Heritage Impact Assessment, Cambridge (Galt), ON
- Winzen Developments Heritage Impact Assessment, Cambridge, ON
- 248-260 Woodbridge Avenue Cultural Heritage Resource Impact Assessment and Heritage Conservation District Conformity Report, Woodbridge Heritage Conservation District, City of Vaughan (Woodbridge)
- 35 Wright Street Cultural Heritage Resource Impact Assessment, Richmond Hill, ON
- 1123 York Road Heritage Impact Assessment, Guelph, ON
- 14288 Yonge Street, Heritage Impact Assessment, Aurora, ON

Heritage Conservation Plans

- William Barber House, 5155 Mississauga Road , Heritage Conservation Plan, Mississauga, ON
- 51 Breithaupt Street Heritage Conservation Plan, Kitchener, ON
- Hamilton Psychiatric Hospital Conservation Plan, for Infrastructure Ontario, Hamilton, ON

- Harrop Barn Heritage Conservation Plan, Milton, ON
- 120 Huron Street Conservation Plan, Guelph, ON
- 324 Old Huron Road Conservation Plan, Kitchener, ON
- 264 Woolwich Street Heritage Conservation Plan, Guelph, ON
- 14288 Yonge Street Heritage Conservation Plan, Aurora, ON
- 1123 York Road Heritage Conservation Plan, Guelph, ON

Heritage Conservation District Studies and Plans

- Downtown Whitby Heritage Conservation District Study and Plan, Town of Whitby, ON
- MacGregor/Albert Heritage Conservation District Study and Plan, City of Waterloo, ON
- Queen Street East Heritage Conservation District Study, Toronto, ON
- University of Toronto & Queen's Park Heritage Conservation District Study, City of Toronto, ON

Cultural Heritage Landscape Inventories/Studies

- Cultural Heritage Landscape Study, City of Kitchener, ON
- Cultural Heritage Landscape Inventory, City of Mississauga, ON
- Cultural Heritage Scoping Study, Township of Centre Wellington, ON

Peer Reviews

- Acton Quarry Cultural Heritage Landscape & Built Heritage Study & Assessment Peer Review, Acton, ON
- Belvedere Terrace - Peer Review, Assessment of Proposals for Heritage Property, Parry Sound, ON
- Forbes Estate Heritage Impact Assessment Peer Review, Cambridge (Hespeler), ON
- Heritage Square Heritage Impact Assessment Peer Review for Township of Centre Wellington (Fergus), ON
- Little Folks Heritage Impact Assessment Peer Review for Township of Centre Wellington (Elora), ON
- Potter Foundry and the Elora South Condos Heritage Impact Assessment Peer Review for Township of Centre Wellington (Elora), ON
- Expert Services in Defence of Appeals to 2014 City of Markham Official Plan, Part 1, Site Specific Appeals, Markham, ON
- Heritage Conservation Documents for Fourward Holdings development proposal for 558 Welbanks Road, Prince Edward County, ON

Expert Witness Experience

- Oelbaum Ontario Municipal Board Hearing, Eramosa Township, ON, 1988
- Roselawn Centre Conservation Review Board Hearing, Port Colborne, ON, 1993
- Halton Landfill, Joint Environmental Assessment Act and Environmental Protection Act Board Hearing, 1994
- OPA 129 Ontario Municipal Board Hearing, Richmond Hill, ON, 1996
- Diamond Property Ontario Municipal Board Hearing, Aurora, ON, 1998
- Harbour View Investments Ontario Municipal Board Hearing, Town of Caledon, ON, 1998
- Aurora South Landowners Ontario Municipal Board Hearing, Aurora, ON, 2000
- Ballycroy Golf Course Ontario Municipal Board Hearing, Palgrave, ON, 2002
- Doon Valley Golf Course Ontario Municipal Board Hearing, Cambridge, ON, 2002
- Maple Grove Community Ontario Municipal Board Hearing, North York, ON, 2002
- Maryvale Crescent Ontario Municipal Board Hearing, Richmond Hill, ON, 2003
- LaFarge Lands Ontario Municipal Board Mediation, Guelph, ON, 2007
- 255 Geddes Street, Elora, ON, heritage opinion evidence - Ontario Superior Court of Justice, 2010
- Downey Trail Ontario Municipal Board Hearing, Guelph, ON, 2010
- Wilson Farmhouse Conservation Review Board Hearing, Guelph, ON, 2014
- 85 Victoria Street, Churchville Heritage Conservation District, Ontario Municipal Board Hearing, Brampton, ON, 2016
- Haylock / Youngblood Development OMB Mediation Hearing, Centre Wellington, ON, 2018
- Riverbank Drive LPAT Mediation Hearing, Cambridge, ON, 2019

7.

ARCHAEOLOGIC ASSESSMENT

- Stage 1-2 Archaeological Assessment prepared by Detritus Consulting Ltd. dated November 17, 2021

Stage 1-2 Archaeological Assessment
Bridge 34/B-T9 (Bridge St. Bridge)

Lots 20 and 21 Concession 3 Block A,
Lots 20 and 21 Concession 4 Block A and
the Road Allowance Between Concessions 3 and 4 Block A,
Geographic Township of Wilmot,
Region of Waterloo, Ontario

Submitted to:
K. Smart Associates
on behalf of the
Township of Wilmot

and

Ontario's Ministry of Heritage, Sport, Tourism and Culture Industries

Submitted by:

Detritus
CONSULTING LTD.
archaeology · heritage

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ORIGINAL REPORT

November 17, 2021

Executive Summary

Detritus Consulting Ltd. ('Detritus') was retained by Mr. Pedram Yazdan Panah of K. Smart Associates on behalf of the Township of Wilmot ('the Proponent') to conduct a Stage 1-2 archaeological assessment on Lots 20 and 21, Concession 3 Block A and Lots 20 and 21, Concession 4 Block A, as well as the road allowance between Concessions 3 and 4 Block A in the Geographic Township of Wilmot within the Region of Waterloo, Ontario (Figure 1). This assessment was undertaken in advance of a proposed bridge replacement (Bridge 34/B-T9) located on Bridge Street (Township Road 11A), between Tye Road and Puddicombe Road, to the southwest of the village of Haysville.

The assessment was triggered by the Provincial Policy Statement ('PPS') that is informed by the *Planning Act* (Government of Ontario 1990a), which states that decisions affecting planning matters must be consistent with the policies outlined in the larger *Ontario Heritage Act* (1990b). According to Section 2.6.2 of the PPS, "development and site alteration shall not be permitted on lands containing archaeological resources or areas of archaeological potential unless significant archaeological resources have been conserved." To meet the condition, a Stage 1-2 assessment of the Study Area was conducted, during the pre-approval phase of the proposed bridge replacement, under archaeological consulting license P462 issued to Mr. Mike Pitul by the Ministry of Heritage, Sport, Tourism and Culture Industries ('MHSTCI') and adheres to the archaeological license report requirements under subsection 65 (1) of the *Ontario Heritage Act* (Government of Ontario 1990b) and the MHSTCI's Standa*rds and Guidelines for Consultant Archaeologists* ('*Standards and Guidelines*'; Government of Ontario 2011).

Prior to conducting the Stage 2 field assessment, the Mississaugas of the Credit First Nation ('MCFN'), and Six Nations of the Grand River First Nation ('Six Nations') were contacted by Detritus at the request of the Proponent. Over the course of the field investigation, representatives from MCFN and Six Nations participated as on-site monitors. Additional information on the Aboriginal engagement practices conducted as part of the current Stage 2 assessment is provided in the Supplementary Documentation to this report.

The original area to be assessed (the 'Study Area') comprised a portion of Bridge Street (Township Road 11A), its right-of-way ('ROW'), and Bridge 34/B-T9. In accordance with the preference of First Nations representatives on-site at the time of assessment, and in agreement with the engineer present on site representing the Proponent, the Study Area was adjusted to incorporate a two-transect-wide test pit survey on the north and south sides of the road. The revised shape of the Study Area was increased in width to 10 metres ('m') north and south of the ROW, but reduced in length to a point 130m east of the west end of the bridge, and 105m west of the east end of the bridge (see Figure 3).

Following the initial Stage 2 assessment the Proponent elected to expand the Study Area limits to include an additional 134m on the east end of the Study Area, an additional 70m on the western end, and an additional 'L' shaped area on the north side of the road, in the western end of the Study Area. The revised Study Area measures approximately 1.8 hectares ('ha') and is bound by Bridge Street (Township Road 11A) to the east and west as well as woodlots, agricultural fields, and residential properties to the north and south.

At the time of the assessment the Study Area comprised an asphalt road with gravel shoulders and embankments, two gravel driveways, two field entrances, areas of overgrown grass, scrub, and woodlot, and a portion of the Nith River.

The Stage 1 background research indicated that the overgrown grass, scrub, and woodlot components of the Study Area exhibited moderate to high potential for the identification and recovery of archaeological resources and were recommended for Stage 2 archaeological assessment (Figure 3). The existing asphalt road with gravel shoulders and embankments, the gravel driveways, and field entrances were evaluated as having no potential based on the identification of extensive and deep land alteration that has severely damaged the integrity of archaeological resources, as per Section 2.1, Standard 2b of the *Standards and Guidelines* (Government of Ontario 2011). These areas of disturbance, as confirmed during the Stage 2 field survey, were mapped and photo documented in accordance with Section 2.1, Standard 6 and Section 7.8.1, Standard 1b of the *Standards and Guidelines* (Government of Ontario 2011).

A portion of the Nith River is present within the Study Area. This area was evaluated as being permanently wet and therefore was determined to retain no potential, as per Section 2.1, Standard 2a of the *Standards and Guidelines* (Government of Ontario 2011). Additionally, a portion of the woodlots on either side of the Nith River, both north and south of the road, were steeply sloped. These areas were determined to retain no archaeological potential due to the identification of a physical feature of low archaeological potential, in this case a slope of greater than 20°, as per Section 2.1, Standard 2aiii of the *Standards and Guidelines* (Government of Ontario 2011). The permanently wet and steeply sloped areas, as confirmed during the Stage 2 field survey, were mapped and photo documented in accordance with Section 2.1, Standard 6 and Section 7.8.1, Standard 1a of the *Standards and Guidelines* (Government of Ontario 2011).

The subsequent Stage 2 assessment was conducted between October 13, 2020 and October 20, 2021. This investigation consisted of a standard test pit survey at a 5m interval of the overgrown grass, scrub, and woodlot components of the Study Area. Furthermore, test pits in the southwestern portion of the Study Area were excavated to a depth of 120 centimetres ('cm') and proved to be disturbed with the present of construction aggregates within the test pits, however, the subsoil was not able to be reached by means of hand excavation. Therefore, in consultation with Six Nations and MCFN it was agreed that a mechanical excavator would be used to remove the disturbed overburden to the depth of 150cm for a maximum of a 10m interval, and that excavation would cease when the topsoil or subsoil was reached. If the topsoil was found then the interval would be increased to 5m and typical test pits would be excavated. In total, six test pits were mechanically excavated, to a maximum depth of 180cm, using a Bobcat E32 excavator with a straight edge ditching bucket. Disturbance in the form of mixed layers of construction aggregates as well as alluvial/fluvial sediments was observed in the profile of each mechanically excavated test pit. No evidence of intact topsoil or subsoil was observed. The Stage 2 assessment resulted in the identification and documentation of no archaeological resources. Therefore, **no additional investigation is recommended for the Study Area**.

The Executive Summary highlights key points from the report only; for complete information and findings, the reader should examine the complete report.

Table of Contents

Project Personnel

Project Manager:	Garth Grimes, P017
Field Director:	Mathew Gibson, R1160; Jonathan M. Peart, R1263
Field Technician:	Walter McCall, P389
First Nations Monitors:	Chris Tobicoe and Donovan King (Mississaugas of the Credit First Nation) Bill Lucas (Six Nations of the Grand River First Nation)
Report Preparation:	Mathew Gibson, R1160; Amanda McCall, R470
Mapping and GIS:	Mathew Gibson, R1160; Amanda McCall, R470
Licensee Review:	Mike Pitul, P462

Acknowledgments

Generous contributions by the following individual and agencies made this report possible.

- Mr. Pedram Yazdan Panah, K. Smart Associates Limited
- Township of Wilmot

1.0 Project Context

1.1 Development Context

Detritus Consulting Ltd. ('Detritus') was retained by Mr. Pedram Yazdan Panah of K. Smart Associates on behalf of the Township of Wilmot ('the Proponent') to conduct a Stage 1-2 archaeological assessment on Lots 20 and 21, Concession 3 Block A and Lots 20 and 21, Concession 4 Block A, as well as the road allowance between Concessions 3 and 4 Block A in the Geographic Township of Wilmot within the Region of Waterloo, Ontario (Figure 1). This assessment was undertaken in advance of a proposed bridge replacement (Bridge 34/B-T9) located on Bridge Street (Township Road 11A), between Tye Road and Puddicombe Road, to the southwest of the village of Haysville.

The original area to be assessed (the 'Study Area') comprised a portion of Bridge Street (Township Road 11A), its right-of-way ('ROW'), and Bridge 34/B-T9. In accordance with the preference of First Nations representatives on-site at the time of assessment, and in agreement with the engineer present on site representing the Proponent, the Study Area was adjusted to incorporate a two-transect-wide test pit survey on the north and south sides of the road. The revised shape of the Study Area was increased in width to 10 metres ('m') north and south of the ROW, but reduced in length to a point 130m east of the west end of the bridge, and 105m west of the east end of the bridge (see Figure 3).

Following the initial Stage 2 assessment the Proponent elected to expand the Study Area limits to include an additional 134m on the east end of the Study Area, an additional 70m on the western end, and an additional 'L' shaped area on the north side of the road, in the western end of the Study Area. The revised Study Area measures approximately 1.8 hectares ('ha') and is bound by Bridge Street (Township Road 11A) to the east and west as well as woodlots, agricultural fields, and residential properties to the north and south.

The assessment was triggered by the Provincial Policy Statement ('PPS') that is informed by the *Planning Act* (Government of Ontario 1990a), which states that decisions affecting planning matters must be consistent with the policies outlined in the larger *Ontario Heritage Act* (1990b). According to Section 2.6.2 of the PPS, "development and site alteration shall not be permitted on lands containing archaeological resources or areas of archaeological potential unless significant archaeological resources have been conserved." To meet the condition, a Stage 1-2 assessment of the Study Area was conducted, during the pre-approval phase of the proposed bridge replacement, under archaeological consulting license P462 issued to Mr. Mike Pitul by the Ministry of Heritage, Sport, Tourism and Culture Industries ('MHSTCI') and adheres to the archaeological license report requirements under subsection 65 (1) of the *Ontario Heritage Act* (Government of Ontario 1990b) and the MHSTCI's Stand*ards and Guidelines for Consultant Archaeologists* ('*Standards and Guidelines*'; Government of Ontario 2011).

The purpose of a Stage 1 Background Study is to compile all available information about the known and potential archaeological heritage resources within the Study Area and to provide specific direction for the protection, management and/or recovery of these resources. In compliance with the *Standards and Guidelines* (Government of Ontario 2011), the objectives of the following Stage 1 assessment are as follows:

- To provide information about the Study Area's geography, history, previous archaeological fieldwork and current land conditions;
- to evaluate in detail, the Study Area's archaeological potential which will support recommendations for Stage 2 survey for all or parts of the property; and
- to recommend appropriate strategies for Stage 2 survey.

To meet these objectives Detritus archaeologists employed the following research strategies:

- A review of relevant archaeological, historic and environmental literature pertaining to the Study Area;

- a review of the land use history, including pertinent historic maps; and
- an examination of the Ontario Archaeological Sites Database ('ASDB') to determine the presence of known archaeological sites in and around the Study Area.

The purpose of a Stage 2 Property Assessment was to provide an overview of any archaeological resources within the Study Area, and to determine whether any of the resources might be archaeological sites with cultural heritage value or interest ('CHVI'), and to provide specific direction for the protection, management and/or recovery of these resources. In compliance with the *Standards and Guidelines* (Government of Ontario 2011), the objectives of the following Stage 2 assessment are as follows:

- To document all archaeological resources within the Study Area;
- to determine whether the Study Area contains archaeological resources requiring further assessment; and
- to recommend appropriate Stage 3 assessment strategies for archaeological sites identified.

The licensee received permission from the Proponent to enter the land and conduct all required archaeological fieldwork activities, including the recovery of artifacts.

1.2 Historical Context

1.2.1 Post-Contact Aboriginal Resources

The earliest recorded history of southern Ontario began in 1626, when French Recollet Father Daillon travelled the entire length of the Grand River and documented 28 Neutral villages in the area (Harper 1950; White 1978). In 1647, the Seneca attacked one eastern group of the Neutral (White 1978) and, by 1653, the Neutral had been assimilated by the Five Nations (Jamieson 1992; Noble 1978). The Five Nations relinquished the Niagara Peninsula and northern Lake Ontario area before 1700.

The late 17th and early 18th centuries represent a watershed moment in the evolution of the post-contact Aboriginal occupation of southern Ontario. At this time, various Iroquoian-speaking communities began migrating into southern Ontario from New York State, followed by the arrival of Algonkian-speaking groups from northern Ontario (Konrad 1981; Schmalz 1991). This period also marks the arrival of the Mississaugas into southern Ontario and, in particular, the watersheds of the lower Great Lakes.

The oral traditions of the Mississaugas, as told by Chief Robert Paudash and recorded in 1904, suggest that the Mississaugas defeated the Mohawk Nation, who retreated to their homeland south of Lake Ontario. Following this conflict, a peace treaty was negotiated between the two groups and, at the end of the 17th century, the Mississaugas settled permanently in southern Ontario (Praxis Research Associates n.d.). Around this same time, members of the Three Fires Confederacy (Chippewa, Ottawa, and Potawatomi) began immigrating from Ohio and Michigan into southwestern Ontario (Feest and Feest 1978).

In 1722, the Five Nations adopted the Tuscarora in New York becoming the Six Nations (Pendergast 1995). Sir Frederick Haldimand, Governor of Québec, made preparations to grant a large plot of land in south-central Ontario to those Six Nations who remained loyal to the Crown during the American War of Independence (Weaver 1978). More specifically, Haldimand arranged for the purchase of the Haldimand Tract in south-central Ontario from the Mississaugas. The Haldimand Tract, also known as the 1795 Crown Grant to the Six Nations, was provided for in the Haldimand Proclamation of October 25th, 1784 and was intended to extend a distance of six miles on each side of the Grand River from mouth to source (Weaver 1978).

In July 1792, Simcoe divided Upper Canada into 19 counties stretching from Essex in the west to Glengarry in the east. Later that year, the four districts originally established in 1788 were renamed as the Western, Home, Midland and Eastern Districts. The current Study Area is situated in the historic Home District, which comprised lands obtained in the 'Between the Lakes Purchases' of 1784 and 1792 (Archives of Ontario 2012-2015).

The Study Area first enters the Euro-Canadian historic record in the 1792 Between the Lakes Treaty, which…

> *…was made with the Mississa[ug]a Indians 7th December, 1792, though purchased as early as 1784. This purchase in 1784 was to procure for that part of the Six Nation Indians coming into Canada a permanent abode. The area included in this Treaty is, Lincoln County excepting Niagara Township; Saltfleet, Binbrook, Barton, Glanford and Ancaster Townships, in Wentworth County; Brantford, Onondaga, Tusc[a]r[o]ra, Oakland and Burford Townships in Brant County; East and West Oxford, North and South Norwich, and Dereham Townships in Oxford County; North Dorchester Township in Middlesex County; South Dorchester, Malahide and Bayham Township in Elgin County; all Norfolk and Haldimand Counties; Pelham, Wainfleet, Thorold, Cumberland and Humberstone Townships in Welland County.*
>
> Morris 1943:17-18

At this time, European squatters had already begun to settle along the banks of the Thames River, although their specific locations were not recorded until the first survey of the area was made after the First Nation land surrender in 1790 (Hamil 1951).

The size and nature of the pre-contact settlements and the subsequent spread and distribution of Aboriginal material culture in southern Ontario began to shift with the establishment of European settlers in southern Ontario.

Despite the inevitable encroachment of European settlers on previously established Aboriginal territories, "*written accounts of material life and livelihood, the correlation of historically recorded villages to their archaeological manifestations, and the similarities of those sites to more ancient sites have revealed an antiquity to documented cultural expressions that confirms a deep historical continuity to Iroquoian systems of ideology and thought*" (Ferris 2009:114). As Ferris observes, despite the arrival of a competing culture, First Nations communities throughout southern Ontario have left behind archaeologically significant resources that demonstrate continuity with their pre-contact predecessors, even if they have not been recorded extensively in historical Euro-Canadian documentation.

1.2.2 Euro-Canadian Resources

The current Study Area is located in the Geographic Township of Wilmot within the Region of Waterloo, Ontario (Figure 1).

On July 24, 1788, Sir Guy Carleton, the Governor-General of British North America, divided the Province of Québec into the administrative districts of Hesse, Nassau, Mecklenburg and Lunenburg (Archives of Ontario 2012-2015). Further change came in December 1791 when the former Province of Québec was rearranged into Upper Canada and Lower Canada under the *Constitutional Act*. Colonel John Graves Simcoe was appointed as Lieutenant-Governor of Upper Canada (Coyne 1895) and he introduced several initiatives to populate the province including the establishment of shoreline communities with effective transportation links between them.

In July 1792, Simcoe divided Upper Canada into 19 counties, including Waterloo County, stretching from Essex in the west to Glengarry in the east. Later that year, the four districts originally established in 1788 were renamed as the Western, Home, Midland and Eastern Districts (Archives of Ontario 2012-2015). At this time, the land including Wilmot Township was declared a Crown Reserve, but was opened to immigration to Mennonite and Amish families following its survey in 1824 (Heritage Wilmot 2020).

The *Illustrated Historical Atlas of the Counties of Waterloo and Willington, Ont.* (‘*Historical Atlas’;* Parsell & Co. 1881), demonstrates the extent to which Wilmot Township had been settled by 1881 (Figure 2). Landowners are listed for many lots within the township. Structures and orchards are prevalent throughout the township, almost all of which front early roads.

The Study Area is located within Lots 20 and 21, Concession 3 Block A; Lots 20 and 21, Concession 4 Block A; and the road allowance between Concession 3 and 4 Block A. The *Historical Atlas* map of Wilmot Township does not indicate landowners for any of the four lots the Study Area falls within. In addition, no structures or orchards are indicated on the lots, nor are any community structures nearby (schools, churches etc.). The Nith River is illustrated transecting all four lots. Looking further afield the early village of Haysville is illustrated to the northwest of the Study Area.

Although sparse landowner information is available on the historical atlas map of Wilmot Township; it should be recognized that historical county atlases were produced primarily to identify factories, offices, residences and landholdings of subscribers and were funded by subscriptions fees. Therefore, landowners who did not subscribe were not always listed on the maps (Caston 1997). Moreover, associated structures were not necessarily depicted or placed accurately (Gentilcore and Head 1984).

1.3 Archaeological Context

1.3.1 Property Description and Physical Setting

The Study Area measures approximately 1.8ha and is bound by Bridge Street (Township Road 11A) to the east and west as well as woodlots, agricultural fields, and residential properties to the north and south. At the time of the assessment the Study Area comprised an asphalt road with gravel shoulders and embankments, two gravel driveways, two field entrances, areas of overgrown grass, scrub, and woodlot, and a portion of the Nith River.

The Study Area is situated within the Oxford Till Plain physiographic region. The Oxford Till Plain is located in the centre of southwestern Ontario and covers an area of approximately 155,400ha, primarily within Oxford County. The plain is at an approximate elevation of between 305 and 365m metres (‘m’) above sea level. The region consists of a drumlinized till plain formed when glacier advance overrode a pre-existing moraine from a northwesterly direction. The dominant parent material is Middle Devonian limestone creating a calcareous till. The region contains the headwaters of the Thames River from a swamp within a clay plain. Many of the drainages are misfits within their valleys existing as small drainages within glacial spillways. These spillways often have gravel deposits or have sufficiently eroded overburden down to bedrock such that it is conducive for quarrying. The region is marked for being generally good for agriculture; soils in the region are primarily developed beneath a maple-beech forest (Chapman and Putnam 1984: 143-44).

The closest source of potable water is the Nith River, which transects the centre of the Study Area.

1.3.2 Pre-Contact Aboriginal Land Use

This portion of southwestern Ontario has been demonstrated to have been occupied by people as far back as 11,000 years ago as the glaciers retreated. For the majority of this time, people were practicing hunter gatherer lifestyles with a gradual move towards more extensive farming practices. Table 1 provides a general outline of the cultural chronology of Wilmot Township (Ellis and Ferris 1990).

Table 1: Cultural Chronology for Wilmot Township

Time Period	Cultural Period	Comments
9500 – 7000 BC	Paleo Indian	first human occupation hunters of caribou and other extinct Pleistocene game nomadic, small band society

Time Period	Cultural Period	Comments
7500 - 1000 BC	Archaic	ceremonial burials increasing trade network hunter gatherers
1000 - 400 BC	Early Woodland	large and small camps spring congregation/fall dispersal introduction of pottery
400 BC – AD 800	Middle Woodland	kinship based political system incipient horticulture long distance trade network
AD 800 - 1300	Early Iroquoian (Late Woodland)	limited agriculture developing hamlets and villages
AD 1300 - 1400	Middle Iroquoian (Late Woodland)	shift to agriculture complete increasing political complexity large palisaded villages
AD 1400 - 1650	Late Iroquoian	regional warfare and political/tribal alliances destruction of Huron and Neutral

1.3.3 Previously Identified Archaeological Work

In order to compile an inventory of archaeological resources, the registered archaeological site records kept by the MHSTCI were consulted. In Ontario, information concerning archaeological sites stored in the ASDB (Government of Ontario n.d.) is maintained by the MHSTCI. This database contains archaeological sites registered according to the Borden system. Under the Borden system, Canada is divided into grid blocks based on latitude and longitude. A Borden Block is approximately 13 kilometres (‘km’) east to west and approximately 18.5km north to south. Each Borden Block is referenced by a four-letter designator and sites within a block are numbered sequentially as they are found. The study area under review is within Borden Block AiHd.

Information concerning specific site locations is protected by provincial policy, and is not fully subject to the *Freedom of Information and Protection of Privacy Act* (Government of Ontario 1990c). The release of such information in the past has led to looting or various forms of illegally conducted site destruction. Confidentiality extends to all media capable of conveying location, including maps, drawings, or textual descriptions of a site location. The MHSTCI will provide information concerning site location to the party or an agent of the party holding title to a property, or to a licensed archaeologist with relevant cultural resource management interests.

According to the ASDB, three archaeological sites have been registered within 1km of the Study Area. The sites are all pre-contact Aboriginal sites dated to the Archaic and Woodland periods. For further information See Table 2, below.

Table 2: Registered Archaeological Sites within 1km

Borden Number	Site Name	Time Period	Affinity	Site Type
AiHd-13	Brown	Woodland, Early	Aboriginal	Unknown
AiHd-12	Zimmer	Archaic	Aboriginal	Unknown
AhHd-5	Wintemberg 1	Archaic, Woodland	Aboriginal	camp/campsite

To the best of Detritus’ knowledge, no other assessments have been conducted adjacent to the Study Area, and no sites are registered within 50m of the Study Area.

1.3.4 Archaeological Potential

Archaeological potential is established by determining the likelihood that archaeological resources may be present on a subject property. Detritus applied archaeological potential criteria commonly used by the MHSTCI to determine areas of archaeological potential within Study Area. According to Section 1.3.1 of the *Standards and Guidelines* (Government of Ontario 2011), these variables include proximity to previously identified archaeological sites, distance to various types of water sources, soil texture and drainage, glacial geomorphology, elevated topography, and the general topographic variability of the area.

Distance to modern or ancient water sources is generally accepted as the most important determinant of past human settlement patterns and, when considered alone, may result in a determination of archaeological potential. However, any combination of two or more other criteria, such as well-drained soils or topographic variability, may also indicate archaeological potential. When evaluating distance to water it is important to distinguish between water and shoreline, as well as natural and artificial water sources, as these features affect site locations and types to varying degrees. As per Section 1.3.1 of the *Standards and Guidelines* (Government of Ontario 2011), water sources may be categorized in the following manner:

- Primary water sources: lakes, rivers, streams, creeks;
- secondary water sources: intermittent streams and creeks, springs, marshes and swamps;
- past water sources: glacial lake shorelines, relic river or stream channels, cobble beaches, shorelines of drained lakes or marshes; and
- accessible or inaccessible shorelines: high bluffs, swamp or marshy lake edges, sandbars stretching into marsh.

As was discussed above, the closest source of potable water is the Nith River, which transects the centre of the Study Area.

Soil texture is also an important determinant of past settlement, usually in combination with other factors such as topography. The Study Area is situated within the Oxford Till Plain physiographic region. As was discussed earlier, the primary soils within the Study Area, have been documented as being suitable for pre-contact Aboriginal practices. Add to this discussion the presence of three pre-contact Aboriginal sites registered within 1km of the Study Area and the Aboriginal archaeological potential is judged to be moderate to high.

For Euro-Canadian sites, archaeological potential can be extended to areas of early Euro-Canadian settlement, including places of military or pioneer settlements; early transportation routes; and properties listed on the municipal register or designated under the *Ontario Heritage Act* (Government of Ontario 1990b) or property that local histories or informants have identified with possible historical events.

As the background research presented above indicates, settlement in Wilmot Township began in the early 19th century. The *Historical Atlas* map of the township demonstrates the extent to which Wilmot Township had been settled by 1881 (Parsell & Co. 1881; Figure 2). The Study Area is on a historical road near the early village of Haysville. The potential for post-contact Euro-Canadian archaeological resources is judged to be moderate to high.

Finally, despite the factors mentioned above, extensive land disturbance can eradicate archaeological potential within a Study Area, as per Section 1.3.2 of the *Standards and Guidelines* (Government of Ontario 2011). Current aerial imagery identified a number of potential disturbance areas within the Study Area including the existing asphalt road, the gravel shoulders and embankments (see Section 1.3.1 above). It is recommended that these areas be subject to a Stage 2 property inspection, conducted according Section 2.1.8, Standard 1 of the *Standards and Guidelines* (Government of Ontario 2011), Section 1.2 of the *Standards and Guidelines* (Government of Ontario 2011), to confirm and document the degree and extent of the disturbance.

Additionally, it is also recommended that the Nith River be included in the Stage 2 property inspection to confirm if it represents a permanently wet area of low or no archaeological potential, as per Section 2.1, Standard 2.a.i. of the *Standards and Guidelines* (Government of Ontario 2011).

2.0 Field Methods

The current Stage 2 archaeological assessment was conducted between October 13, 2020 and October 20, 2021 under archaeological consulting license P462 issued to Mr. Mike Pitul by the MHSTCI.

Prior to conducting the Stage 2 field assessment, the Mississaugas of the Credit First Nation (‘MCFN’), and Six Nations of the Grand River First Nation (‘Six Nations’) were contacted by Detritus at the request of the Proponent. Over the course of the field investigation, representatives from MCFN and Six Nations participated as on-site monitors. Additional information on the Aboriginal engagement practices conducted as part of the current Stage 2 assessment is provided in the Supplementary Documentation to this report.

During the course of the Stage 2 field work, assessment conditions were excellent. At no time were the field, weather, or lighting conditions detrimental to the recovery of archaeological material. Table 3 details the weather and field conditions during each day of fieldwork. Photos 1 to 9 demonstrate the land conditions at the time of the survey throughout the Study Area. Figure 3 provides an illustration of the Stage 2 assessment methods, as well as photograph locations and directions as well as the Stage 2 assessment methods in relation to the development of the Study Area.

Table 3: Field and Weather Conditions

Date	Field Director	Activity	Weather	Soil Conditions
October 13, 2020	Mathew Gibson	test pit survey	sunny, high 13° Celsius	soil dry and screens easily
September 28, 2021	Mathew Gibson	test pit survey	sunny, high 17° Celsius	soil dry and screens easily
October 5, 2021	Jonathan M. Peart	test pit survey	partly cloudy, high 18° Celsius	soil dry and screens easily
October 20, 2021	Jonathan M. Peart	mechanically excavated test pits	sunny, high 14° Celsius	soil dry, soil clearly visible

Approximately 50% of the Study Area comprised overgrown grass, scrub, and woodlot on level ground, which was deemed inaccessible to ploughing. These areas were subject to a typical test pit survey at 5m intervals in accordance with Section 2.1.2 of the *Standards and Guidelines* (Government of Ontario 2011). All test pits were at least 30 centimetres (cm) in diameter and were excavated 5cm into sterile subsoil. The soils were then examined for stratigraphy, cultural features, or evidence of fill. A single soil layer (topsoil) was observed. All soil from the test pits was screened through six-millimetre (‘mm’) hardware cloth to facilitate the recovery of small artifacts and then used to backfill the pit.

Furthermore, test pits in the southwestern portion of the Study Area were excavated to a depth of 120 centimetres (‘cm’) and proved to be disturbed with the present of construction aggregates within the test pits, however, the subsoil was not able to be reached by means of hand excavation. Therefore, in consultation with Six Nations and MCFN it was agreed that a mechanical excavator would be used to remove the disturbed overburden to the depth of 150cm for a maximum of a 10m interval, and that excavation would cease when the topsoil or subsoil was reached. If the topsoil was found then the interval would be increased to 5m and typical test pits would be excavated. In total, six test pits were mechanically excavated, to a maximum depth of 180cm, using a Bobcat E32 excavator with a straight edge ditching bucket. Disturbance in the form of mixed layers of construction aggregates as well as alluvial/fluvial sediments was observed in the profile of each mechanically excavated test pit. No evidence of intact topsoil or subsoil was observed. No artifacts were encountered during the test pit survey; therefore, no further survey methods were employed.

Approximately 30% of the Study Area comprised existing asphalt road with gravel shoulders and embankments, the gravel driveways, and field entrances. These areas were evaluated as having no potential based on the identification of extensive and deep land alteration that has severely damaged the integrity of archaeological resources, as per Section 2.1, Standard 2b of the *Standards and Guidelines* (Government of Ontario 2011). These disturbed areas were mapped and photo documented only in accordance with Section 2.1, Standard 6 and Section 7.8.1, Standard 1b of the *Standards and Guidelines* (Government of Ontario 2011).

Approximately 15% of the Study Area comprises the Nith River. This area was evaluated as having no archaeological potential (see Section 1.3.4 above). These permanently wet areas were mapped and photo documented in accordance with Section 2.1 Standard 6; Section 7.8.1, Standard 1a; and Section 7.8.6, Standard 1b of the *Standards and Guidelines* (Government of Ontario 2011).

The remaining 5% of the Study Area comprises steeply sloping woodlots on either side of the Nith River, both north and south of the road. These areas were determined to retain no archaeological potential due to the identification of a physical feature of low archaeological potential, in this case a slope of greater than 20°, as per Section 2.1, Standard 2aiii of the *Standards and Guidelines* (Government of Ontario 2011). The steeply sloped areas, as confirmed during the Stage 2 field survey, were mapped and photo documented in accordance with Section 2.1, Standard 6 and Section 7.8.1, Standard 1a of the *Standards and Guidelines* (Government of Ontario 2011).

3.0 Record of Finds

The Stage 2 archaeological assessment was conducted employing the methods described in Section 2.0 and resulted in the identification and recovery of no archaeological resources. An inventory of the documentary record generated by fieldwork is provided in Table 4 below.

Table 4: Inventory of Document Record

Document Type	Current Location of Document Type	Additional Comments
2 Page of Field Notes	Detritus office	Stored digitally in project file
1 Map provided by the Proponent	Detritus office	Stored digitally in project file
1 Field Map	Detritus office	Stored digitally in project file
12Digital Photographs	Detritus office	Stored digitally in project file

As no material culture was collected during the Stage 2 survey, no storage arrangements have been made.

4.0 Analysis and Conclusions

Detritus was retained by the Proponent to conduct a Stage 1-2 archaeological assessment in advance of a proposed bridge replacement (Bridge 34/B-T9) located on Bridge Street (Township Road 11A), between Tye Road and Puddicombe Road, to the southwest of the village of Haysville.

The Stage 1 background research indicated that the overgrown grass, scrub, and woodlot components of the Study Area exhibited moderate to high potential for the identification and recovery of archaeological resources and were recommended for Stage 2 archaeological assessment (Figure 3). The existing asphalt road with gravel shoulders and embankments, the gravel driveways, and field entrances were evaluated as having no potential based on the identification of extensive and deep land alteration that has severely damaged the integrity of archaeological resources, as per Section 2.1, Standard 2b of the *Standards and Guidelines* (Government of Ontario 2011). These areas of disturbance, as confirmed during the Stage 2 field survey, were mapped and photo documented in accordance with Section 2.1, Standard 6 and Section 7.8.1, Standard 1b of the *Standards and Guidelines* (Government of Ontario 2011).

A portion of the Nith River is present within the Study Area. This area was evaluated as being permanently wet and therefore was determined to retain no potential, as per Section 2.1, Standard 2a of the *Standards and Guidelines* (Government of Ontario 2011). Additionally, a portion of the woodlots on either side of the Nith River, both north and south of the road, were steeply sloped. These areas were determined to retain no archaeological potential due to the identification of a physical feature of low archaeological potential, in this case a slope of greater than 20°, as per Section 2.1, Standard 2aiii of the *Standards and Guidelines* (Government of Ontario 2011). The permanently wet and steeply sloped areas, as confirmed during the Stage 2 field survey, were mapped and photo documented in accordance with Section 2.1, Standard 6 and Section 7.8.1, Standard 1a of the *Standards and Guidelines* (Government of Ontario 2011).

The subsequent Stage 2 assessment was conducted between October 13, 2020 and October 20, 2021. This investigation consisted of a standard test pit survey at a 5m interval of the overgrown grass, scrub, and woodlot components of the Study Area. Furthermore, test pits in the southwestern portion of the Study Area were excavated to a depth of 120cm and proved to be disturbed with the present of construction aggregates within the test pits, however, the subsoil was not able to be reached by means of hand excavation. Therefore, in consultation with Six Nations and MCFN it was agreed that a mechanical excavator would be used to remove the disturbed overburden to the depth of 150cm for a maximum of a 10m interval, and that excavation would cease when the topsoil or subsoil was reached. If the topsoil was found then the interval would be increased to 5m and typical test pits would be excavated. In total, six test pits were mechanically excavated, to a maximum depth of 180cm, using a Bobcat E32 excavator with a straight edge ditching bucket. Disturbance in the form of mixed layers of construction aggregates as well as alluvial/fluvial sediments was observed in the profile of each mechanically excavated test pit. No evidence of intact topsoil or subsoil was observed. The Stage 2 assessment resulted in the identification and documentation of no archaeological resources.

5.0 Recommendations

No artifacts were recovered from the Study Area. Accordingly, **no further archaeological assessment of the Study Area is recommended.**

6.0 Advice on Compliance with Legislation

This report is submitted to the Minister of Ministry of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest , and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.

The *Cemeteries Act*, R.S.O. 1990 c. C.4 and the *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.

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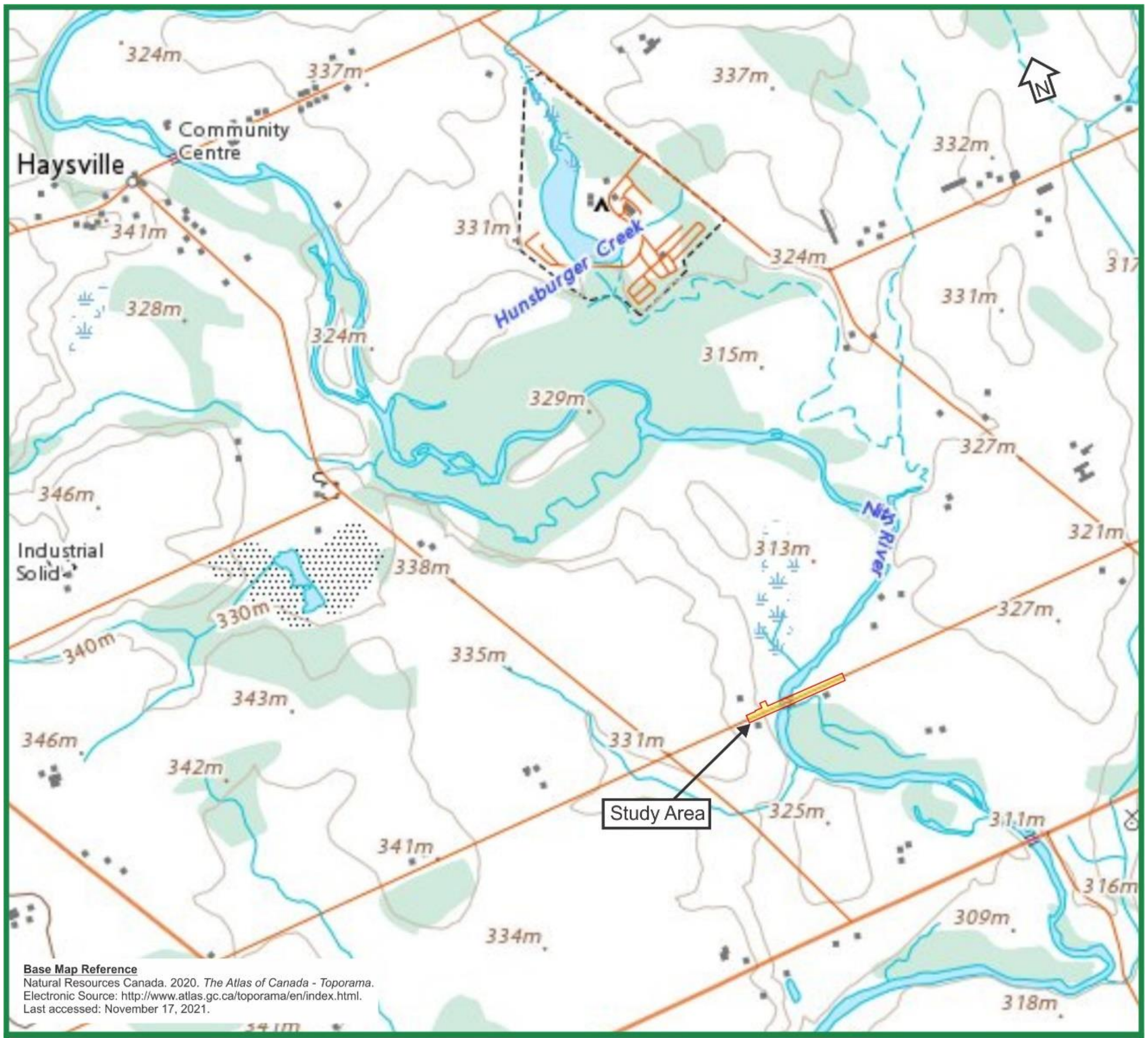
8.0 Maps



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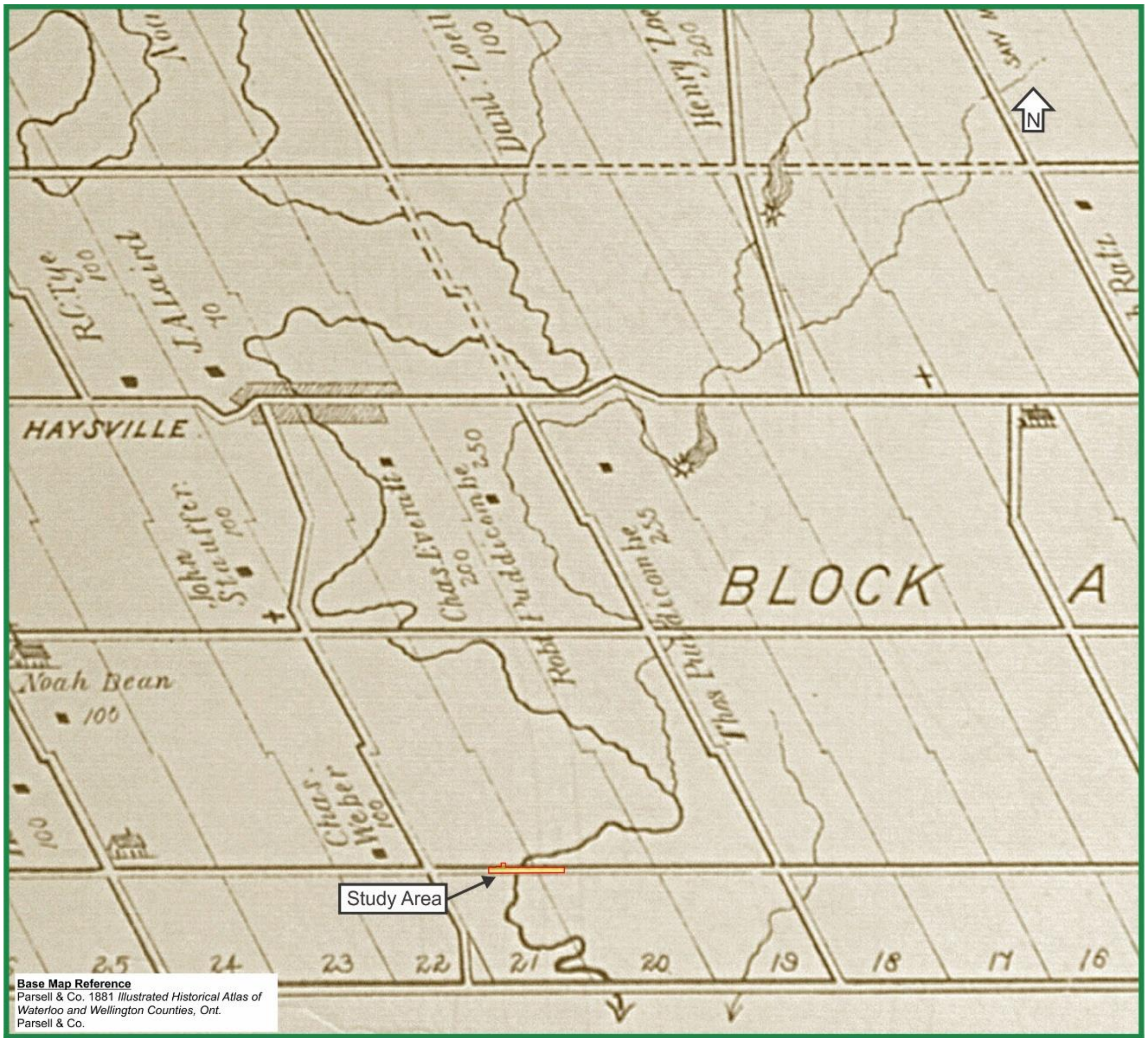
Scale 1:30 000

Figure 1: Study Area



Base Map Reference
Parsell & Co. 1881 *Illustrated Historical Atlas of Waterloo and Wellington Counties, Ont.*
Parsell & Co.

Not to Scale

Figure 2: Portion of the 1881 *Historical Atlas* Map of Wilmot Township

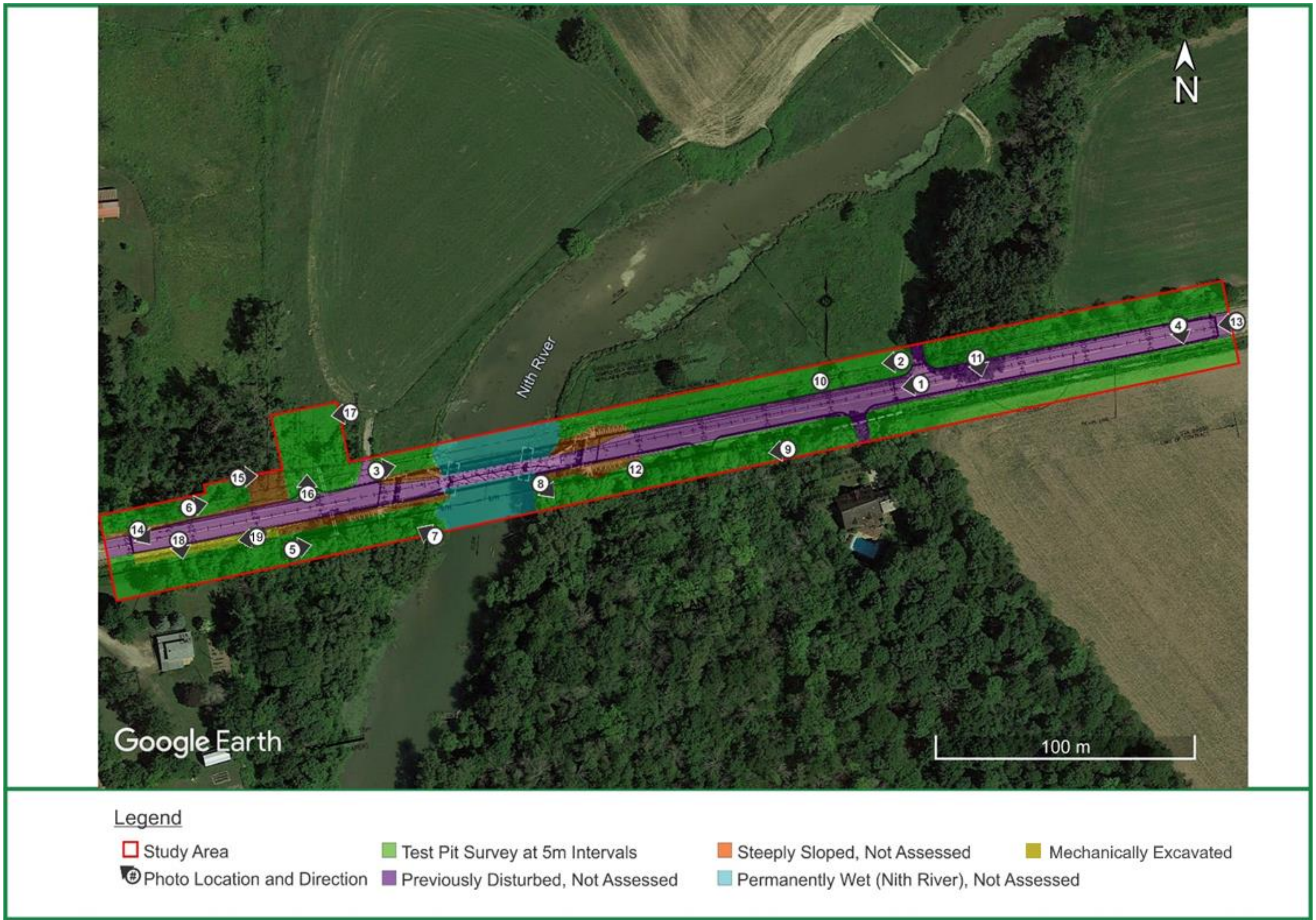
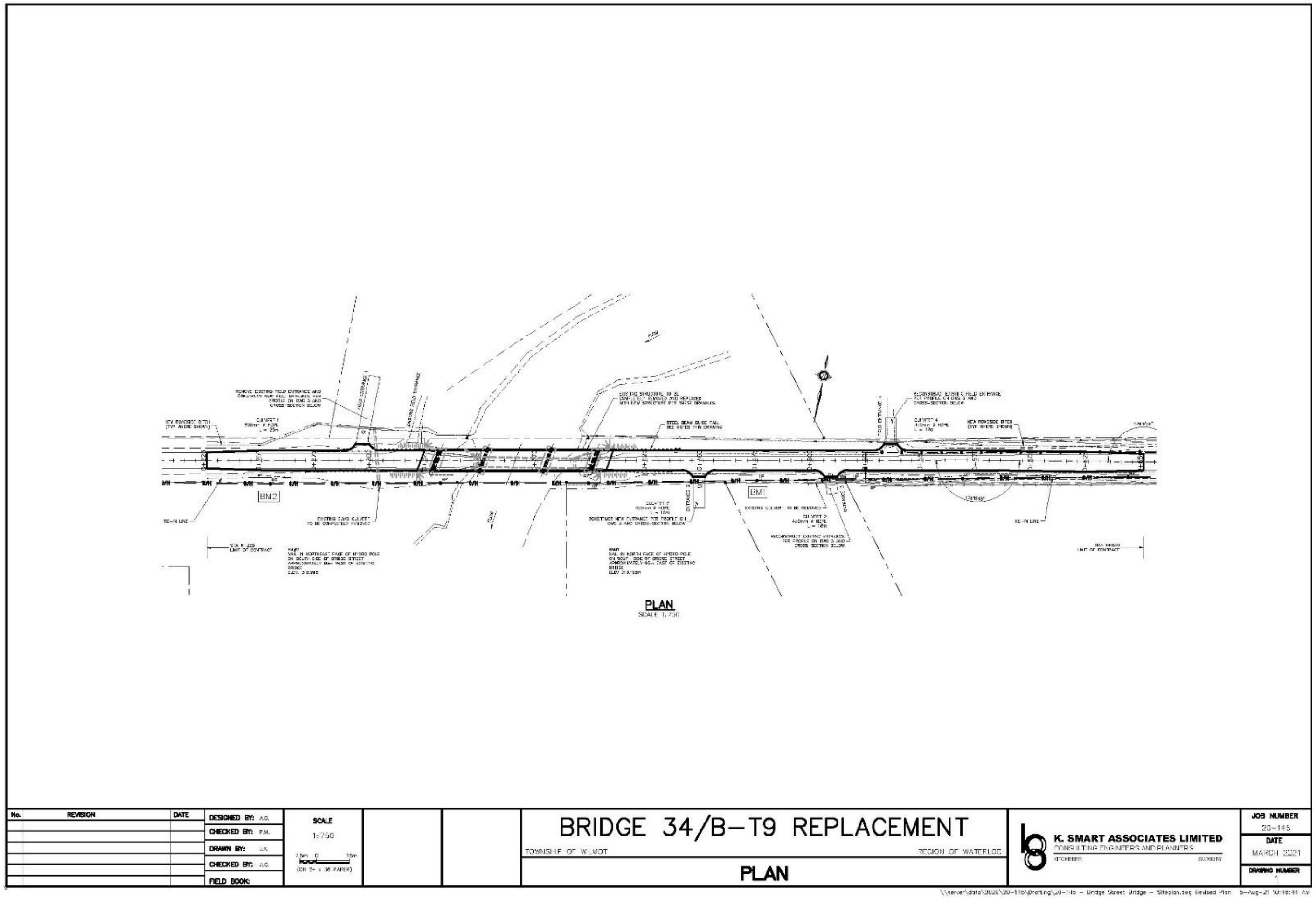


Figure 3: Stage 2 Survey Methods

Figure 4: Development Map



9.0 Images

Photo 1: Looking west along Bridge Street

Photo 2: Looking west across scrub with test pitting

Photo 3: Looking east over scrub with test pitting

Photo 4: Test pit survey in trees, looking south

Photo 5: Test pit survey in forest

Photo 6: Test pit survey in forest

Photo 7: Forest south of road and west of river, looking northwest

Photo 8: Forest south of road and east of river, looking southeast

Photo 9: Forest south of road and east of river, looking west

Photo 10: Sample test pit

Photo 11: Test Pit Survey at 5m Intervals

Photo 12: Sample test pit

Photo 13: Disturbed Asphalt Road Not Assessed, Both Sides of the Road Test Pit Survey at 5m Intervals, looking southwest

Photo 14: Disturbed Asphalt Road Not Assessed, Both Sides of the Road Test Pit Survey at 5m Intervals, looking southeast

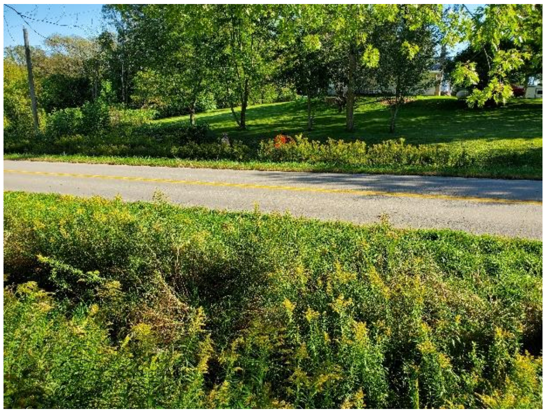


Photo 15: Steeply Sloped Woodlot Not Assessed, looking northeast

Photo 16: Woodlot Test Pit Survey at 5m Intervals, looking north

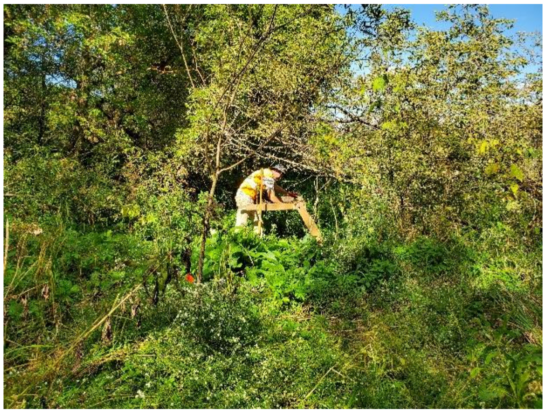


Photo 17: Test Pit Surveyed at 5m Intervals, looking southwest19

Photo 18: Test Pit Survey at 5m Intervals, looking south

Photo 19: Mechanically excavated area looking southwest

8.

SCOPED ENVIRONMENTAL SCREENING REPORT

- Scoped Environmental Screening Report prepared by Environmental Liability Management (ELM) Inc. dated September 17, 2021

ELM
Environmental Liability
Management Inc.

September 17, 2021

Allan Garnham, P.Eng.
K. Smart Associates Limited
85 McIntyre Drive
Kitchener ON N2R 1H6

***Sent via email**: agarnham@ksmart.ca*

RE: Environmental Study to Support the Bridge Street Replacement, south of Haysville, in Wilmot Township

Dear Mr. Garnham:

Environmental Liability Management Inc. (ELM) is pleased to submit this revised Environmental Study to K.Smart Associates Limited (KSAL) to support a proposal for the replacement of the Bridge Street Bridge, south of Haysville, in Wilmot Township (hereinafter, the Site).

It is prudent to note than a draft version was reviewed by Staff from KSAL as well as individuals at the Grand River Conservation Authority (GRCA). These past reviews resulted in improvements to different sections of the draft version, with the final version included with this letter. Following the review of the draft, ELM met with Staff from the GRCA on-Site to discuss these topics in detail. The discussion on-Site guided the revisions within the Environmental Study.

At this time, ELM understands that it is necessary to complete the Environmental Assessment for this proposed activity. We anticipate the information included within this study will enhance KSAL's understanding of the Site.

Thank you for the opportunity to complete this study. We would be pleased to assist with future stages of this activity.

If you have any questions or concerns, please do not hesitate to contact Dr. Fitzgerald, at 226-606-1072 or Dean@elminc.ca.

Sincerely,

Environmental Liability Management Inc.

Dean Fitzgerald, M.Sc., Ph.D.
Senior Ecologist
Director, Environmental Services

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Appendices

MEMORANDUM

To:	Allan Graham, K.Smart Associates Limited
From:	Dean Fitzgerald & Jessica Zadori, ELM Inc.
Subject:	Environmental Screening of the Bridge Street Bridge, Township of Wilmot
Date:	September, 2021

1.0 INTRODUCTION

Environmental Liability Management Inc. (ELM) was retained by K.Smart Associates Limited (hereinafter, K.Smart) to complete environmental screening studies at the Bridge Street Bridge, located in proximity to Haysville and New Dundee in Wilmot Township, Ontario (hereafter, the Site, Figure 1a,b). The Bridge Street Bridge is located along the Nith River, part of the Grand River Watershed. At this time, it is ELM's understanding that it is necessary to replace the Bridge. Therefore, the goal of these screening studies is to assess the natural features present at the Site, evaluate for the possible presence of SAR within a minimum two-kilometer radius of the Site, provide advice regarding appropriate Best Management Practices (BMPs) for on-going activities on-Site and environmental management recommendations for the proposed activities. For this study, ELM assessed the environmental features on-Site such as existing land use, past land use, distance to water, vegetation cover, fish, wildlife, and other facets. This assessment is warranted, to ensure no significant disturbance of fish and wildlife populations from the proposed activity, as required under Ontario's *Fish and Wildlife Conservation Act*.

For the purpose of this evaluation, the possible presence of Species At Risk (SAR) was assessed using a public database (i.e., Natural Heritage Information Centre – NHIC), maintained by Ontario's Ministry of Natural Resources and Forestry (MNRF). Other public databases that include natural heritage information were also considered within this review. It is essential to screen for possible presence of SAR and possible SAR habitat on-Site and within proximity to the Site. This approach to screen for SAR and SAR habitat is required under Ontario's Endangered Species Act -(ESA, Ontario, 2007) as proposed activities are intended to avoid disturbance of SAR specimens and their habitat. Based on ELM's past experience, it is probable the proposed activity will require registration with the Ministry of Environment, Conservation and Parks (MECP), due to the likely presence of SAR in the Nith River. Thus, this document will be used to facilitate relevant communication with the MECP in the future, to reconcile the exact requirements for management of SAR, as defined under Ontario's ESA.

A second purpose for this document is to clarify future study requirements with the Grand River Conservation Authority (GRCA), as this agency provides oversight for the management of habitats associated with the Nith River. Therefore, the whole document will thereby act as a source of information for separate Environmental Assessment (EA) studies currently underway that are assessing how to best replace the bridge on-Site. For example, the findings reported in this document will inform the EA regarding existing environmental features and associated environmental constraints as well as requirements from government agencies including MECP and GRCA.

Figure 1a: A high elevation aerial photograph of the Site during 2019. This study will be focused on completing an environmental screening of the Bridge Street Bridge and nearby natural areas. The Site is located within the red rectangle, with the Bridge Street Bridge indicated with a yellow marker. Aerial imagery was obtained from a public database (i.e., Google Earth).

Figure 1b: A low elevation aerial photograph of the Site during 2019. This study will be focused on completing an environmental screening of the Bridge Street Bridge and nearby natural areas. The Site is located within the red rectangle, with the Bridge Street Bridge indicated with a yellow marker. Aerial imagery was obtained from a public database (i.e., Google Earth).

1.1 Overview of Proposed Activities

It is the understanding of ELM that future on-Site work will involve replacing the current bridge structure with a new structure. It is ELM's understanding that this work is necessary as a result of the Bridge's deterioration from age and harsh weather conditions, such as heavy ice and repetitive flooding. Demolition of the existing bridge will involve the removal of the existing structure, including the abutments. With this process, Staff from K.Smart will design the new bridge structure. This future bridge will extend across the Nith River with two supporting pillars to be placed within the water, and the associated abutments existing on the shoreline. Photographs of a bridge with similar construction, designed by Staff from K.Smart, have been included within Figure 2a,b to illustrate the likely design for the Site. This similar bridge exists on Township Road 11, and also crosses over the Nith River. Staff from K.Smart stated this downstream bridge construction was subject to similar environmental constraints and challenges as the Bridge Street Bridge.

Figure 2a: View, looking south of a bridge located along Township Road 11, near Ayr, ON. This structure also crosses over the Nith River, and was constructed with two in-water pillars.

Figure 2b: View, looking east, atop a bridge located along Township Road 11, near Ayr, ON. This bridge appears to be constructed in a similar manner to that planned for the Bridge Street Bridge. This structure appears to include a gradual incline of the road upwards towards the bridge, likely completed to accommodate the seasonal flooding typical within the Nith River.

With this basis, it is expected that in-water work will be a required step as part of this project, thus also requiring the registration of the project with MECP as a result of SAR likely present in this portion of the Nith River. It is also anticipated that as part of the demolition and construction, a laydown area for materials and equipment will be used, and will be located in the general area. For this proposed construction activity, a prudent activity is to also remove non-native weeds from the area. Such non-native weeds often invade disturbed areas and achieves high densities to the detriment of native plants (Gross and Werner, 1978). It is also expected that demolition and construction activities will be completed using standard Best Management Practices (BMPs) for construction projects. For example, one BMP often used in such projects is to revegetate the construction area after completion using only native vegetation.

1.2 Relevant GRCA Policies

Much of the Grand River and its associated tributaries exist within lands carefully managed by the GRCA. This management is a direct complement to the existing requirement to protect functionality and features with surface waters and wetlands, as defined within the Ontario’s Provincial Policy Statement (PPS). That is, the GRCA developed a Wetland Policy, in order to provide a standardized approach to manage and protect wetlands. Thus, the GRCA is responsible for maintaining the careful management and protection of wetlands and associated vegetation, fish habitat, and other significant wildlife habitat along the Grand River watershed. Hence, this study has been completed in accordance with the tenets that define the GRCA Wetlands Policy, more specifically that all projects near water need to evaluate the area for the presence of wetlands during the pre-consultation phase, as explained within Section 6.2.9 of the GRCA Wetlands Policy (GRCA, 2005). Hence, this study assesses the applicability of the GRCA Wetlands Policy to the Site.

Similarly, proposed development within Provincially Significant Wetlands (PSWs) in southern Ontario, is subject to the study requirements defined within the PPS and the GRCA Wetlands Policy (GRCA, 2005). If activities are proposed in proximity to PSWs, a study is required to demonstrate that no negative impacts on the habitats or the ecological function will occur as a result of the proposed development or activities (OMMAH, 2005). With his in mind, this current study acts to document salient information regarding the potential impacts of the proposed bridge construction on surrounding natural areas and habitats.

1.3 Species at Risk

It is appropriate to design on-going activities on-Site with the goal to ideally avoid environmental disturbance or minimally reduce environmental disturbance. This requires the evaluation of proposed activities relative to possible disturbance of SAR specimens and habitat that could be used for SAR. When environmental disturbance is reduced or avoided, it represents a strategy to reduce possible consequences on plant and wildlife communities generally. Such strategies also have the added benefit to reduce and/or avoid disturbance of SAR specimens and associated habitat that may exist within an area.

This Site represents an area that could provide habitat to varied plants and wildlife specimens, including potential habitat for SAR trees along with bats, birds, snakes, and turtles. For example, many freshwater turtles have become protected under the ESA. As a result of habitat degradation, poaching and the introduction of invasive species, many freshwater turtles have reached Special Concern (SC), Threatened (THR) or Endangered (END) status, assigned by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in the province of Ontario (COSEWIC, 2008). Therefore, it is vital to screen for the potential presence of turtles or turtle habitats on or in proximity to the Site. Potential habitat for turtles is largely dependent on the species-specific habitat requirements. Generally, such habitats consist of relatively shallow, slow flowing water, often rich in vegetation and organic substrates. Potential habitats for turtles can include ponds, swamps, marsh, and bogs with sufficient water depth (COSEWIC, 2008).

This Site is also located in an area known to support SAR snake species. A variety of Ontario snakes have become protected under the ESA over the past decade as a result of road expansion and habitat degradation/development among other factors (COSEWIC, 2012). Snakes often can live in a variety of macrohabitats across Ontario, however, they always require microhabitats in the area suitable for hibernation, gestation, and foraging (COSEWIC, 2012). In general, habitats with large rocks or rocky outcrops away from water are preferred by most snake species (COSEWIC, 2012).

It is also prudent to evaluate the possible presence of migratory SAR birds in proximity to the Site. In recent years, many species of migratory birds have become protected under the ESA. Therefore, it is essential to screen for the possible presence of birds, nests or candidate nesting habitat in proximity to the Site. Furthermore, during the last decade, some migratory bat (also referred to as myotis) species and the habitat they use became protected under the ESA, due primarily to the arrival of a disease to North America (COSEWIC, 2013). Due to the prevalence of this disease, the current management strategy is to protect and carefully manage candidate habitat used by migratory and resident SAR bats and this habitat includes large trees, generally defined by a Diameter at Breast Height (DBH) $\geq$ 10 cm, and man-made structures, such as buildings (COSEWIC 2013). Thus, if trees with DBH $\geq$ 10 cm exist in proximity to a proposed activity, then justification exists to assess these trees for cavities that could be used by bats. Thus, the assessment approach used to screen the location of the existing Site considers a suite of environmental, natural heritage, and human-built features.

2.0 METHODS

Information on environmental features for the Site were assessed using three-step process by Staff from ELM described within this Memorandum, as follows:

1. Complete a desktop screening of environmental features on-Site, including inspection of aerial photographs as well as a review of available information on SAR in NHIC databases;
2. Conduct a site visit(s) to document the environmental features on-Site, if justified by the findings from the desktop study. A field visit would involve completing documentation of the natural features of the Site, habitat or significant wildlife habitat, and the collection of representative photographs; and,
3. Share professional opinion on insights for follow-up study requirements based on existing habitat features and other considerations after the visit. This information will be presented in accordance with relevant GRCA guidelines, to ensure proper management of wetlands and other wildlife habitat in the future.

3.0 RESULTS

3.1 Aerial Photographs

For this study, Staff from ELM initially evaluated the Site relative to available aerial photographs from 2006 and 2019 (Figure 3). Inspection of these aerial photographs led to the determination that the Site is predominantly surrounded by natural areas, such as woodlands and agricultural fields. A number of private residences are also visible in proximity to the Bridge Street Bridge.

The Bridge Street Bridge appears to expand approximately 45 m across the Nith River east-west in direction along Bridge Street, west of New Dundee, Ontario. The Site appears to be surrounded predominantly by agricultural fields, with a large woodland located south of the Bridge along the eastern bank of the Nith River. The woodland appears to be composed of both young and mature woody stems, of varying diameters and of varying species. Woody stems are also apparent along the western shoreline of the River and south of the Bridge, however in much less capacity. These stems also appear to range in diameter and species. The shoreline upstream of the Bridge does not appear to have any woody stems, but rather is immediately surrounded by grassy fields or meadowed area. It is also prudent to mention the presence of three private residential properties surrounding the Bridge, with one residence located southeast of the Bridge, one located southwest of the Bridge, and one located northwest of the Bridge. The presence of these varied features led to the determination that a field inspection was justified in order to confirm the spatial distribution of the features of the Site. Thus, Staff from ELM conducted an evaluation to identify environmental features of concern.

Figure 3: View on left displays an aerial view of the Site in 2006 while, view on the right displays an aerial view of the Site in 2019. Images were obtained from public data base (i.e., Google Earth). These two views and Figures 1 and 2 demonstrate the continuous presence of the Bridge Street Bridge and surrounding woodlands and agricultural fields, this suggesting consistent environmental management and no major disturbances such as forest fires during this period.

3.2 Flood Plain Mapping

Available flood plain mapping was examined in order to further identify natural features at the Site. The Nith River falls within the jurisdiction of the GRCA. Flood plain mapping reveals that the Bridge Street Bridge lies within a large area of engineered floodplain, which extends over adjacent fields and woodland areas. West of the Nith River, an area with slopes ranging from steep to over steep is documented. At the base of this sloped area a number of regulated wetlands exist. It is likely that water from flooding is trapped at the base of these slopes following seasonal flooding events, allowing moisture tolerant vegetation to thrive and creating micro wetland ecosystems. It is also prudent to document the presence of two small tributary creeks located downstream of the Bridge and two small tributary creeks located upstream from the Bridge. These areas are not expected to be disturbed by the proposed activities given the distance at which they exist from the Site.

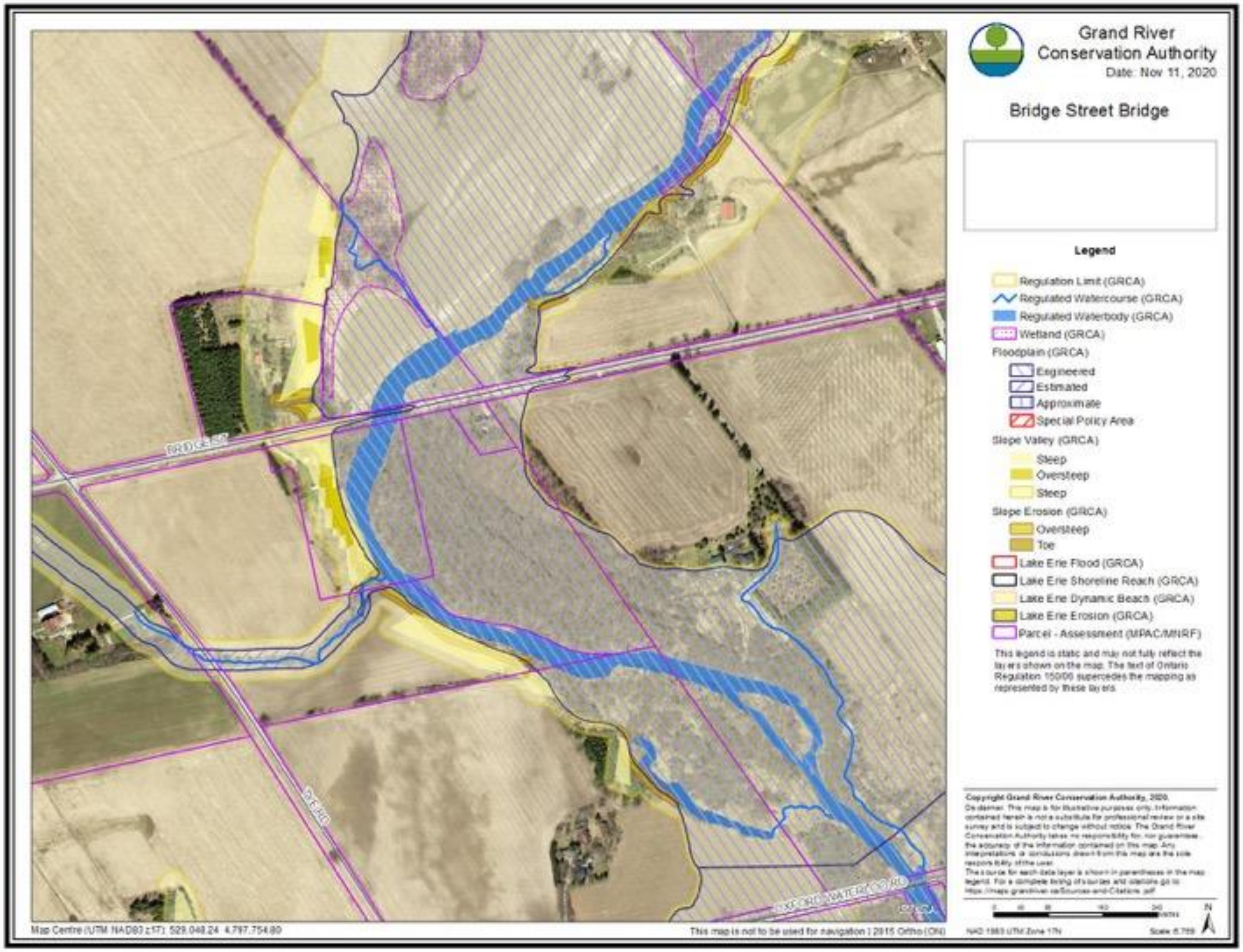


Figure 4: View of available floodplain mapping in proximity to the Bridge Street Bridge. The Nith River exists within land currently regulated by the GRCA. Mapping demonstrates that the Bridge lies in an area with engineered floodplains with steep slopes located west of the Nith River. Produced using information under License with the Grand River Conservation Authority © Grand River Conservation Authority, 2020.

3.3 Review of Natural Heritage

Following the evaluation of the aerial photographs, the Site was then screened for records of SAR using the NHIC database and other natural heritage screening databases, such as the Department of Fisheries and Oceans (DFO) database, and iNaturalist.com. This desktop review identified candidate wildlife habitat in proximity to the Site. It is prudent to note, SAR documented as present at the Site with a most recent observation date of more than 30 years ago, are generally considered no longer present within the area and will be deemed absent from the area.

When the Site was screened through the NHIC database, the Site falls within NHIC Square 17NH2997. This square identified that Bridge Street Bridge exists within three different natural areas, including the Nith River Flood Plain, the Plattsville North – Nith River Wetland, and the Grand River Watershed. This Square also identifies Green Dragon (*Arisaema dracontium*) as a potential SAR present in proximity to the Bridge. Green Dragon is currently listed as Special Concern by COSEWIC. As some SAR species are known to occupy large habitat ranges or are considerably mobile, NHIC database squares located north, south, east and west of the Site were also screened. These squares identified a number of additional SAR potentially in proximity to the Bridge, including Greater Redhorse (*Moxostoma valenciennesi*), Black Redhorse (*Moxostoma duquesnei*), and Snapping Turtle (*Chelydra serpentina*). These species are currently listed as Special Concern, Threatened, and Special Concern, respectively. Dates of the last observation of these species was not listed at the time this review was completed. Squares surrounding the Site also identified an additional natural area in proximity to the Bridge, the Haysville Wetland Complex. All SAR identified by NHIC have been reviewed in Table 1.

The Site was screened through the Ontario Reptiles and Amphibian Atlas (ORAA), a database that documents records of SAR within a 20 x 20 km grid. When screened the Site falls within ORAA database square17NH29. Square 17NH29 identifies three potential SAR reptiles in the area, including Snapping Turtle (*Chelydra serpentina*), Midland Painted Turtle (*Chrysemys picta marginata*), and Eastern Hog-nosed Snake (*Heterodon platirhinos*), These species were last observed in 2019, 1981 and 1944, respectively (reviewed in Table 1).

When the Site was screened through inaturalist.com, a natural heritage database focused on documenting observations of flora and fauna in Ontario, a single SAR specimen was identified in proximity to the Site. Butternut (*Juglans cinerea*) was documented to be observed south of the Site, along the eastern shoreline of the Nith River in 2018. Butternut is currently listed as Threatened by COSEWIC.

When the Site was screened through the DFO database, four SAR were documented as potentially present within 1 km of the Bridge Street Bridge. This database identified Black Redhorse, Silver Shiner (*Notropis photogenis*), Rainbow Mussel (*Villosa iris*), and Wavy-rayed Lampmussel (*Lampsilis fasciola*). Black Redhorse and Silver Shiner are both currently listed as Threatened by COSEWIC, while the Rainbow Mussel and Wavy-rayed Lampmussel are currently listed as Special Concern.

Table 1: Summary of the potential SAR specimens identified during a desktop review as observed in proximity to the Site, located at the Bridge Street Bridge, Township of Wilmot. Species at Risk have been designated as Special Concern (SC), Threatened (THR), Extirpated (EXP) or Endangered (END) in the province of Ontario.

Common Name	Scientific Name	COSEWIC Designation	Date of Last Observation
17NH2997 – NHIC			
Natural Area	Nith River Flood Plain	-	-
Natural Area	Plattsville North - Nith River Wetland	-	-
Natural Area	Grand River	-	-
Green Dragon	*Arisaema dracontium*	SC	N/A
17NH2998 (North) – NHIC			
Natural Area	Haysville Wetland Complex	-	-
Natural Area	Grand River	-	-
Greater Redhorse	*Moxostoma valenciennesi*	SC	N/A
Snapping Turtle	*Chelydra serpentina*	SC	N/A
17NH2996 (South) – NHIC			
Natural Area	Grand River	-	-
Black Redhorse	*Moxostoma duquesnei*	THR	-
17NH2897 (West) – NHIC			
Natural Area	Nith River Flood Plain	-	-
Natural Area	Haysville Wetland Complex	-	-
Natural Area	Grand River	-	-
Green Dragon	*Arisaema dracontium*	SC	N/A
Snapping Turtle	*Chelydra serpentina*	SC	N/A
17NH3097 (East) – NHIC			
Natural Area	Plattsville North - Nith River Wetland	-	-
17NH29 – Herp Atlas			
Midland Painted Turtle	*Chrysemys picta marginata*	SC	1981*
Snapping Turtle	*Chelydra serpentina*	SC	2019
Eastern Hog-nosed Snake	*Heterodon platirhinos*	THR	1944*
inaturalist.com			
Butternut	*Juglans cinerea*	THR	2018
DFO			
Black Redhorse	*Moxostoma duquesnei*	THR	N/A
Silver Shiner	*Notropis photogenis*	THR	N/A
Rainbow Mussel	*Villosa iris*	SC	N/A
Wavy-rayed Lampmussel	*Lampsilis fasciola*	SC	N/A

Table 1 (Continued): Summary of the potential SAR specimens identified during a desktop review as observed in proximity to the Site, located at the Bridge Street Bridge, Township of Wilmot. Species at Risk have been designated as Special Concern (SC), Threatened (THR), Extirpated (EXP) or Endangered (END) in the province of Ontario.

Common Name	Scientific Name	COSEWIC Designation	Date of Last Observation
Barn Swallow	*Hirundo rustica*	THR	-
Bald Eagle	*Haliaeetus leucocephalus,*	SC	-
Eastern Small-footed Myotis	*Myotis leibii*	END	-
Tricoloured Bat	*Perimyotis subflavus*	END	-
Black Ash	*Fraxinus nigra*	THR	-
Monarch	*Danaus plexippus*	END/SC**	-

* - SAR documented as present at the Site with a most recent observation date of more than 30 years ago, are generally considered no longer present within the area and will be deemed absent from the area.
** - the COSEWIC designation is END while the current Ontario SAR website lists this species as SC (https://www.ontario.ca/page/monarch).

Based on the experience of ELM staff members with similar projects in the areas, it is possible that Black Ash may also exist within proximity to the Bridge. Black Ash is currently designated as Threatened by COSEWIC, due to the infestation in Canada by Emerald Ash Borer (*Agrilus planipennis*). The Emerald Ash Borer spread across Ontario since 2000 and resulted in the death of most ash trees (Herms and McCullough, 2014). In southern and central Ontario, most Black Ash have been killed by the Emerald Ash Borer (reviewed in Table 1).

Additionally, other SAR occurrences in the Nith River or adjacent natural areas may include birds such as Barn Swallow (*Hirundo rustica*; Threatened) and Bald Eagle (*Haliaeetus leucocephalus*, Special Concern) In addition, all birds, including these SAR, receive protection from harm and disturbance under the North America *Migratory Bird Treaty Act*.

Other SAR in the area includes Monarch (*Danaus plexippus*), Myotis such as Tricoloured Bat (*Perimyotis subflavus;* Endangered) and Eastern Small-footed Myotis (*Myotis leibii*; Endangered) (reviewed in Table 1). Hence, the future field inspection will search for these SAR and associated habitat on-Site.

Fish Community

A diverse fish community has been previously reported to exist in the Nith River. Such diversity minimally includes more than 30 species representing at least eight families. This diverse fish community includes SAR Silver Shiner and SAR Greater Redhorse. A summary of the fish community is presented within Table 2 and represents information from a suite of sources (Scott and Crossman, 1973; GRCA, 2001; MOE, 1966; XCG Consultants Ltd, 2015; Premier Environmental Services, 2017). For example, Premier Environmental Services (2017) reported the catch of fish in 2017 around the Holland Mills Bridge, about five kilometres upstream of the Site. Since fish are mobile, these species possibly exist upstream and/or downstream of Bridge Street Bridge. The MNRF also reported the Nith River is classified as warm water habitat and is consistent with the water temperature designation from DFO (DFO, 2017).

Table 2: Fish species reported to exist in proximity to the Site based on studies from the 1960s to 2017.

Family	**Common Name**	**Scientific Name**
Catostomidae	Northern Hog Sucker	*Hypentelium nigricans*
Catostomidae	White Sucker	*Catostomus commersoni*
Catostomidae	Golden Redhorse	*Moxostoma erythrurum*
Catostomidae	Greater Redhorse	*Moxostoma valenciennesi*
Centrarchidae	Rockbass	*Ambloplites rupestris*
Centrarchidae	Pumpkinseed	*Lepomis gibbosus*
Centrarchidae	Smallmouth Bass	*Micropterus dolomieu*
Cyprinidae	Common Shiner	*Luxilus cornutus*
Cyprinidae	Blackchin Shiner	*Notropis heterodon*
Cyprinidae	Spottail Shiner	*Notropis hudsonius*
Cyprinidae	Rosyface Shiner	*Notropis rubellus*
Cyprinidae	Spotfin Shiner	*Cyprinella spiloptera*
Cyprinidae	Bluntnose Minnow	*Pimephales notatus*
Cyprinidae	Blacknose Dace	*Rhinichthys atratulus*
Cyprinidae	Longnose Dace	*Rhinichthys cataractae*
Cyprinidae	Creek Chub	*Semotilus atromaculatus*
Cyprinidae	Central Stoneroller	*Campostoma anomalum*
Cyprinidae	Striped Shiner	*Luxilus chrysocephalus*
Cyprinidae	Silver Shiner	*Notropis photogenis*
Cyprinidae	Mimic Shiner	*Notropis volucellus*
Cyprinidae	Common Carp	*Cyprinus carpio*
Esocidae	Northern Pike	*Esox lucius*
Gasterosteidae	Brook Stickleback	*Culaea inconstans*
Ictaluridae	Stonecat	*Noturus flavus*
Ictaluridae	Brown bullhead	*Ameiurus nebulosus*
Percidae	Iowa Darter	*Etheostoma exile*
Percidae	Johnny Darter	*Ethoestoma nigrum*
Percidae	Greenside Darter	*Etheostoma blennioides*
Percidae	Rainbow Darter	*Etheostoma caeruleum*
Percidae	Walleye	*Stizostedion vitreum*
Percidae	Johnny Darter	*Etheostoma nigrum*
Percidae	Blackside Darter	*Percina maculata*
Umbridae	Central Mudminnow	*Umbra limi*

3.4 Field Investigations

Based on the results of the desktop review, a field inspection was justified. Multiple Site visits were completed in order to confirm natural heritage features at the Site. Representative photographs of the Site during both inspections are provided within Section 3.4.4.

3.4.1 September 25, 2020

A visit to the Site was completed on September 25, 2020. The visit was led by Dr. Dean Fitzgerald and Dr. Ed Kott. Mr. Chris Tomicoe, representative from the Massasaugas of the Credit First Nation, and Mr. Mark Jeffery, representative from Wilmot Township, were also in attendance. Weather on-Site during the inspection was partly cloudy upon arrival, however developed into full sun throughout the inspection. Ambient air temperature during the visit was around 15ºC. This field study was focused on investigating the natural features in proximity to the Bridge Street Bridge.

Upon arrival water levels in the Nith River appeared low, despite the recent rain. Water at the time of the inspection was considered very clear. A walk around the Bridge area was completed, small dip nets were used to help survey for small fish. Area directly around the Bridge was noted to contain shallow water (30 – 60 cm) with rocks that do not readily move. Rock substrates and other debris in the water was easily observed due to the shallow and clear nature of the water. It is inferred the rocks are embedded around the Bridge area, tightly packed with no obvious spaces between rocks, due to past high flows and floods. At this time, Mr. Jeffery noted that a large flood had occurred in this area in 2018. Additionally, large quantities of small rocks were visible along the east shoreline and within the woodland along the east shoreline, also likely as a result of past flooding.

No evidence of mussels was observed around the west and east Bridge abutments. Although the water was very clear, observations included many fish but no live mussels or dead mussels. The lack of mussels was attributed to the near absence of sediment around the west and east Bridge footings. As mentioned, a number of small fish were observed around the west bridge footing, in the shallow water. A dipnet was used to scooped some of the fish and identify them before releasing them alive. Fish were identified as Common Shiner (*Luxilus cornutus*) and Mimic Shiner (*Notropis volucellus*).

Upstream of the Bridge, water was also shallow (30 – 60 cm). The substrate of the river appeared to transition from rock into softer silt-dominated sediments. When entering the soft sediment area, freshwater mussels were observed in the mud. However, these mussels were not disturbed. The presence of dead mussel shells in the mud of this area was also documented. The first observation of these mussels was approximately 150 m upstream of the Bridge. The area of sediment may be readily observed when one looks at the river, as it contains floating vegetation. This vegetation is rooted in the sediments but it is completely absent around the Bridge, likely due to the prevalence of rock and concrete in the water. This floating vegetation was used as an indicator for the presence of sediment suitable for freshwater mussels.

In addition, a variety of fish were observed in the water upstream of the Bridge in the sediment area among the aquatic vegetation. Dip nets were again used to scoop up some of the fish, identify them and the release them live. This was completed a few times, fish caught were identified as Rock Bass (*Ambloplites rupestris*), Common Shiner, and Mimic Shiner. A number of Darters (*Etheostoma spp.)* were also observed swimming around on the sediment in the shallow water. It was noted that this water was likely too shallow near the Bridge and within the upstream for large-bodied Black Redhorse, however, this part of the River could be used at time of higher water levels, such as during spring after the snow melt, and after the autumn rain rise. Therefore, at this time the shallow water at the Bridge and the area immediately upstream should be considered as not suitable habitat for Black Redhorse use or for spawning.

A walk of the woodland south of the east Bridge footing was completed. This woodlot is owned by Waterloo Region Nature (WRN). In the past, Dr. Kott has walked this woodland with members of WRN, at the time called KW Field Naturalists. Dr. Kott mentioned that SAR Green Dragon (*Arisaema dracontium*); a plant similar to Jack-in-the-pulpit) exists in this woodland and it is listed as Special Concern in Ontario. Green Dragon was not observed during this inspection, however this species is more commonly observed earlier in the year. Furthermore, SAR Black Ash, now listed as Threatened in Ontario, was observed. These Black Ash were documented more than 30 m from the Bridge area.

It is prudent to discussed that while walking in the woodland south of the Bridge, the presence of more than 100 dead freshwater mussels was documented. It appears that the large flood, in 2018, displaced large quantities of gravel and the mussels were swept in to the woodland. When walking it is feasible to observe shells all over the ground. The observation of extensive gravel and sand within the woodland along with freshwater mussel shells provides a simple explanation for the lack of gravel, sediment, and sand in the area of the west and east bridge abutments. It strongly appears the 2018 flood scoured out the Bridge area and displaced massive quantities of rock, sand, woody debris, and other materials along with the freshwater mussels. Hence, it appears this flood resulted in the displacement of the mussels into the woodland or to downstream areas away from the Bridge. Due to this past scouring of the river near the bridge, it represents a simple explanation for the nearly total lack of sediment, sand, and gravel, as well as explains why no freshwater mussels have been observed in this area.

Based on the presence of debris piles, it appears that water was pooled very deep into the woodland for an extended period. This pooling of water appears to have killed some of the Sugar Maple (*Acer saccharum*), American Beech (*Fagus grandifolia*) and other trees in the woodland. A number or the trees documented as dead are known to be intolerant to extended periods of water logged roots (caused by flooding). For example, Sugar Maple can only tolerate about two weeks of water logged roots before the tree dies. It is likely the dead Sugar Maple and American Beech in this woodland represent another consequence of the severe 2018 flood.

Inspection of the Bridge itself was completed. Six Barn Swallow (*Hirundo rustica*) nests were documented as present at the Bridge on the date of inspection. A Bald Eagle (*Haliaeetus leucocephalus*), currently listed as Special Concern in Ontario, was also observed flying overhead during the inspection. As no large nests were observed, it is likely that the Bald Eagle was foraging or simply migrating over. No turtles or other amphibians were observed either near the Bridge or upstream.

During the inspection, a number of noxious and invasive weed species were observed. Wild Parsnip (*Pastinaca sativa*) was observed on the northwest side of the Bridge, while a number of other species, including Field Bindweed, was observed interspersed throughout the Site. The observed species are known to invade disturbed areas and achieve high densities to the detriment of native plants (Gross and Werner, 1978). It is possible that these weeds arrived at the Site through the natural transfer of seed by wildlife and the elements, or via seed transfer by foot or vehicle traffic. It is also prudent to mention, that no Wild Parsnip was observed on the south east side of the Bridge.

3.4.2 October 13, 2020

A visit to the Site was completed on October 13, 2020. The visit was led by Dr. Dean Fitzgerald. Others in attendance included Miss Jessica Zadori, a staff member from ELM, Mr. Chris Tomicoe, a representative from the Massasaugas of the Credit First Nation, and Mr. Mark Jeffery, representative from Wilmot Township, were also in attendance. Weather on-Site during the inspection included full sun with little cloud cover. Ambient air temperature during the visit was around 15ºC. This field study was focused on investigating the natural features and documenting vegetation in proximity to the Bridge Street Bridge (Figure 4). Vegetation species have been reviewed within Table 3.

Figure 5: Aerial view of the Bridge Street Bridge. Polygons depict the areas surveyed at each corner of the Bridge for vegetation. Aerial imagery obtained from a public database (i.e., Google Earth).

Southwest

Vegetation surveys commenced at the southeastern corner of the bridge abutment. Along the roadside, weeds typical of the area were observed, including Wild Carrot (*Daucus carota*), Garlic Mustard (*Alliaria petiolata*), Reed Canary Grass (*Phalaris arundinacea subsp. Arundinacea*), Common Burdock (*Arctium lappa*), Stinging Nettle (*Urtica dioica*), and Common Ragweed (*Ambrosia artemisiifolia*). A steep slope is present along the roadside towards the River and surrounding area, this area including a number of additional species, such as, Beggars Tick (*Bidens frondosa*), Common Bedstraw (*Galium aparine*), Riverbank Grape (*Vitis riparia*), Canada Goldenrod (*Solidago canadensis*), Arrow-leaved Aster (*Symphyotrichum urophyllum*), and Joe Pye Weed (*Eutrochium purpureum*). Along this slope a stem of Manitoba Maple (*Acer negundo*) and a stem of American Elm (*Ulmus americana*) were also documented. In addition, woody debris was observed gathered several meters up the slope from the bank. East of the bank of the River, parallel to Bridge Street an existing 30 meters of vegetation was documented. This area included a number of the species documented along the slope, however also included vegetation such as Wild Mint (*Mentha arvensis*), Coltsfoot (*Tussilago farfara*), Barley (*Hordeum vulgare*), and assorted sedges (*Carex spp.*). The presence of sedge species indicates that this area may be considered a floodplain.

A row of Hybrid Willow (*Salix alba x S. fragilis*) and Crack Willow (*Salix fragilis*) was documented approximately 25 m south of the abutment. These trees were estimated to be around 40-50 years of age, and were likely planted following Hurricane Hazel within a province-wide strategy to improve drainage along all surface waters (Pross and Lambert, 1967). A small, live Green Ash (*Fraxinus pennsylvanica*), and a few stems of Red Osier Dogwood (*Cornus sericea*) were also observed near these larger trees. It is also prudent to note that a small Black Ash was observed approximately 35 m south of the bridge abutment. This Black Ash was documented as live, and growing from a stump sprout. Based on the stump, the original Black Ash appeared to be damaged by beavers. It is unlikely these trees will be disturbed as a result of activities occurring at the Bridge, as a result of their distance and the presence of the existing vegetation buffer.

In line with these trees, the water along the bank of the River was observed to be very shallow (~30 cm depth). Water was clear around the edges of the River, and murkier near the middle, likely as a result of recent rainfall. Sediments in this area were documented as fine. A single dead mussel shell was observed at this location, approximately 30 m south of the Bridge, however no live mussels were observed. Walking north, back towards the eastern abutment of the Bridge, sediment became increasingly coarse. Directly surrounding the abutment, a number of solidified concrete bags and large stones were observed, as wells protective sheeting along the floor of the River. It is likely that the concrete and sheeting were installed during construction of the primary Bridge. The presence of these however, has created an area of scour extending approximately 2-3 m towards the center of the Nith River. Within this area, no vegetation was observed, likely as a result of its inability to root, as no sand or sediment was observed in this area.

In the past, it appears that large rocks were placed along the southeastern edge of Bridge Street as a means to control erosion. These rock piles begin approximately 30 m east of the shoreline and extend an additional 20 m to where a small culvert was documented. This culvert extends north-south under Bridge Street, and likely acts as a small underpass for wildlife. The rocks then continue south, extending past the culvert. These rocks may be considered candidate habitat for SAR snakes, however given the history of flooding in the area, it is unlikely that the first 20 m of rock are utilized by SAR snakes. Rocks beyond the wildlife culvert represent a drier habitat, therefore representing preferrable habitat conditions for snakes. It is unlikely that this area of rock will be disturbed by activities proposed at the Bridge Street Bridge.

During vegetation surveys in proximity to the southeastern abutment, a local citizen approached surveyors. This gentleman told surveyors he was a local farmer in the area, noting that he farms 30 acres of field in direct proximity to the Bridge Street Bridge, particularly the fields located upstream of the Bridge, along the eastern and western banks of the Nith River. During conversation, the gentleman also noted the Nith River is prone to annual flooding, with water coming as high as two feet from the bottom of the Bridge Street Bridge. Flooding was described to cover a large portion of the surrounding fields, and into the woodland during the spring snow melt and summer rainfall episodes. The area was described to resemble a lake during periods of flood, providing evidence as to why moisture tolerant vegetation was document at distance from the banks of the Nith River.

Northwest

Northwest of the Bridge inspections vegan along the northern side of the Bridge abutment. A steep slope is present from the edge of Bridge Street, towards the Nith River. Along this slope, species such as Wild Raspberry (*Rubus idaeus*), Stinging Nettle, Garlic Mustard, Joe Pye Weed, Beggars Tick, and Bittersweet Nightshade (*Solanum dulcamara* L.) were evident. Two small stems of Manitoba Maple were observed approximately 2.0 and 2.5 m north of the abutment . An area of erosion with an undercut bank, spanning approximately 5x6x3 m, was observed in proximity to the abutment. This area was determined to be a tile drain, functioning to drain water from the field located just northwest of the Bridge. Directly surrounding this tile drain, a large patch, approximately 10 m^2, of Wild Parsnip was document. Wild Parsnip was then surrounded by a number of Giant Ragweed (*Ambrosia trifida*). As the inspection continued north, extensive amounts of Reed Canary Grass was observed. Vegetation such as Common Burdock, Sow Thistle (*Sonchus arvensis*), New England Aster (*Symphyotrichum novae-angliae*), and Daisy Fleabane (*Erigeron annuus*) was observed intermixed among the Reed Canary Grass. This vegetation extended approximately 8 m northwest directly out from the riverbank, before the area transitions to an agricultural field hay field. At the time of the inspection, the hay field had been recently cut.

Further upstream, north of the patch of Common Parsnip, and the patch of extensive Reed Canary Grass, is an area composed of upland terrestrial plants, such as Canada Goldenrod, Common Milkweed (*Asclepias syriaca*), and New England Aster. These plants are indicative of well-drained soils, while the lack of trees present between the bank and the field is likely a result of seasonal flooding. This vegetation also extended approximately 8 northwest of the riverbank at its narrowest point. The presence of Milkweed stems indicates that this area may represent candidate habitat for Monarch (*Danaus plexippus*). Monarch is currently designated as Special Concern in Ontario (MECP, 2019a) and Endangered in Canada by COSEWIC (COSEWIC, 2016).

A third transition in vegetation was then documented. Moving further upstream, vegetation was observed to change back into an area dominated by Reed Canary Grass, Bull Thistle, Burdock and New England Aster. The field was documented to transition from hay to Soybean (*Glycine max*), with a large Manitoba Maple and creek with an associated drainage culvert present at the junction between the fields, approximately 200 m upstream. Water from the culvert, draining to the Nith River, was shallow and clear. Sediment within the drainage path was fine sediment. Surrounding the drainage culvert were species such as Reed Canary Grass, Sow Thistle, Green Foxtail Grass (*Setaria viridis*), and a large patch of Velvetleaf (*Abutilon theophrasti*).

A secondary area of drainage was also documented. In this area, water appeared to be draining directly from the Soybean field towards the Nith River. Water was observed to be pooling along the bank, with limited to no drainage actually entering the River. Water was considerably deeper at this location, and murky brown in colour. Vegetation surrounding the pool was composed of mainly Reed Canary Grass, and dead Common Parsnip. A single stem of Purple Loosestrife (*Lythrum salicaria*), and a single stalk of Common Horsetail was documented to be present.

Water in the Nith River, upstream of the Bridge, was documented to be clear and relatively shallow (>30 cm). The floor of the River appeared to be a mixture of fine sediments and gravel. A small sandbar was observed near the center of the River, this area may represent candidate habitat for nesting SAR turtles. During the inspection, five small birds were observed on the small sandbar. These birds were identified as Sanderling (*Calidris alba*), likely stopping over during their southward migration. In line with this small sand bar, a large dead mussel shell was found on the bank. This mussel shell was collected for the purpose of in-office identification.

Along the most eastern edge of the hay field another meadowed buffer area was documented at the base of a sloping hill. The meadowed area was again dominated by Reed Canary Grass and included a 10 m buffer of Red Osier Dogwood. The slope likely represents the edge of the floodplain, and contained woody stems and shrubs, such as Crack Willow, Norway Maple (*Acer platanoides*) and Manitoba Maple. At the northern edge of the slope a number of Apple trees (*Malus spp.*) were documented, while at the edge of the slope, a small gravel driveway was observed. This driveway enters the field from Bridge Street, and was lined with an number of noxious weeds, including Common Mullein (*Verbascum thapsus*).

Southeast

Southeast of the Bridge is an area of woodland, owned by WRN. A number of woody stems were therefore observed, including Crack Willow, a stem of Ironwood (*Ostrya virginiana*), and more than 10 stems of Manitoba Maple. The Crack Willow appeared similar in age and within the same transect location as those observed on the southeastern bank of the River, and were therefore assumed to be planted at the same time, following Hurricane Hazel.

Vegetation in close proximity to the western abutment was similar to that observed previously, including species such as Crow's Foot, Stinging Nettle, and Riverbank Grape. Surveyors also documented new species such as Dames Rocket (*Hesperis matronalis*) and Zigzag Goldenrod (*Solidago flexicaulis*).

During this visit a number of mussel shells were collected from the woodland. As discussed in s. 3.3.1, it is hypothesized that these shells arrived in the woodland as a result of a large flood event which occurred in 2018. The dead mussel shells were collected for the purpose of identification later in-office. Shells were found in proximity to well-sorted piles of gravel and sediment, which were also likely displaced from the Nith River during seasonal floods.

Northeast

In proximity to the western abutment moisture tolerant species such as Bullrush (*Typha latifolia*) and Cattail were observed. Moving further upstream, species such as Sow Thistle, Reed Canary Grass, Beggars Tick and Chicory (*Cichorium intybus*), became more apparent. Minimal trees were documented on this side of the River, as only two small stems of Manitoba Maple were observed.

A small drainage ditch was observed running towards the river from the roadside. Within this ditch a number of invasive weeds were once again documented, including Colt’s Foot, Ragweed, and Common Burdock. A large patch, approximately 10 x 10 m, of Field Bindweed was also documented along the sloped roadside, as well as Garlic Mustard, Poison Ivy (*Toxicodendron radicans*), Daisy Fleabane, Stinging Nettle and Teasel (*Dipsacus fullonum*).

Further upstream, vegetation was documented to be similar to that described within the upstream northeastern habitat consisting mainly of Timothy Grass, Canada Goldenrod, New England Aster, and other upland terrestrial species.

Table 3: Summary of common woody and herbaceous plant species observed in proximity to the four abutments of the Bridge Street Bridge. The origin of each plant is listed as Native (N) or Non-native (I) to Ontario. All native woody plants on-Site below are listed as secure in global rank (i.e., G5) and species rank (S4 or S5). In other words, no woody species of conservation concern were observed.

Common Name	**Scientific Name**	**Abutment**			
		Southwest	**Southeast**	**Northwest**	**Northeast**
Woody Species					
American Elm	*Ulmus Americana*, N	X			
American Beech	*Fagus grandifolia*, N		X		
Apple Tree	*Malus pumila*, N			X	
Black Ash	*Fraxinus nigra*, N	X			
Black Willow	*Salix nigra*, N		X		
Black Walnut	*Juglans nigra*, N		X		
Crack Willow	*Salix fragilis*, I	X	X	X	
Green Ash	*Fraxinus pennsylvanica*, N	X	X		
Hybrid Willow	*Salix alba x S. fragilis*	X	X		
Ironwood	*Ostrya virginiana*, N		X		
Manitoba Maple	*Acer negundo*, I	X	X	X	X
Norway Maple	*Acer platanoides*, I			X	
Red Osier Dogwood	*Cornus sericea*, N	X		X	
Silver Maple	*Acer saccharinum*, N	X	X		X
Staghorn Sumac	*Rhus typhina*, N				
Sugar Maple	*Acer saccharum*, N		X		
Herbaceous Species					
Arrow-leaved Aster	*Symphyotrichum urophyllum*, N			X	
Barley	*Hordeum vulgare*, I	X			
Beggar’s Tick	*Bidens frondosa*, I	X	X	X	X
Bittersweet Nightshade	*Solanum dulcamara* L., I	X		X	
Bull Thistle	*Cirsium vulgare*, I			X	
Bullrush	*Typha latifolia*, N				X

Canada Goldenrod	*Solidago canadensis*, N	X		X	X
Canada Thistle	*Cirsium arvense*, I				
Common Bedstraw	*Galium aparine*, N	X		X	
Common Chicory	*Cichorium intybus*, I				X
Common Milkweed	*Asclepias syriaca*, N			X	
Common Mullein	*Verbascum thapsus*, I				X
Common Ragweed	*Ambrosia artemisiifolia*, N	X			X
Coltsfoot	*Tussilago farfara*, I	X	X		X
Daisy Fleabane	*Erigeron annuus*, N			X	
Dame’s Rocket	*Hesperis matronalis*, I		X		
Field Horsetail	*Equisetum arvense*, N			X	
Field Bindweed	*Convolvulus arvensis*, I			X	X
Garlic Mustard	*Alliaria petiolata*, I	X	X	X	X
Giant Ragweed	*Ambrosia trifida*, N	X	X	X	X
Grass spp.	*Poa spp.*, N				
Great Burdock	*Arctium lappa*, I	X		X	X
Green Foxtail Grass	*Setaria viridis*, I			X	
Jack-in-the-pulpit	*Arisaema triphyllum*, N				
Joe Pye Weed	*Eutrochium purpureum*,N	X		X	X
New England Aster	*Symphyotrichum novae-angliae*, N			X	X
Prickly lettuce	*Lactuca serriola*, I	X			X
Poison Ivy	*Rhus radicans L.*, N				X
Reed Canary Grass	*Phalaris arundinacea subsp. Arundinacea*, I	X	X	X	X
Riverbank Grape	*Vitis riparia*, N	X	X	X	X
Scentless Chamomile	*Tripleurospermum inodorum*, I				
Sedge spp.	*Carex spp.*	X	X	X	X
Sow Thistle	*Sonchus arvensis*, I	X	X	X	X
Spotted Jewelweed	*Impatiens capensis*, N	X			X
Spotted Knapweed	*Centaurea maculosa*, I		X	X	
Stinging Nettle	*Urtica dioica*, I	X	X	X	X
Teasel	*Dipsacus fullonum*, I		X	X	

Velvetleaf	*Abutilon theophrasti*, I			X	X
Wild Carrot	*Daucus carota*, N	X		X	X
Wild Mint	*Mentha arvensis*, N	X			
Wild Parsnip	*Pastinaca sativa*, I		X		
Wild Raspberry	*Rubus idaeus*, I	X	X	X	X
White Clover	*Trifolium repens*, I	X			
Zig Zag Goldenrod	*Solidago flexicaulis*, N		X		

3.4.3 October 16, 2020

A visit to the Site was completed on October 16, 2020. The visit was led by Dr. Dean Fitzgerald. Others in attendance included Miss Jessica Zadori, a staff member from ELM. Weather on-Site during the inspection included full sun with little cloud cover. Heavy rain was recorded within the previous 24 hours, and the River was documented to be slightly higher than on previous visits. Ambient air temperature during the visit was around 13ºC. This field study was focused on measuring the depth of water across the Nith River in proximity to the Bridge Street Bridge. A summary of the water depth and floor composition is included within Table 4.

Water depth across the River was measured at four different transects. All transects were measured form the eastern shoreline or abutment to the western shoreline or abutment. Measurements were completed using two, wooden 1-metre sticks. Transect 1 was measured from abutment to abutment beneath the southern edge of the Bridge. Transect 2 was measured from abutment to abutment beneath the northern edge of the Bridge. Transect 3 was measured from shoreline to shoreline approximately 30 m upstream of the Bridge, while Transect 4 was measured from shoreline to shoreline approximately 30 m downstream of the Bridge. Transects have been depicted within Figure 6.

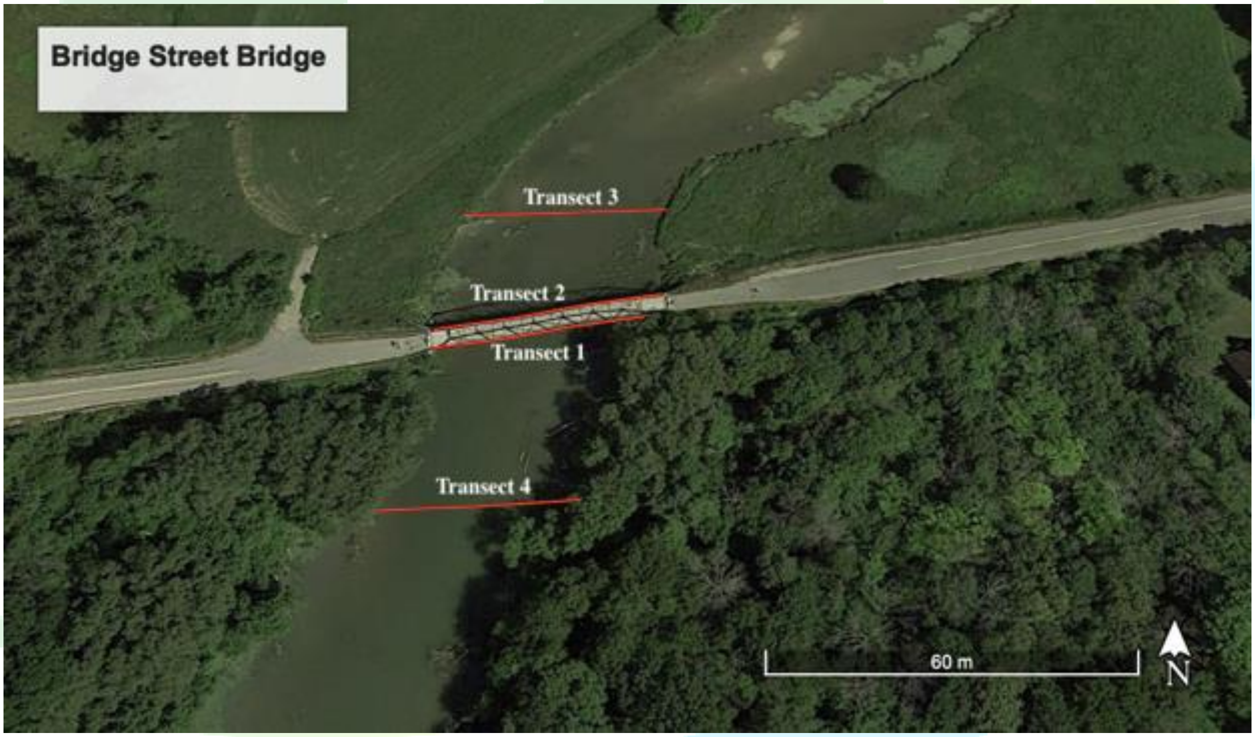


Figure 6: The depth of water across the Nith River was documented to range from approximately 30 cm along the shoreline to more that 1.5 m at the deepest points in proximity to the center of the River. Based on depth measurements, the River appears to be shallowest upstream of the Bridge and gradually gets deeper as water flows downstream.

Composition of the sediment across the River floor was also observed to vary upstream and downstream, however was documented to included sediments ranging from coarse to very fine through the entire survey area, including boulders, rock cobble, gravel, sand and silt. Transects beneath the Bridge were documented to have large boulders and concrete surrounding the abutments leading to the creation of a scour area, expanding 2-3 m towards the center of the River. Upstream and downstream transects were documented to have a greater quantity of silt material, particularly sitting over coarser sediment such as rock cobble and gravel and in proximity to the shoreline. These areas were also largely absent of the large boulders and concrete observed directly beneath the Bridge.

Table 4: Summary of the water depth and sediment composition across four transects of the Nith River in proximity to the Bridge Street Bridge.

Distance from east abutment (m)	Water Depth (m)	Sediment Composition
Transect 1		
0	-	East abutment
1	0.42	95% Boulder, 5% silt
2	0.77	80% boulders and rock cobble, 15% gravel, 5% silt
3	0.94	70% rock cobble, 25% gravel, 5 % silt
4	0.97	80% rock cobble, 15% gravel, 5% silt
5	0.84	40% rock cobble, 40% gravel, 20% silt
6	0.88	40% rock cobble, 40% gravel, 20% silt
7	0.96	50% rock cobble, 40% gravel, 10% sand
8	1.05	50% rock cobble, 30% gravel, 20% sand
9	1.10	50% rock cobble, 30% gravel, 20% sand
10	1.30	50% rock cobble, 30% gravel, 20% sand
11	1.10	50% rock cobble, 30% gravel, 20% sand
12	1.00	50% rock cobble, 30% gravel, 20% sand
13	0.90	50% rock cobble, 40% gravel, 10% sand
14	0.85	40% rock cobble, 40% gravel, 20% silt
15	0.80	80% rock cobble, 15% gravel, 5% silt
16	0.73	80% rock cobble, 15% gravel, 5% silt
17	0.65	80% rock cobble, 15% gravel, 5% silt
18	0.65	80% rock cobble, 15% gravel, 5% silt
19	0.73	70% rock cobble, 25% gravel, 5 % silt
20	0.60	80% boulders and rock cobble, 15% gravel, 5% silt
21	0.36	95% Boulder, 5% silt
22	0.35	Concrete with large boulders
23	0.33	Concrete with large boulders
24	-	West abutment
Transect 2		
0	-	East abutment
1	0.30	100% rock cobble
2	0.30	85% rock cobble, 15% gravel

3	0.60	75% rock cobble, 25% gravel
4	0.95	70% rock cobble, 20% gravel, 10% silt
5	0.91	60% rock cobble, 30% gravel, 10% silt
6	0.87	60% rock cobble, 25% gravel, 15% silt
7	0.84	60% rock cobble, 25% gravel, 15% silt
8	0.83	40% rock cobble, 30% gravel, 25% silt, 5% sand
9	0.90	10% rock cobble, 90% sand
10	0.90	60% rock cobble, 20% gravel, 10% silt, 10% sand
11	0.95	90% rock cobble, 5% silt, 5% sand
12	0.91	70% rock cobble, 10% gravel, 10% silt, 10% sand
13	0.96	60% rock cobble, 20% gravel, 10% silt, 10% sand
14	1.05	90% rock cobble, 10% gravel
15	0.65	100% rock cobble
16	0.46	100% rock cobble
17	0.55	75% rock cobble, 25% gravel
18	0.75	75% rock cobble, 25% gravel
19	0.80	70% rock cobble, 20% gravel, 10% silt
20	0.60	75% rock cobble, 25% gravel
21	0.37	85% rock cobble, 15% gravel
22	0.30	85% rock cobble, 15% gravel
23	0.36	85% rock cobble, 15% gravel
24	0.55	100% rock cobble
25	0.45	100% rock cobble
26	0.26	100% rock cobble
27	-	West abutment
Transect 3 (~30 m upstream)		
0	-	East shoreline
1	0.27	50% rock cobble, 30% gravel, 10% sand, 10% silt
2	0.39	80% rock cobble, 10% gravel, 10% silt
3	0.59	60% rock cobble, 30% gravel, 10% silt
4	0.73	60% rock cobble, 30% gravel, 10% sand
5	0.70	80% rock cobble, 15% gravel, 5% sand
6	0.76	50% rock cobble, 35% gravel, 5% sand
7	0.78	60% rock cobble, 35% gravel, 5% sand
8	0.82	60% rock cobble, 35% gravel, 5% sand
9	0.86	60% rock cobble, 35% gravel, 5% sand
10	0.89	60% rock cobble, 35% gravel, 5% sand
11	0.84	60% rock cobble, 35% gravel, 5% sand
12	0.83	60% rock cobble, 35% gravel, 5% sand
13	0.86	60% rock cobble, 35% gravel, 5% sand
14	0.83	90% rock cobble, 10% sand
15	0.80	90% rock cobble, 10% sand
16	0.67	~10 cm silt over rock cobble
17	0.51	~10 cm silt over rock cobble

18	0.43	~10 cm silt over rock cobble
19	0.51	~10 cm silt over rock cobble
20	0.62	~10 cm silt over rock cobble
21	0.68	~10 cm silt over gravel and rock cobble
22	0.65	~10 cm silt over gravel and sand
23	0.63	~10 cm silt over gravel and sand
24	0.54	~10 cm silt over rock cobble
25	0.50	~10 cm silt over rock cobble
26	0.53	~10 cm silt over rock cobble
27	0.55	~10 cm silt over rock cobble
28	0.54	~10 cm silt over rock cobble
29	0.53	~10 cm silt over rock cobble
30	0.54	~10 cm silt over rock cobble
31	0.50	~10 cm silt over rock cobble
32	0.45	~10 cm silt over rock cobble
33	0.40	~10 cm silt over rock cobble
34	0.33	West shoreline
Transect 4 (~30 m downstream)		
0	-	East shoreline
1	0.63	~ 2 cm silt over sand
2	0.72	~ 10 cm silt over sand
3	0.85	~ 10 cm silt over sand
4	0.89	~ 10 cm silt over gravel
5	0.99	~ 10 cm silt over gravel
6	1.05	~ 10 cm silt over gravel
7	1.10	> 10 cm silt over rock cobble
8	1.20	> 10 cm silt over rock cobble
9	1.20	> 10 cm silt over rock cobble
10	1.20	> 10 cm silt over rock cobble
11	1.30	90% rock cobble, 10% gravel
12	1.30	90% rock cobble, 10% gravel
13	1.30	80% rock cobble, 20% gravel
14	1.40	80% rock cobble, 20% gravel
15	1.50	80% rock cobble, 10% gravel, 10% silt
16	-	Unsafe conditions – too deep to survey
17	-	Unsafe conditions – too deep to survey
18	-	Unsafe conditions – too deep to survey
19	-	Unsafe conditions – too deep to survey
20	-	Unsafe conditions – too deep to survey
21	-	Unsafe conditions – too deep to survey
22	-	Unsafe conditions – too deep to survey
23	-	Unsafe conditions – too deep to survey
24	-	Unsafe conditions – too deep to survey
25	-	Unsafe conditions – too deep to survey

26	-	Unsafe conditions – too deep to survey
27	-	Unsafe conditions – too deep to survey
28	-	Unsafe conditions – too deep to survey
29	-	Unsafe conditions – too deep to survey
30	1.50	80% Rock Cobble, 20% gravel
31	1.20	60% rock cobble, 40% gravel
32	0.82	40% rock cobble, 30% gravel, 30% sand
33	0.67	40% rock cobble, 40% gravel, 20% sand
34	0.50	40% rock cobble, 60% sand
35	0.40	100% sand
36	0.35	100% sand

It is also prudent to note, that during this field inspection a number of individuals from WRN were present working on a fall cleanup of their property. Most notably, Anita Smith, and Fraser Gibson, were among those present. Fraser Gibson is a recognized naturalist, and has been making observations along the Nith River in proximity to the Bridge for a number of years. In conversation with Staff from ELM, Mr. Gibson discussed the presence of freshwater mussel shells along the shoreline and in the woodland for the past four years. Mr. Gibson noted he personally documented a number of freshwater mussel species, including Spike (*Eurynia dilatata*), Giant Floater (*Pyganodon grandis*), Creek Heelsplitter (*Lasmigona compressa*), as well as a single specimen of Wavy-rayed Lampmussel (*Lampsilis fasciola*) since he began collecting shells four years ago. Relevant correspondence with representatives from WRN are included within Appendix B.

3.4.4 Select Photographs of the Site

Select representative photographs are included herein. A full set of Site photographs has been included within Appendix A. Note, Photo No. are consistent with their order as included within Appendix A.

Photo No. 16	
Date: October 13, 2020	
Description: Another view of a culvert, present in proximity to the south-facing rocky slope present along the edge of Bridge Street. This culvert likely allows the safe passage of wildlife under Bridge Street.	

Photo No. 18	
Date: October 13, 2020	
Description: View of a stump sprouting Black Ash (*Fraxinus nigra*) tree. The original Black Ash appears to have been cut and taken by beavers.	

Photo No. 24	
Date: October 13, 2020	
Description: View of a number of solidified concrete bags and large boulders documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 45	
Date: October 13, 2020	
Description: View of the northeastern bank, from the northwestern bank. A small gravelly area is visible near the center of the River. This area may represent candidate habitat for turtle nesting.	

Photo No. 50

Date: October 13, 2020

Description: Another view of a drainage culvert, documented upstream of the Bridge Street Bridge. Sediment in the culvert may be described as well-sort, very fine silt.

Photo No. 61

Date: October 13, 2020

Description: Another view, looking west, across a nearby hay field. The slope in the background of the photo represents the edge of the floodplain.

Photo No. 64	
Date: October 13, 2020	
Description: View of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.	

Photo No. 65	
Date: October 13, 2020	
Description: View of a freshwater mussel shell (marked with blue arrow), found within sediment in the Cultural Woodland, near the southeastern bank. Gravel and sediment was hypothesized to have been deposited along the floor of the woodland as a result of flooding	

3.5 Ecological Land Classification

Information on land use and vegetation communities was used to prepare an Ecological Land Classification (ELC) map for the Site. This effort generated polygons to describe the vegetation communities associated with the Site, following standard methods for southern Ontario (Lee et al. 1998; Lee, 2008). This application also follows MNRF's vegetation type classification codes to encompass the range of natural and cultural vegetation communities with reference to the updated list from December, 2008. For this Study, interpretation of aerial photographs and field inspections were used to define vegetation community boundaries as distinct polygons (Figure 7). Then field data on actual plant species community boundaries were identified, and acted as the basis to classify these communities.

For the areas upstream and downstream of the Site, it is well known the lack of large impoundments on the Nith River results in seasonal floods (i.e., flooding each year during spring, after snow melt). On this theme, Staff from ELM previously observed flooding in these areas all along the river shorelines during the springs of 2017, 2018, and 2019 while doing studies associated with the upstream Holland Mills Bridge. Hence, the frequency of seasonal flooding of this portion of the Nith River is well known. For these reasons, Staff from ELM have used this knowledge to understand the disturbance arising from spring floods that vary from minor to severe, dependent on snow pack, rate of temperature warming, and precipitation. Hence, years with large snow pack, quick temperature rise and spring rain often are associated with large floods while small snow pack with slow temperature rise and limited spring rain are associated with small floods. The flooding results in changes to Nith River shoreline soils and vegetation, and is germane to the environmental features used to define the ELC map within this study. The topic of flooding in close proximity to the Site is explicitly addressed in Section 3.6 of this memorandum.

It is prudent to note that the ELC hierarchy recommends that a vegetation community polygon be greater than or equal to 0.5 ha in size before it is defined. Patches of vegetation less than 0.5 ha or areas of disturbance that are small, on the landscape perspective, are often integrated with adjacent communities that are most similar. However, ELM deemed it important to represent each ecosite on-Site even when it was smaller than 0.5 ha, as vegetation communities in proximity to the Site differed to such a large degree.

Various information collected on-Site was used to designate these lands following the ELC framework (Lee et al., 1998; Lee, 2008). Information applied for the designation of lands included general land use, vegetation species, slope, and evidence of past, recent, and current disturbance; surface water features also contributed to this analysis. From this information, a total of seven ELC ecosite polygons types were documented and presented within Figure 7.

These ecosites were as follows:

1. CUM1-1: Dry – Fresh Cultural Meadow

Areas of CUM1-1 are typically dominated by Creeping Thistle, Tufted Vetch, Queen Anne's Lace, Goldenrod species and other Grass species. Species are largely composed of those considered to be "roadside tolerant", with species of Canada Goldenrod and Late Goldenrod often encountered, along with Kentucky Bluegrass, Awnless Brome and Reed Canary Grass as the most frequently encountered grasses.

Figure 7: Aerial view of the Bridge Street Bridge with ELC polygons overlaid. A total of seven different ELC polygons were documented based on vegetation communities and soil.

These ecosites were as follows (continued):

2. CUW1-b: Exotic Cultural Woodland

CUW1-b is defined by the presence of Manitoba Maple, Hybrid Crack Willow, Black Walnut, White Willow, Green or Red Ash, American Elm, and Common Buckthorn. Vegetation such as Thicket Creeper, Riverbank Grape, Spotted Touch-me-not and Garlic Mustard may also be present.

3. FODM6-1: Fresh – Moist Sugar Maple – Lowland Ash Deciduous Forest Type

FODM6-1 may be considered the most common and widespread type of Sugar Maple Deciduous Forest Type across Southern Ontario. This area is defined by the presence of Sugar Maple, Green Ash and Black Ash. Other less dominant species may include Red Maple, White Elm, Yellow Birch, Basswood and Beech species. Species such as Sassafras and Hackberry may be present to a lesser extent.

4. MEFM1-1: Goldenrod Forb Meadow Type

Areas of MEFM1-1 are defined by the presence of open herbaceous species, with tree and shrub cover of less than 25%. These areas may vary from patchy to continuous and are typically dominated by broadleaf species, in the case of this Site, Goldenrod species.

5. MAMM1-16: Reed Canary Grass Graminoid Mineral Meadow Marsh

MAMM1-16 is defined by the presence of dominant grass or sedge species. In the case, the presence of dominate Reed Canary Grass dominates the vegetation. Areas may be considered rich, dominated by clonal species, or sparsely vegetated in areas with evidence of ice scour. Also, MAMM1-1 is commonly found in exposed areas near shorelines associated with a history of human disturbance, often near roads.

6. OAGM1 - Medium Mineral Annual Row Crop

OAGM1 is characterized by the presence of loam soil, utilized for the purpose of row-cropped, open agriculture. Areas of OAGM1 maybe be considered active or fallow.

7. SAGM2 - Abandoned Orchard

SAGM2 represents habitat created previously as an orchard that is now abandoned. This vegetation community is defined by the presence of fruit trees, in the case of this Site, old Apple and Crab-apple. The herbaceous ground cover ranges from grass to common weed species among the fruit trees.

3.6 Flooding Patterns within the Nith River

3.6.1 Seasonal Flooding

As briefly discussed within Section 3.2, the Bridge Street Bridge is located within an engineered floodplain, within an area regulated by the GRCA. This floodplain is documented to extend over adjacent fields, located northwest and northeast of the Bridge, and into nearby woodlands, located southwest and southeast of the Bridge. Areas of steep and over-steep slope are documented along the western boundaries of the northwestern field, marking the edge of the floodplains. As noted during field inspections, often in areas where this continuous flooding occurs, only water-tolerant vegetation was dominant, and this corresponded with no standing surface water at the time of the initial inspections during autumn 2020. The presence of these species was attributed to the seasonal flooding of the Nith River in proximity to the Site. Seasonal spring flooding is predominately attributed to the melting of snowpack from surrounding fields and woodlands, along with increased contributions into the Nith River from the upstream culvert, as well as from upstream tile drains that drain surface runoff from nearby surrounding areas.

In order to capture the extent of the flooding, the Site was visited on March 12, 2021 by staff from ELM. Upon arriving at the Bridge, water was documented to exist approximately 30 cm below the base of the bridge deck (Figure 8). Water was observed as fast flowing, and very turbulent. Flooding was documented to extend into all surrounding fields and woodlands (Figures 9 and 10).

Follow-up field visits were completed a exactly a week later on March 19 and March 20. These follow-up visits documented that water had returned back to a near-normal flow scenario, with little to no standing water remaining within the southeastern woodlands. It is prudent to note that the flooding resulted in significant scouring and disturbance of the woodland. Large amounts of displaced sand, silt, gravel, garbage, wood and other debris were observed upwards of 60 m east into the woodlands (Figure 11). Depositional areas of fine sand were typically observed deeper within the woodlands, while deposition of gravel and larger rock was most frequently observed along the shoreline and within the first 20 m between the woodland and the shore. Similarly, large amounts of garbage, broken glass, and metal fragments were observed. Additionally, depositional areas of vegetation, including tree trunks, branches, sticks, leaves, and grasses were documented to be collecting in different parts of the woodland (Figure 12).

Follow up visits to the Site also documented a number of newly displaced mussel shells within the woodlands in proximity to Area 6. Mussels were documented to range in size from less than 1 cm to greater than 8 cm. Mussel shells also ranged in completeness, with some remaining fully complete (both halves of shell), to partially complete (half a shell or a shell fragment). A number of extremely small fragments were observed in the soil, it was hypothesized that these shells shattered on ground impact, as a result of the fast flowing water through the woodland. Mussel shells were documented to be both sitting on top of displaced soil, as well as partially buried within soil and hence frozen into the ground (Figure 13). It is expected that the seasonal occurrence of these floods acts to continually displace live mussels from within the Nith River into adjacent woodlands, south of the Bridge. A number of mussels and mussel fragments were collected within the woodland on March 19 and 20, and returned to the office for identification. All collected mussel shells were documented to be dead and clear of flesh.

Figure 8: View of the Nith River during the March 12, 2021 flooding event. Water was documented to exist nearly 30 cm from the Bridge deck, and flood into surrounding fields and woodlands.

Figure 9: View of the southeastern woodland from atop the Bridge on May 12, 2021. Water was documented to be fast flowing and very turbulent flowing through the woodlands and fields.

Figure 10: View of the northeastern and northwestern agricultural fields from the roadside of Bridge Street on March 12, 2021. Water was documented to be fast flowing and very turbulent flowing through the woodlands and fields.

Figure 11: View of a large depositional area of gravel and rock present within the southeastern woodland, approximately 10 m from the shoreline of the Nith River, on March 19.

Figure 12: View of a large depositional area of trees, branches and vegetation, present within the southeastern woodland, approximately 5 m from the shoreline of the Nith River, on March 19.

Figure 13: View of a mussel shell (marked with green arrow), displaced from the Nith River during the flood. This mussel shell was buried in displaced gravel and sand, and frozen into the ground, on March 19. It was necessary to use a shovel to carefully extract the specimen.

3.6.2 Episodic Flooding

The Site was visited again on two different dates in March and again during multiple dates of April in order to document the consequences of episodic flooding downstream of the Bridge Street Bridge. A summary of the visits in March and April are included in Table 5. The first visit was on March 26, 2021, to document and collect any remaining mussel shells present in the floodplain located southeast of the Bridge. Weather during the field visit was extremely windy with light scattered showers. During this field visit, an area of shoreline was documented as flood plain, located approximately 225 m downstream of the Bridge, and appeared to have been recently flooded (hereinafter called Area 6; Figure 14). Area 6 included both standing pools of water, as well as a large number of displaced mussel shells evident on top of residual vegetation, sand, rock, and other debris (Figure 15). All shells collected at this location were documented to be dead and free of flesh, with most documented as fully complete (i.e., with specimens including both shell halves). Mussels were collected and returned to the office for identification.

The Bridge was again visited on March 27, 2021 following the occurrence of an overnight rainstorm. This storm resulted in approximately 2-3 mm of precipitation. Field visits completed on this day documented that the area of shoreline surveyed the previous afternoon was now flooded and inaccessible (Figure 16). Flowing water through this location was documented to be relatively fast flowing, turbulent and upwards of 45 cm deep directly off the shoreline.

Follow-up surveys of the area downstream of the bridge were completed to quantify the displacement of mussels to the floodplain, as reviewed within Table 5 (Figures 17 to 19). The survey dates extended from March 19 until May 11, 2021. The goal of these surveys was to view the flood plain area after precipitation events in order to document mussel deposition patterns. Results of these varied field visits indicate that natural areas downstream of the Bridge repetitively flood following even minor precipitation after the major spring flood that follows snow melt. Furthermore, as a result of the repetitive flooding downstream of the Bridge after each precipitation event, it demonstrates this process displaces mussels and represents a constant source of mortality. In general, after each rain, mussels are displaced to the floodplain and apparently do not make it back to the river. For example, during surveys of Area 6 on March 27, nearly 600 mussel shells or mussel shell fragments were collected. In contrast, a total of 65 were found on April 21 and 20 on May 11. These surveys ended with growth of vegetation and baseflows in the river.

Table 5: Summary of dates for all mussel surveys during spring, 2021.

Date of Survey	Approximate Number of Shells Collected
March 19, 2021	173
March 20, 2021	87
March 26, 2021	594
March 27, 2021	249
April 1, 2021	125
April 9, 2021	60
April 21, 2021	65
May 11, 2021	20

Figure 14: View of the shoreline, looking north, of an area that appeared to be recently flooded. This area included pools of standing water, as well as a large number of deposited mussel shells.

Figure 15: View of the deposited mussel shells on March 26, 2021 in an area of shoreline approximately 225 m downstream of the Bridge. This area was titled to be a “mussel graveyard” as a result of the large number of dead and deposited shells. It is expected that the shoreline will again appear like this following the receding of flooding on March 27, 2021. A number of shells have been highlighted with red arrows.

Figure 16: View of the same shoreline, looking north, now flooded. This area now included fast flowing, and turbulent water, documented to be upwards of 45 cm deep off the shoreline.

Figure 17: View of the same shoreline on April 1, looking north, once flooding has receded. This phot demonstrate the effects of episodic flooding, vegetation may be observed to have been matted down in the downstream direction, as a result of past fast flowing water moving through the area.

Figure 18: View of the shoreline on May 11, during the search for mussels. This search was done by Dr. Kott, Ms. Zadori, and Mr. Gibson and Dr. Fitzgerald (not pictured).

Figure 19: View of the shoreline on May 11 with Dr. Kott holding an Elktoe found on top of the vegetation, likely displaced from the river during a recent rain storm. Mr. Gibson is also visible.

3.7 Analysis of Mussel Shells

Mussel shells included for this analysis were collected from five different areas of the woodland on October 13 and October 16, 2020, as well as when found along shorelines upstream and downstream of the Bridge (hereinafter, Areas 1 to 5; Figure 21). In addition, mussels were located during March 2021 from Areas 1 to 5. As a complement, mussel shells collected from Area 6 during visits from March to May of 2021 were excluded from this analysis as a result of their distance from the Bridge (~225 m). The majority of mussel shells were broken in half, with only a limited number including both the left and right halves of the shell. All collected mussel shells were documented to be free of flesh, and were likely displaced into the woodland as a result of seasonal flooding. A single live mussel was collected during surveys in April, 2021 and was gently placed back in the River into sand sediment with a water depth of ~30 cm.

Figure 21: View of the five different areas from which mussel shells were collected. Collection of mussel shells was performed with a radius of approximately 10 m surrounding each marker.

Prior to identification, each mussel shell was washed and given a unique number code (Figure 22). Mussels shells were then identified based on the length, presence and type of pustules/nodules, presence of ridges, type of rays, type of beak sculpture, presence of a dorsal wing, type and formation of teeth (lateral and interdental), and shell colour. Identification was aided through the use of the digital Canadian Freshwater Mussel Guide and the accompanying Clam Counter App, both created in partnership by the Toronto Zoo, and Fisheries and Oceans Canada.

Figure 22: View of a portion of the mussel shells collected from the woodlands in proximity to the Bridge Street Bridge in 2020. Collected mussels were first washed and given a unique number and letter code before being identified.

It is prudent to note that a number of observations of freshwater mussel shells were documented on iNaturalist (Figure 23). The majority of these observations were made by Mr. Fraser Gibson between 2018 and 2020. Mr. Gibson is affiliated with WRN. During 2020 and 2021, Staff from ELM communicated with Mr. Gibson to learn more about the Site and to gain a more complete set of observations regarding the mussels, spanning over multiple past seasons. Relevant correspondence with Mr. Gibson has been included within Appendix B.

Figure 23: Summary of observations of freshwater mussels made by Mr. Fraser Gibson along the Nith River in proximity to the Bridge Street Bridge.

A total of 215 freshwater mussel shells were collected from the five areas within the woodlands located southeast of the Bridge and identified in-office following field studies in October of 2020. Of these 215 mussels, 98 of them were of a size where identification was possible (> 1 cm in shell length), while the remaining 117 were considered too small (< 1 cm) to properly discern identification features such as teeth, rays and ridges. Mussel shells collected from Area 6 during visits in March and April of 2021 were excluded from this analysis as a result of their distance from the Bridge (~225 m). A total of twelve (12) species were identified from the collected shells in combination with Mr. Gibson's records. All identified species were determined to be typical of the Grand River Watershed. Identified species were as follows:

- Giant Floater *(Pyganodon grandis*)
- Elktoe (*Alasmidonta marginata*)
- Flutedshell (*Lasmigona costata)*
- Fatmucket (*Lampsilis siliquoidea*)
- Creeper (*Strophitus undulatus*)
- Cylindrical Papershell (*Anodontoides ferussacianus*)
- Creek Heelsplitter (Lasmigona compressa)
- Black Sandshell (*Ligumia recta*)
- Spike (*Eurynia* dilatata)
- Fragile Papershell (*Leptodea fragilis*)
- Wavy-rayed Lampmussel (*Lampsilis fasciola*)
- Rainbow (*Villosa iris*)

Lengths of mussels were observed to vary significantly from area to area, with the largest shells located within collection areas closer to the river, with lengths observed to decrease with increasing distance between the collection area and Bridge. Species were documented to range in shell length from 13.9 cm (maximum) to less than 1 cm, often only a few millimeters (minimum). The smallest length of mussel in when the species was identified was 1.3 cm. It is also prudent to note that some shells were unable to be identified as a result of being too worn or too broken. A summary of the results are within Table 6.

Table 6: Summary of shell length by area, with shell maximums, minimums, and averages noted.

Area No.	No. of Shells Collected	Maximum/Minimum (Average) Length of Identifiable Shells*
0**	3	13.5/11.1 (12.8)
1	57	13.9/2.8 (8.0)
2	7	8.2/4.3 (6.4) (6.4)
3	76	9.6/1.3 (3.9) (66 shells < 1 cm length)
4	47	10.8/2.1 (5.4) (36 shells < 1 cm length)
5	15	N/A (<1cm) (15 shells < 1 cm length)

* - Identifiable shells were determined to be those measuring above 1 cm in length, with discernable identification features (i.e. nodules, ridges, rays, teeth, etc.)

** - Area 0 includes shells collected from shorelines upstream and downstream of the Bridge Street Bridge.

3.8 Green Dragon

Specimens of Jack-in-the-pulpit (*Arisaema triphyllum*), a plant very similar to Green Dragon, were found by Dr. Kott on May 11 within 30 m of the river shoreline, 200+ m downstream of the proposed bridge construction area. This area was in close proximity to the area with high numbers of freshwater mussels. Then on May 12, Mr. Gibson found two specimens of Green Dragon near this Jack-in-the-pulpit, and other Green Dragon specimens are suspected in the area. Generally, these Green Dragon are considered as far from the proposed bridge construction area and are very likely not to be disturbed in the future.

Figure 20: View of a Jack-in-the-pulpit, found approximately 30 m from the shoreline on May 11. A subsequent visit by Mr. Gibson located a Green Dragon in close proximity to this Jack-in-the-pulpit on May 12. The Green Dragon specimen is located about 200+ m from the proposed bridge work area. A total of two Green Dragon specimens were in this area by Mr. Gibson but due to the cool weather and recent frost at night, it is possible that other specimens may also emerge in the coming weeks with warmer temperatures.

4.0 DISCUSSION

Studies during the last calendar year provided the opportunity to document and learn about the natural habitats around the Bridge Street Bridge Site. This documentation and learning identified a diverse array of plants and wildlife exist in these habitats. The study also documented the presence of SAR birds, fish, and mussels in the general area as well as on-Site. These efforts also revealed the agriculture and natural habitats on-Site do not include the presence of wetlands managed by the GRCA. With this basis, the following discussion of findings focuses on the plants and wildlife identified in proximity to, or on-Site. This focus includes considerations of appropriate environmental management strategies available to avoid or reduce disturbance on plants and wildlife during the proposed future replacement of the bridge.

4.1 Species At Risk

Observations from the desktop study documented potential habitat on-Site occupied by different types of SAR on-Site as well as within upstream and downstream areas. This documentation led to the completion of the field inspection to determine the likelihood and potential for SAR to be present on-Site. The SAR identified within the desktop review and field inspection included: Greater Redhorse, Black Redhorse, Silver Shiner, Rainbow Mussel, Wavy-rayed Lampmussel, Snapping Turtle, Midland Painted Turtle, Eastern Hog-nosed Snake, Bald Eagle, Barn Swallow, Black Ash, Butternut, Green Dragon, Little Brown Bat, Eastern Small-footed Myotis, and Tri-Coloured Bat. This section now addresses presence/absence for each of the SAR of concern.

Aquatic species such as Greater Redhorse, Black Redhorse, and Silver Shiner, were determined to be potentially present on-Site following the desktop review. Although no fish surveys were completed as part of field inspections, appropriate aquatic habitat for these fishes was observed. For example, the Nith River at this location includes various areas of water less than 2 m deep, with suitable substrate (sand and gravel) for use by Black Redhorse (MECP, 2019b). Given the presence of this habitat, it is entirely possible, if not likely that these species are in fact present at the Site. Due to the assumed presence of these species, specifically, Black Redhorse and Silver Shiner, it will be necessary to register the project with MECP and develop appropriate strategies for mitigation in order to minimize impacts to these species. Appropriate mitigation strategies are discussed further in Section 5.1.

The possible presence of SAR Rainbow Mussel and Wavy-rayed Lampmussel was also documented at the Site. Similar to the case with fishes, no in-water mussel surveys were completed as part of field inspections. However, the presence of mussels within this section of the River was concretely confirmed based on observations and collection of mussel shells from within the nearby woodland. It has been hypothesized that these mussels, along with sediments, were displaced from in-water areas located in proximity to the Bridge as a result of past flooding events. Although only common mussel species were identified from the collected shells, this is thought to be representative of the portions of species within the River, thus since these SAR mussels are rare within the watershed, it is also expected to be rare to find a displaced shell from these mussels within the woodland. Due to the assumed presence of these species, it will be necessary to register the project with MECP and develop appropriate strategies for mitigation in order to minimize impacts to these species. Appropriate avoidance and mitigation strategies are discussed further in s. 5.1.

The presence of Midland Painted Turtle, Snapping Turtle and candidate turtle nesting habitat was documented during the desktop review, as well as with the field inspection. It is prudent to note that Midland Painted Turtle has not been observed near the Site in more than 30 years, leading this species to be assumed absent. However, Snapping Turtle was observed in 2019, indicating it is likely present in proximity to the Site. Although no Snapping Turtles were observed, it is inferred they could possibly exist as areas near the bridge, implying it possible that turtle nesting also occurs in this area. While these two turtles are currently designated as Special Concern and therefore not afford extensive protection under the ESA, it is prudent to identify avoidance and mitigation, in order to avoid disturbance of specimens and habitats. Appropriate avoidance and mitigation strategies are discussed further in Section 5.1.

Desktop review also identified Eastern Hog-nosed Snake as a potential SAR present in proximity to the Bridge. Eastern Hog-nosed Snake was most recently documented at the Site in 1944, over 30 years ago. As there are no more recent documented observations of this species, it is likely no longer present in proximity to the Site, therefore is considered absent from the Site for the purposes of this review. With this in mind, hibernacula suitable for use by snakes was documented approximately 50 m from the western abutment on the southern side. While SAR Eastern Hog-nosed Snake has been deemed likely absent from the Site, it remains possible that species of no conservation concern utilize this hibernacula. However, this habitat is unlikely to be disturbed as a result of its distance from the bridge structure, indicating that snakes are also unlikely to be disturbed as a result of on-gong activities at the Site.

Bald Eagle was observed flying overhead during field inspections, however since no large stick nests were documented within the surrounding woodlands, this species was assumed to just be passing over, possibly searching for forage. While it is possible that Bald Eagle are nesting within surrounding woodlands, no nests were observed in proximity to the Bridge, indicating that any nests are sufficiently distant from the Bridge and will not be disturbed in the case they do exist. Thus Bald Eagle is not nesting in the area.

Barn Swallow are known to use human structures for nesting. Field inspections documented the presence of six Barn Swallow nest the underside of the Bridge. While no Barn Swallow themselves were observed, likely as a result of the inspection taking place in the autumn season, the presence of nests provides evidence of the use of the bridge by Barn Swallow. Based on this, the project will require registration with MNRF, as required by the ESA. For this Site, the SAR Barn Swallow are not expected to be disturbed by the proposed bridge replacement as a result of obligations set out as part of the project’s registration. Appropriate mitigation strategies are discussed further in Section 5.1.

Field inspections did not document the presence of any suitable habitat for myotis within proximity to the Bridge. While the presence of large specimens of Crack Willow were documented downstream of the Bridge, these did not appear appropriate for use by SAR myotis (i.e., no visible hollow sections or small holes to be used for entrance). In the past, a common practice in Ontario was to plant Crack Willow along the shorelines of rivers, streams, and lakes, as a low cost means to enhance the woody vegetation community, improve runoff, and enhance soils. Another consideration is the Crack Willow is a hybrid and does not produce viable seeds, so it was inferred to not represent a hazard to ecosystems (Pross and Lambert, 1967). In the unlikely chance that these trees are being utilized by SAR myotis, they exist at distance from the Bridge and are therefore unlikely to be disturbed regardless. It is possible that more suitable habitat for myotis exists within the surrounding woodland, however none were observed, indicating that they also exist at a distance from the Bridge and will not be disturbed. Thus, Little Brown Bat, Eastern Small-footed Myotis, and Tri-Coloured Bat should be considered absent from the Site.

Field inspections documented the presence of Common Milkweed, a plant which is vital to the life process of Monarch. Common Milkweed was predominantly documented within the areas of upland terrestrial vegetation, located on along the northwest shoreline, upstream of the Bridge. Although no Monarch themselves were observe, likely as a result of the time of year the field inspections were completed, based on the presence of this habitat, Monarch should be assumed present in proximity to the Site, however unlikely to be disturbed. Monarch are not expected to be disturbed by the proposed bridge replacement as a result of the distance presence between the upland terrestrial areas and the Bridge, however since Monarch is an extremely mobile species and could possibly pass through the boundaries of the work area, appropriate mitigation strategies are discussed further in Section 5.1.

A few specimens of Black Ash were observed on the south western banks of the Nith River approximately 30 m downstream of the Site. However, these stems are not expected to be disturbed as a result of proposed activities, as a result of this spatial separation. That is, the 30 m distance between the bridge area and the woodland is expected to act as a buffer to environmental impacts on Black Ash. As this is a sessile species, it is also unlikely that Black Ash will become further established closer to the Site prior to the commencement of construction activities. Additionally, it expected that BMPs will be implemented to protect all tree species in proximity to the Bridge, as reviewed in Section 5.1. For these reasons, Black Ash has been confirmed as present in proximity to the Bridge, however absent from the Site.

Field inspections did not document the presence of any Butternut or Green Dragon within 120 m of the Bridge. As these are sessile species, it is also unlikely they will become established at the Site prior to the commencement of construction activities. It is also expected that BMPs will be implemented to protect all tree species in proximity to the Bridge, as reviewed in Section 5.1. For these reason, Butternut and Green Dragon are assumed absent from the Site.

In summary, due to the noted environmental features documented during the desktop review and field inspections, species have been determined as present or absent from the Site as follows:

- Greater Redhorse, Black Redhorse, and Silver Shiner – Assumed present at the Site, based on presence of appropriate habitat in combination with SAR records. As a result of the requirement for in-water work, it will be necessary to register the project with MECP and avoid disturbance.
- Rainbow Mussel and Wavy-rayed Lampmussel - Assumed present at the Site, based on presence of appropriate habitat in combination with SAR records. The discovery of shells of both species in the flood plain implies they are in the river. Hence, due to the need for in-water work, it will be necessary to register the project with MECP and develop appropriate strategies to avoid disturbance of mussels in the river with suitable mitigation.
- Snapping Turtle – Possibly present upstream of the Site, due to the presence of appropriate nesting habitat. Appropriate mitigation strategies will be implemented to ensure this species is unable to enter the Site and will therefore not be disturbed as a result of on-Site activities.
- Midland Painted Turtle – Absent from the Site but could migrate to the Bridge. Appropriate mitigation strategies will be implemented to ensure this species, similar to Snapping Turtle, is unable to enter the Site and will therefore not be disturbed as a result of on-Site activities.
- Eastern Hog-nosed Snake - Absent from the Site, due to the lack of recent observation record of this species in proximity to the Bridge. Mitigation strategies implemented for the protection of Snapping Turtle will also act to protect other non-SAR amphibians and reptiles from the work area.

- Bald Eagle – Absent from the Site but could migrate in area during spring or autumn. Determination of absence due to the lack of stick nests observed on tall trees or other structures within 120 m of the bridge. It is possible that this species nests further upstream/downstream, however nests would remain undisturbed as a result of their distance from the Bridge.
- Barn Swallow – Confirmed to be present at the Site, based on presence of appropriate habitat in combination with SAR records. As a result of the requirement for in-water work, it will be necessary to register the project with MECP and develop appropriate strategies for mitigation.
- Little Brown Bat, Eastern Small-footed Myotis, Tri-Coloured Bat – Absent from the Site due to the lack of suitable habitat for myotis within proximity to the Bridge. In the unlikely chance that these trees are being utilized by SAR myotis, they exist at distance from the Bridge and are therefore unlikely to be disturbed regardless.
- Monarch - Possibly present upstream of the Site, due to the presence of Common Milkweed upstream of the Bridge. Appropriate mitigation strategies will be implemented to ensure this species will therefore not be disturbed as a result of on-Site activities.
- Black Ash - Present in surrounding woodland, however absent from the Site and therefore unlikely to be disturbed. Mitigation strategies will be implemented to protect all tree species.
- Green Dragon – specimens found > 200 m from the bridge. Due to this location, these specimens can be considered spatially separated from a future work area. At this time, it is unclear how many specimens exist in this area downstream of the bridge and members of WRN are currently conducting a survey and will share such information in the future.
- Butternut – no specimens found within 120 m of the bridge work area. It is inferred that this tree is likely absent, as very few Black Walnut exist in the flood plain woodland.
- Possible migratory SAR (e.g., birds) use the bridge area during spring and autumn seasons. Such transient species can be excluded from a future work area and thereby avoid disturbance.

4.2 Flooding Patterns

Based on field visits completed in early March, in combination with past evidence of a major flooding event occurring in 2018, it may be concluded that the Nith River is prone to seasonal flooding within proximity to the Bridge Street Bridge. Seasonal flooding was documented to act as a continual method of natural disturbance within both the watershed and adjacent woodlands. As discussed, large amounts of sediments and gravel have been, and will likely continue to be, deposited into the woodland, causing extreme scour and displacing freshwater mussels in the process. In ELM's opinion, this seasonal disturbance may be considered much more damaging to the woodland, and occurring over a much larger area, than activities occurring at the Bridge for construction would likely ever cause to adjacent areas. It is with this in mind that the implementation of suitable BMPs and tailored mitigation strategies will likely be sufficient to ensure that no further disturbance to the woodland is created as a result of the proposed Bridge replacement.

Field inspections identified the extensive nature of the flood plain associated with the Site. This flood plain extends upstream and downstream of the bridge and corresponds to areas used for agriculture, fallow fields, or natural flood plain forest. Within this mosaic of habitats upstream and downstream of the bridge, plant species classified as hydrophilic (i.e., water loving) and commonly found in wetlands are evident. However, these hydrophilic plants do not form wetlands, due to past agricultural uses of these lands as well as the seasonal flooding that disturbs these habitats on an annual basis. Due to no defined wetlands on-Site, the GRCA policies concerning wetland management is not applicable to these habitats or the Site.

The documentation of the increasing water levels after a rainstorm demonstrates that this portion of the Nith River is extremely prone to episodic flooding in addition to seasonal flooding. It is expected that after even minimal amounts of precipitation (i.e. a couple mm), flooding downstream of the Bridge occurs to some capacity. This repetitive occurrence of flooding along the shorelines, and sometimes into the adjacent woodlands, works to continually disturb the woodlands, creating large areas of scour and debris deposition. Furthermore, this flooding acts as a continuing form of natural disturbance to the freshwater mussel community within the Nith River. Following the receding of the seasonal flooding on March 27, mussel shells were again be trapped on shorelines and floodplains, creating the continual presence of freshwater mussel shell graveyards in proximity to the Bridge. It is expected that this process of receding and deposition, as well as of continuing disturbance to the woodlands, is therefore a reoccurring pattern within this portion of the River as a result of both seasonal and episodic flooding patterns causing the repetitive deposition of mussel shells along the shorelines of the Nith River.

4.3 Fishes

Available information identifies that a diverse fish community exists in the Nith River near the Site. For this proposed project, it should be feasible to use timing windows and other activities such as BMPs to reduce the disturbance of fish habitat. Such BMPs would include fish removal and release from the work area in the future, to avoid harm to fish specimens. In addition, the habitat enhancements that will occur along the shoreline in the future can be expected to represent improvements to the existing habitat features. For example, a wide area around the east bridge abutment shows extensive erosion with concrete debris and garbage in the shallow water. In addition, the west shoreline also shows erosion around the bridge abutments along with numerous bags of cement that exist on top of the native mud and rocks in the river. The future construction will enhance both of these shoreline areas representing a benefit to the native fishes. It will be also necessary to post the area as no fishing during the construction period, as it is a popular area for citizen anglers. This posting for no-fishing will represent a reasonable safety measure for the Site.

4.4 Freshwater Mussels

Surveys of the shoreline areas near the Site resulted in the identification of more than twelve (12) species of freshwater mussels. These results reflect past citizen science records and surveys during this study. These results reflect a study area from along the river shoreline to > 100 m within the flood plain forest. Based on these records and identifications, a number of assumptions may be made regarding the makeup of the mussel community within the adjacent Nith River without doing a dedicated mussel survey or disturbing aquatic habitat.

It is hypothesized that the freshwater mussel species identified along the shoreline and within the flood plain forest are representative of the species within the Nith River. With that in mind, it may also be hypothesized that the ratio of different species within the mussel communities identified may also be representative of the species ratios within the mussel communities which still remain within the Nith River. For example, Fatmucket and Flutedshell were among the species most frequently identified within the collected shells, thus indicating that these may be the most readily observed in the case a mussel survey was completed within the Nith River near the bridge. This concept can be further extended to the low numbers of SAR Rainbow Mussel or Wavy-rayed Lampmussel, as only a very small number of these specimens were discovered. As noted earlier, these latter two species are of conservation concern, indicating low population numbers in natural habitats. This information does provide insight into the relative abundances of the different species, from common to SAR. These results confirm the pattern that SAR are present in the River in much lower proportions when compared with other mussel species. While this information does not necessarily provide the exact locations of mussels generally or SAR specifically, it does confirm the presence in this portion of the Nith River. This confirmation of presence represents clear justification to use careful planning to avoid and limit disturbance to freshwater mussels.

A key observation from this study is the continued deposition of mussels on to the flood plain following the spring freshet and then following major rain storms. Hence, these two processes represent meaningful mortality events for mussels. That is, mortality associated with seasonal spring freshet flooding and mortality associated with episodic rainstorms. Identification of mortality events during different parts of the calendar year act to provide context to identify strategies to avoid / limit mortality of freshwater mussels from the proposed bridge construction activities.

4.5 Invasive Vegetation

A number of herbaceous and woody invasive species were documented on-Site, many of which are considered harmful to the native vegetation communities. It is for this reason that ELM recommends the removal of a number of invasive species from the Site, including: Common Mullein, Wild Parsnip and Field Bindweed among others. It is ELM’s opinion that these species offer the greatest threat to native vegetation on-Site. Removal of these species should be completed by hand to ensure that surrounding native species are not harmed and that the seeds of non-native vegetation are minimally spread during the removal. Treatment should be completed in a two-step control method following construction. The first step should involve removal when noxious weeds are found at the start of construction. Then the second step is to remove them again after construction is completed. This approach will act to remove mature specimens and any that grow from seed, and provide multiple benefits to the Site.

5.0 ENVIRONMENTAL RECOMMENDATIONS

Based on the findings of the desktop review in combination with observations gathered during the field inspections, a number of environmental recommendations were developed in order to minimize the environmental impact of the proposed activity. Recommendations are discussed herein.

Preferred Approach for the Proposed Activity

With the information collected with this study, ELM recommends that future construction activities occur on the shoreline during July and August with in-water work starting after 1 September. If the in-water work for construction starts in September, it would involve habitat disturbance after all bird, fish, mussel, and turtle species have completed reproduction for the year. If in-water work is completed after 1 September, the progeny of all noted wildlife species will be sufficiently mobile to avoid any disturbance on-Site. Despite the absence of defined wetlands near the bridge, these plant communities do provide habitat to varied wildlife. For this reason alone, BMPs to reduce disturbance on vegetation communities should also be applied during future proposed activities. If construction occurs during autumn, it will correspond to the low water period of the calendar year, and facilitate an efficient process to inspect and possibly clear the work area along the shorelines of any freshwater mussels that could occur in these shallow water habitats.

5.1 Applicability of Government Regulations to the Proposed Activity

With the completion of desktop literature review, field inspections, ecological inventory studies, ELC mapping, and analysis of all available information, it is feasible to identify the government regulations that apply directly to the proposed activity. With the foregoing information in mind, the following interpretation of the requirements for government regulations is presented:

1. GRCA *Wetlands Policy* – no wetlands identified near the Site. However, use of BMPs and timing windows justified to avoid disturbance of plant communities along the Nith River shoreline;

2. *Migratory Bird Treaty Act* – use timing windows to avoid disturbance of birds;

3. Ontario's *Endangered Species Act* – use timing windows and BMPs to avoid and/or reduce disturbance to SAR birds, fish, mussels, plants, turtles, and other wildlife species;

4. Ontario's *Fish and Wildlife Conservation Act* – use timing windows and BMPs to avoid and/or reduce disturbance to common fish and wildlife species. This regulation also includes the need for maintenance of fish and wildlife migration pathways; and,

5. Ontario PPS under *Planning Act* – use timing windows and BMPs to avoid and/or reduce disturbance to common fish and wildlife species and associated habitats. This regulation also includes the need for maintenance of fish and wildlife migration pathways.

5.2 Recommendations for Species At Risk

Field studies suggest a number of SAR are present or likely present on-Site or in proximity to the Site and will require the implementation of avoidance and mitigation strategies to ensure they are not disturbed as a result of on-Site activities. The following SAR that will require specific mitigation approaches include: fish (Greater Redhorse, Black Redhorse, and Silver Shiner), freshwater mussels (Rainbow Mussel and Wavy-rayed Lampmussel), turtles (Midland Painted Turtle, Snapping Turtle), bird (Barn Swallow), and insect (Monarch). For this group of species, standard avoidance and mitigation strategies exist that can be applied to avoid and reduce disturbance within the study area. This strategy will include:

- Timing windows for birds, fish, freshwater mussels, turtles, and vegetation removal;
- Active surveys in the river just before construction followed by translocation of specimens;
- Application of BMPs to exclude specimens from the work area; and
- Use of rehabilitation methods along the shoreline and within the Nith River.

A summary of SAR species on-Site not requiring follow-up surveys are included with Table 7.

Table 7: Summary of the recommendations provided by ELM for future survey efforts for SAR specimens and SAR candidate habitat.

SAR Species	Recommendations for future SAR surveys
Greater Redhorse, Black Redhorse, and Silver Shiner	Both fish species inferred to exist in the river. Propose that the project use timing windows and exclusion strategies to avoid interactions and mitigate habitat disturbance. **No additional SAR surveys are recommended.**
Rainbow Mussel and Wavy-rayed Lampmussel	Studies during the last year demonstrate more than 12 mussel species in the area of the Bridge. Such study in the last year demonstrated the presence of Rainbow Mussel and Wavy-rayed Lampmussel in this area as well. We propose that the project use timing windows and exclusion strategies to avoid interactions and mitigate habitat disturbance. We also propose that the work area along the shoreline near the construction area be screened for mussels using standard methods prior to habitat disturbance during the low water period of late summer – early autumn.
Snapping Turtle	Possibly present upstream of the Site, unlikely to be disturbed. Specimens will be unable to access construction area due to the presence of physical barriers, such as the erosion control fencing, therefore no interaction possible or expected between turtles and activities. **No additional SAR surveys are recommended.**
Midland Painted Turtle	Absent from the Site, as no recent records of this species exist in proximity to the Bridge. **No additional SAR surveys are recommended.**
Eastern Hog-nosed Snake	Absent from the Site, as no recent records of this species exist in proximity to the Bridge. **No additional SAR surveys recommended.**
Bald Eagle	Absent from the Site, however possibly nesting along river, although none observed. Unlikely to be disturbed, a result of the distance these nests would exist from the Bridge. Mitigation Strategies and BMPs will be implemented in order to assure no surrounding natural areas are disturbed as a result of the proposed activities. **No additional SAR surveys recommended.**
Barn Swallow	Present at the Site, unlikely to be disturbed. The original Bridge will be netted prior to the commencement of the bird breeding season, to ensure no nests are present on the Bridge at the time of demolition. A compensation nesting structure will be installed to ensure that Barn Swallow looking to nest in the area still have adequate habitat. **No additional SAR surveys recommended.**
Myotis (Little Brown Bat, Eastern Small-footed Myotis, Tri-Coloured Bat)	Absent from the Site, however possibly present in surrounding woodlands. Unlikely to be disturbed, as no suitable habitat was observed to exist for upwards of 30 m from the Bridge.

	Mitigation and BMPs will be implemented in order to assure no surrounding natural areas are disturbed as a result of the proposed activities. **No additional SAR surveys recommended.**
Monarch	Possibly present upstream of the Site, unlikely to be disturbed. Areas of Common Milkweed exist at a distance from the Bridge, as well as mitigation strategies will be implemented to ensure that this species is not disturbed as a result of on-Site activities. **No additional SAR surveys recommended.**
Black Ash	-Absent from the Site, present in surrounding woodlands. Unlikely to be disturbed, the only specimen observed exists upwards of 30 m from the Bridge. As this is a sessile species, it is also unlikely to become established closer to the Bridge prior to expected construction. Mitigation and BMPs will be implemented in order to assure no surrounding natural areas are disturbed as a result of the proposed activities. **No additional surveys recommended.**
Butternut	Absent from the Site. No Butternut were observed within 120 m of the Bridge during 2020 field inspections. As these are sessile species, it is also not likely to become established at the Bridge prior to the construction period, making it unlikely to be present or disturbed. **No additional SAR surveys are recommended.**
Green Dragon	Specimens found by F. Gibson of WRN located > 200 m from proposed construction area. Hence, no Green Dragon were observed within 120 m of the Bridge during 2020 field inspections. As these are sessile species, it is also not likely to become established at the Bridge prior to the construction period, making it unlikely to be present or disturbed. **No additional SAR surveys are recommended.**

5.2 Recommendations for Species At Risk, continued:

Fishes

The literature review and field studies confirm the presence of SAR fishes on-Site, specifically, Black Redhorse and Silver Shiner, likely both upstream and downstream of the bridge in the Nith River. With this confirmation of the presence of SAR fishes, this project will be registered with the MECP. This future registration is required, as the habitat near the bridge is used by both of these SAR fishes. It is expected that most disturbance of the fish specimens can be avoided through the use of activity timing windows. For example, exclude activity to the time of year when these fish are not actively spawning and all specimens can be excluded from the work areas.

Mussels

The literature review and field studies confirm the presence of SAR mussels on-Site, specifically Rainbow Mussel and Wavy-rayed Lampmussel, likely both upstream and downstream of the bridge in the Nith River. With this confirmation of the presence of SAR mussels, this project will be registered with the MECP. This future registration is required, as the habitat near the bridge is used by both of these SAR mussels. It is expected that most disturbance of the mussel specimens can be avoided through the use of activity timing windows during the low water season. For example, exclude activity to the time of year when the river water is shallow enough to allow for physical and visual searching of the benthic substrate. Then if a mussel is found, move the mussel specimen away from the fish are not actively spawning and all specimens can be excluded from the work areas.

As SAR freshwater mussels, specifically, Rainbow Mussel and Wavy-rayed Lampmussel, were documented to be present in the Nith River in proximity to the Bridge, this project will likely need to be registered with the MECP. However, if the future methods applied to the work demonstrate no risk to the mussels in the river, then it may be possible to avoid registration of the activity.

Barn Swallow

As Barn Swallow were observed nesting on the underside of the Bridge, this project will be registered with the MECP. In preparation for the Bridge removal, it is recommended that fine-mesh netting be placed over the whole Bridge in order to limit bird nesting on the structure prior to the construction period. This ensure that no migratory birds, including Barn Swallow, will be disturbed during the Bridge removal. Furthermore, this registration requires the construction of compensation habitat within 1000 m of the Bridge. Based on this, ELM proposes the construction of a four-post nesting structure. It is recommended that the structure soffit stand at a minimum of 2.8 metres (~ 9 feet) above the ground and contain an aluminum predator guard on each leg of the artificial habitat. Nest cups should be constructed along the interior beams of the structure. The design of the alternative nest structure and the nest cups conform to the standard designs approved in the past for use by MNRF.

Following the 2021 breeding season for Ontario birds (after August 31), a follow up inspection should be completed to ensure the artificial nest structure is functioning as designed. Furthermore, during this future inspection any nest cups occupied by Barn Swallow will be recorded in future monitoring activities. If other birds are using nest cups, this ancillary information will also be reported. It is expected that follow up monitoring of the structure will be required for a period of three years per Ontario's ESA.

Monarch

As it is possible that Monarch will be present in proximity to the Site, specially within areas including upland terrestrial vegetation, during the proposed activities, it is appropriate to implement mitigation strategies on-Site to ensure that this species and habitat will not be disturbed. While it is unlikely that Common milkweed itself with be disturbed, as Monarch is a transient species, a key aspect of these strategies will be the development of an on-Site protocol which may be implemented in the case that a Monarch enters the work area. For example, in the case that a Monarch stops over on a piece of equipment, use of said equipment should be halted immediately until the species has passed as to ensure that it is not harmed. In addition, the use of sediment erosion control fencing will act to protect any stems of Common Milkweed present in surrounding natural areas. This fencing is not only expected to provide protection from sedimentation but will act as a barrier to keep individuals working on-Site from stepping into, or storing equipment within natural areas that potential contain Milkweed specimens.

Turtles

Although not officially protected under the ESA, Snapping Turtle could possibly exist in the Nith River, using nesting habitat located upstream of the Bridge. Hence, it is appropriate to apply BMPs during the construction period, in order to exclude any turtles from the work area and to help minimize impact on the surrounding environmental as a result of on-Site activities (as reviewed in s. 5.5). A key aspect of these BMPs will be the use of erosion control fencing surrounding the entirety of the work area for the duration of the project. Such use of erosion control fencing will ensure that dirt and debris is not entering Nith River as well as neighboring natural areas, such as the surrounding woodlands. The use of erosion control fencing will also create a physical barrier of entrance to the Site, therefore establishing a level of protection for some terrestrial and semi-aquatic SAR such as amphibians and reptiles, as well as other wildlife that may reside in the area. It is also recommended that this fencing be installed prior to April 1st, as to ensure that no SAR or other wildlife may enter the work area prior to the commencement of the project following their hibernation periods.

5.3 Recommendations for Common Fish and Birds

For the proposed construction activities, it is inferred the use of standard activity windows will allow for the avoidance of disturbance to non-SAR fish during the active reproduction period. In addition, the use of standard activity windows is also expected to allow for the avoidance of disturbance to non-SAR breeding birds during the active reproduction period.

5.4 Recommendations for Vegetation

Following the removal of a number of non-native weeds from the Site as recommended in Section 4.5, it is necessary to replant native herbaceous and woody species in different areas. These areas include: the northwest quadrant, the northeast quadrant, the southwest quadrant, and the southeast quadrant. A prudent observation was presence of native plants found in wetlands with no well-defined wetlands present. This absence of wetlands is likely due to past and current agriculture and the seasonal flooding regime. Hence no recommendations for wetland enhancement are included herein.

After the non-native weeds are removed, it will be necessary to add topsoil to the slope in areas where plants were previously removed as part of the construction of the new Bridge Street Bridge structure and for associated equipment laydown areas. Newly placed soil should be mixed with peat moss and disked to offset the potential impacts caused by ground compression by heavy machinery. Following the addition of topsoil, it is then recommended that the slope be hydroseeded as soon as feasible with an OSC mixture. Native seed mixtures such as "Low Maintenance Retention Basin Native Seed Mixture"[1], which contains seeds for species such as Virginia Wild Rye (*Elymus virginicus*), Ticklegrass (*Agrostis scabra*), Fox Sedge (*Carex vulpinoidea*) and Fowl Bluegrass (*Poa palustris*), or "Creek Bank Native Seed Mixture (Wet Meadow Type)"[2], which contains seeds for species such as Big Bluestem (*Andropogon gerardii*), Black Eyed Susan (*Rudbeckia hirta*), Bottlebrush Grass (*Elymus hystrix*), Fowl Bluegrass (*Poa palustris*), Fowl Manngrass (*Glyceria striata*), Fox Sedge (*Carex vulpinoidea*), and New England Aster (*Aster novae-angliae*) are recommended. It is expected that the use of a native wet-meadow type seed mixture will best suit the area, given the frequency of seasonal flooding patterns.

1- https://www.oscseeds.com/product/low-maintenance-retention-basin-native-mixture-8220/
2- https://www.oscseeds.com/product/bank-native-mixture-wet-meadow-type-8215/

Following hydroseeding, ideally it will occur as soon as feasible after bridge construction. It is then recommended that tree planting occur. Additional details on the exact locations of tree planting will be determined following guidance from the Township of Wilmot. Under this scenario, it is expected that tree planting will likely be completed at a 1:1 compensation ratio for woody stems removed during construction activities. The specific location of where compensation plantings could occur has not been discussed, however, pending final detailed design. It is expected that suitable woody stems may include Crack Willow, Shagbark Hickory, Bur Oak, Silver Maple, and Red Osier Dogwood. It is therefore recommended that KSAL will inform ELM of the nature of the future landscape plan, at which time a more detailed list of appropriate species, as well as a specific number of trees recommended for replanting can be determined.

To summarize, it is the opinion of ELM that the following tasks be completed:

1. Control non-native weeds growing on-Site. This control should include removal completed through the construction period. This will involve removal of non-native herbaceous species by hand;
2. The placement of topsoil and moss in areas disturbed by construction activities;
3. Hydroseeding. Hydroseeding should be completed using a native seed mixture, immediately following the removal of non-native species and placement of soil in proximity to the Bridge, and;
4. Plant native trees on-Site, to compensate for removal of native woody stems. Planted trees require fencing, to reduce the risk of herbivory and increase survival.

5.5 Recommendations for Wildlife

Wildlife habitat exists in proximity to the Site and within adjacent areas along the river. It is expected the recommendations presented to protect SAR will also benefit common wildlife species. In addition, the removal of invasive vegetation and the completion of follow-up planting will act to both protect non-SAR wildlife and SAR wildlife habitat during the proposed construction activities, as well as enhance wildlife habitat in proximity to the Bridge following construction. The removal of invasive species during these activities will aid in allowing native vegetation to thrive in proximity to the Bridge, while the compensation planting of native tree species and native seeds is expected to enhance the promotion of native species along the shoreline. It is expected that with careful environmental management during, and following the proposed activities, construction of the new Bridge Street Bridge may actually benefit the area for these reasons. It is also expected that the use of BMPs and developed mitigation strategies, such as erosion control fencing will protect wildlife communities present in proximity to the Nith River in addition to SAR.

During the field inspection, evidence of recreational fishing activities were observed. While this area may be considered somewhat rural, as it is expected that this area is used frequently for recreational fishing activities, it is recommended that additional health and safety measures be considered to protect individuals that may be in close proximity to the Bridge Street Bridge construction zone. Additional considerations may include the increased presence of warning signage, blocking entrance or area with a perimeter fence to limit access where possible, and ensuring that no access to commercial machinery is possible.

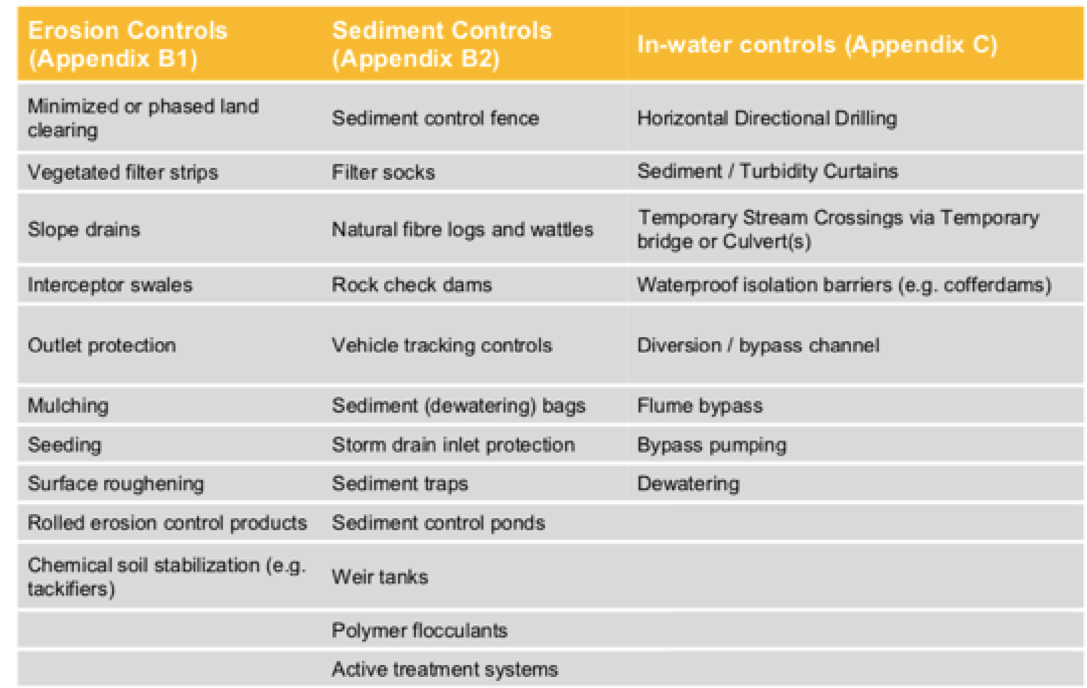
5.6 Review of BMPs available for Future Use

As a preamble to the next phase of this study, the following BMPs are recommended for possible implementation on- Site. These recommendations follow standard guidance (e.g., TRCA, 2019). If the BMPs are implemented, they will likely reduce the possible negative effects from the proposed development. Standard BMPs for construction activities should be used to mitigate other types of disturbance on the environment prior to and during the proposed activities on-Site. Standard BMPs involve use of activities to eliminate, reduce, and otherwise manage vegetation, soil, dust, vehicle exhaust, water runoff, and spills. The use of these mitigation measures is expected to reduce the extent and duration of negative effects of proposed activities. These BMPs and mitigation measures are framed on a site-specific basis to reflect existing conditions and natural heritage features. In addition, other BMPs include the use of appropriate timing windows for removal of vegetation and disturbance of soils. These timing windows are defined by the MNRF. Staff on-Site should also visually inspect all BMPs when it will be inactive for several days, such as over weekends and holidays. Such inspections will help to prepare for rain events that may occur when workers are away. These planned preparation procedures will reduce risk of environmental disturbance. In the future, exact use of the BMPs will need to occur in conjunction with different phases of the proposed development, however basic sediment and erosion control measures have been outlined within Table 8, obtained from the “Erosion and Sediment Control Guide for Urban Construction” published in 2019 by the Toronto and Region Conservation Authority. It is expected that the use of these BMPs will result in the avoidance or reduction of disturbance on-Site. However, it is essential for proper timing of use of BMPs, to ensure they reflect seasonal constraints, such as high runoff events during autumn rains etc.

With this basis, the following BMPs are available for use:

- Completion of demolition activities throughout the winter months when the River is frozen over. This will work to expedite the cleanup process and minimize ground compaction as a result of heavy equipment use;
- Install sediment erosion fences around the entire work area prior to completion of any earthworks or construction activities. Such fences will act to reduce erosion and sediment transport from the work area into natural areas and also exclude wildlife species from the equipment and heavy machines used for the demolition activities. For example, these fences will prevent wildlife such as frogs or snakes from entering the area from the adjacent grassed slopes as well as limit wildlife such as turtles from entering the work area from the water-shoreline area;
- Regularly inspect the sediment erosion fences for damage. These inspections will ensure that no erosion is able to occur through damaged or non-functioning fencing. In addition, these inspections will identify if wildlife is able to enter the work area. In the case that SAR turtles migrate to the demolition area, a qualified biologist should be contacted to remove these species;
- Ensure no refueling of vehicles occurs near the watercourse. It is appropriate to refuel vehicles or equipment at a distance of 30 m from surface waters;
- Install spill containment devices around ground drains located in proximity to the work area, to prevent spills draining to the drainage creek and subsequently into the Nith River;
- Develop a clean equipment protocol that involves the decontamination or washing of equipment prior to entering the Site or changing areas on-Site. This will help to limit the transferring of invasive vegetation through seed to the Site.

Table 8: Summary of basic sediment and erosion control measures to be implemented during construction on-Site to reduce risk of environmental disturbance. Table obtained from the “Erosion and Sediment Control Guide for Urban Construction” published by the TRCA in 2019.



Erosion Controls (Appendix B1)	Sediment Controls (Appendix B2)	In-water controls (Appendix C)
Minimized or phased land clearing	Sediment control fence	Horizontal Directional Drilling
Vegetated filter strips	Filter socks	Sediment / Turbidity Curtains
Slope drains	Natural fibre logs and wattles	Temporary Stream Crossings via Temporary bridge or Culvert(s)
Interceptor swales	Rock check dams	Waterproof isolation barriers (e.g. cofferdams)
Outlet protection	Vehicle tracking controls	Diversion / bypass channel
Mulching	Sediment (dewatering) bags	Flume bypass
Seeding	Storm drain inlet protection	Bypass pumping
Surface roughening	Sediment traps	Dewatering
Rolled erosion control products	Sediment control ponds	
Chemical soil stabilization (e.g. tackifiers)	Weir tanks	
	Polymer flocculants	
	Active treatment systems	

5.6.1 Timing Windows for BMPs

With the information derived from the desktop review, it is feasible to present a strategy that will generally allow for the avoidance and mitigation of disturbance for habitat, wildlife, and SAR from the proposed activity. This allowance to avoid and mitigate disturbance is predicated on careful timing of activities through use of BMPs. With this approach, it allows for activity to occur whereby habitat and specific wildlife will not be disturbed. If this approach is not followed within the set schedule, it will require either a deferral of activities for one calendar year, to meet the schedule requirements or the completion of additional field surveys. These schedule requirements are now presented in Table 9.

Table 9: Recommended use of BMPs to allow for avoidance and mitigation of disturbance for habitat, wildlife, and SAR.

Species of Concern	Recommended BMP Activity	Required Schedule	Comments
Turtles and Amphibians	Install sediment fences for work area, along edge of the tributary, and around laydown area in early spring	By April 1	If sediment fence is not used to isolate the work area and laydown area by April 1, turtles will enter the work area, requiring work to halt and a certified biologist to be notified.
	Install spill containment devices	Prior to heavy machinery entering the Site	If not installed prior to heavy machinery entering the Site, accidental spills that may occur have the potential to drain into the tributary, contaminating and damaging natural areas. Responsible parties will then be held liable for cleanup.
Monarch	Development of an on-Site protocol for when Monarch enter the work area	By May 1	Monarchs begin to arrive back in Ontario throughout the late spring and early summer months. Therefore, protocols should be in pace prior to their potential arrival at the Site.
Non-native vegetation	Remove via hand picking or focal herbicide application	As soon as feasible after demolition completed	Presence of non-native vegetation in demolition area. This vegetation needs to be removed as soon as feasible. Otherwise, it will spread and result in further disturbance of the natural habitats on-Site.
Wildlife	Completion of demolition throughout the winter months when feasible	November – March	Completion of demolition during the winter months will expedite the cleanup process and minimize the amount of ground compaction resulting from heavy equipment use.
	Remove any specimens found in work area or laydown area	As soon as feasible	If SAR are found in the work area or laydown area, it may be necessary to contact MNRF.

The findings from this study are framed within the Statement of Limitations in Appendix C.

6.0 LITERATURE CITED

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Appendix A

Representative Photographs

Photo No. 1

Date: October 13, 2020

Description: View, looking west, of the Bridge Street Bridge and Nith River.

Photo No. 2

Date: October 13, 2020

Description: View, looking east, of the Bridge Street Bridge and Nith River.

Photo No. 3

Date: October 13, 2020

Description: View, looking southeast, from the western abutment.

Photo No. 4

Date: October 13, 2020

Description: View, looking east, from the south side of the western abutment.

Photo No. 5 **Date:** October 13, 2020 **Description:** View, looking south, from the south side of the western abutment.	

Photo No. 6 **Date:** October 13, 2020 **Description:** View of woody debris present near the southern side of the western abutment. Woody debris was present 3-5 metres up the undercut bank from the Nith River.	

Photo No. 7	
Date: October 13, 2020	
Description: View of the southeastern bank, from the southwestern bank.	

Photo No. 8	
Date: October 13, 2020	
Description: View of the Bridge Street Bridge from the western bank, downstream.	

Photo No. 9	
Date: October 13, 2020	
Description: View of a number of Crack Willow and Hybrid Willow, present downstream of the Bridge along the western bank.	

Photo No. 10	
Date: October 13, 2020	
Description: Another view of a number of a Willow, present downstream of the Bridge along the western bank.	

Photo No. 11	
Date: October 13, 2020	
Description: View of Arrow-leaved Aster (*Symphyotrichum urophyllum*), documented along the southwestern bank.	

Photo No. 12	
Date: October 13, 2020	
Description: Another view of the Bridge from the southwestern bank of the Nith River.	

Photo No. 13	
Date: October 13, 2020	
Description: View of woody debris present on top of a south-facing rocky slope along the edge of Bridge Street, approximately 20 m west of the Bridge.	

Photo No. 14	
Date: October 13, 2020	
Description: Another view of woody debris present on top of a south-facing rocky slope along the edge of Bridge Street, approximately 20 m west of the Bridge.	

Photo No. 15	
Date: October 13, 2020	
Description: View of a culvert, present in proximity to the south-facing rocky slope present along the edge of Bridge Street. This culvert likely allows the safe passage of wildlife under Bridge Street.	

Photo No. 16	
Date: October 13, 2020	
Description: Another view of a culvert, present in proximity to the south-facing rocky slope present along the edge of Bridge Street. This culvert likely allows the safe passage of wildlife under Bridge Street.	

Photo No. 17

Date: October 13, 2020

Description: View of sedges, documented within the Cultural Woodland, located southwest of the Bridge. Sedges are moisture tolerant species and therefore indicate that waterlogged soil previously existed in this location.

Photo No. 18

Date: October 13, 2020

Description: View of a stump sprouting Black Ash (*Fraxinus nigra*) tree. The original Black Ash appears to have been cut and taken by beavers.

Photo No. 19

Date: October 13, 2020

Description: Another view of a stump sprouting Black Ash tree. The original Black Ash appears to have been cut and taken by beavers.

Photo No. 20

Date: October 13, 2020

Description: View of an especially shallow area of water, present along the western bank of the River. The shallow area was documented to contain predominately well-sorted, fine silt material as well as leafy debris.

Photo No. 21

Date: October 13, 2020

Description: Another view of an especially shallow area of water, present along the western bank of the River. The shallow area was documented to contain predominately well-sorted, fine silt material as well as leafy debris

Photo No. 22

Date: October 13, 2020

Description: View, looking downstream (south), from the western bank of the Nith River.

<table>
<tr><td>Photo No. 23</td><td rowspan="3"></td></tr>
<tr><td>Date: October 13, 2020</td></tr>
<tr><td>Description: Another view of an especially shallow area of water, present along the western bank of the River. The shallow area was documented to contain predominately well-sorted, fine silt material as well as leafy debris</td></tr>
</table>

<table>
<tr><td>Photo No. 24</td><td rowspan="3"></td></tr>
<tr><td>Date: October 13, 2020</td></tr>
<tr><td>Description: View of a number of solidified concrete bags and large boulders documented to be covering the River floor in proximity to the western abutment of the Bridge.</td></tr>
</table>

Photo No. 25	
Date: October 13, 2020	
Description: Another view of a number of solidified concrete bags documented to be covering the River floor and along the banks in proximity to the western abutment of the Bridge.	

Photo No. 26	
Date: October 13, 2020	
Description: Another view of a number of solidified concrete bags and large boulders documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 27

Date: October 13, 2020

Description: View of the underside of the Bridge Street Bridge.

Photo No. 28

Date: October 13, 2020

Description: Another view of a number of solidified concrete bags, large boulders and sheeting documented to be covering the River floor in proximity to the western abutment of the Bridge.

Photo No. 29	
Date: October 13, 2020	
Description: View, looking upstream, from the western abutment.	

Photo No. 30	
Date: October 13, 2020	
Description: A closer view of sheeting documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 31	
Date: October 13, 2020	
Description: Another view of a number of solidified concrete bags, large boulders and sheeting documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 32	
Date: October 13, 2020	
Description: Another view of a number of solidified concrete bags documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 33	
Date: October 13, 2020	
Description: View of the eastern abutment, from the western abutment.	

Photo No. 34	
Date: October 13, 2020	
Description: View of some aquatic vegetation, observed growing in proximity to the northern side of the western abutment.	

Photo No. 35

Date: October 13, 2020

Description: View of vegetation present along the slope on the northern side of the western abutment.

Photo No. 36

Date: October 13, 2020

Description: View of a large specimen of Wild Parsnip (*Pastinaca sativa*), documented in proximity to the western abutment. Staff member, Jessica Zadori, standing beside for scale.

Photo No. 37

Date: October 13, 2020

Description: View, looking upstream, of vegetation along the western bank of the Nith River.

Photo No. 38

Date: October 13, 2020

Description: View of an area with a sharp drop, documented in proximity to the western abutment (north side). It is hypothesized that this represents a tile drain, draining from a nearby agricultural field.

Photo No. 39	
Date: October 13, 2020	
Description: View of the Bridge Street Bridge, looking southeast, from the northern side of the western abutment.	

Photo No. 40	
Date: October 13, 2020	
Description: View of Reed Canary Grass (*Phalaris arundinacea*), documented to dominant vegetation communities along the western bank, upstream of the Bridge.	

Photo No. 41 **Date:** October 13, 2020 **Description:** View, looking along the boundary of a field looked in proximity to the Bridge. Approximately 8 m of vegetation separate this field from the Nith River.	

Photo No. 42 **Date:** October 13, 2020 **Description:** View of a large are of Canada Goldenrod (*Solidago canadensis*), documented to dominate vegetation communities, upstream of the Bridge.	

Photo No. 43

Date: October 13, 2020

Description: Another view of a large are of Canada Goldenrod and Common Milkweed (*Asclepias syriaca*), documented to dominate vegetation communities, upstream of the Bridge.

Photo No. 44

Date: October 13, 2020

Description: Another view of a large are of Canada Goldenrod and Common Milkweed, documented to dominate vegetation communities, upstream of the Bridge.

Photo No. 45	
Date: October 13, 2020	
Description: View of the northeastern bank, from the northwestern bank. A small gravelly area is visible near the center of the River. This area may represent candidate habitat for turtle nesting.	

Photo No. 46	
Date: October 13, 2020	
Description: View of the northeastern bank, from the northwestern bank.	

Photo No. 47	
Date: October 13, 2020	
Description: View of the northeastern bank, from the northwestern bank. This photograph demonstrates how shallow and clear much of the River is.	

Photo No. 48	
Date: October 13, 2020	
Description: View of a drainage culvert, documented upstream of the Bridge Street Bridge.	

Photo No. 49

Date: October 13, 2020

Description: Another view of a drainage culvert, documented upstream of the Bridge Street Bridge.

Photo No. 50

Date: October 13, 2020

Description: Another view of a drainage culvert, documented upstream of the Bridge Street Bridge. Sediment in the culvert may be described as well-sort, very fine silt.

Photo No. 51

Date: October 13, 2020

Description: Another view of a drainage culvert, documented upstream of the Bridge Street Bridge. Sediment in the culvert may be described as well-sort, very fine silt.

Photo No. 52

Date: October 13, 2020

Description: View of a Green Frog (*Rana clamitans*), observed swimming from the Nith River, towards the upstream drainage culvert.

Photo No. 53	
Date: October 13, 2020	
Description: View of Velvetleaf (*Abutilon theophrasti*), and Green Foxtail Grass (*Setaria viridis*), documented along the western bank of the River, in proximity to the drainage culvert.	

Photo No. 54	
Date: October 13, 2020	
Description: View of a shallow area along the bank of the Nith River. This area was documented to contain very fine, well-sorted silt sediments.	

Photo No. 55

Date: October 13, 2020

Description: View of an area of standing water, present upstream of the Bridge and drainage culvert. Standing water appears to be a result of runoff originating from a nearby soybean field.

Photo No. 56

Date: October 13, 2020

Description: View of another patch of Giant Ragweed (*Ambrosia trifida*). This patch is located in proximity to the standing water, upstream of the culvert and Bridge.

Photo No. 57

Date: October 13, 2020

Description: Another view of an area of standing water, present upstream of the Bridge and drainage culvert. Standing water appears to be a result of runoff from a nearby soybean field. In this photo, Dr. Fitzgerald holds up a single stalk of Purple Loosestrife (*Lythrum salicaria*).

Photo No. 58

Date: October 13, 2020

Description: Another view of an area of standing water, present upstream of the Bridge and drainage culvert. Standing water appears to be a result of runoff originating from a nearby soybean field. In this photo, Dr. Dean Fitzgerald holds up a stalk of Wild Parsnip.

Photo No. 59

Date: October 13, 2020

Description: View, looking west, alongside the soybean field located upstream of the Bridge in proximity to the western bank of the River.

Photo No. 60

Date: October 13, 2020

Description: View, looking west, across a nearby hay field. The slope in the background of the photo represents the edge of the floodplain.

Photo No. 61

Date: October 13, 2020

Description: Another view, looking west, across a nearby hay field. The slope in the background of the photo represents the edge of the floodplain.

Photo No. 62

Date: October 13, 2020

Description: View of Common Mullein (*Verbascum thapsus*), documented along the driveway, leading off Bridge Street and into the hay field, located northwest of the Bridge.

Photo No. 63

Date: October 13, 2020

Description: View looking east, from atop the western abutment, along Bridge Street.

Photo No. 64

Date: October 13, 2020

Description: View of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.

Photo No. 65	
Date: October 13, 2020	
Description: View of a freshwater mussel shell, found within a pile of sediment located within the Cultural Woodland in proximity to the southeastern bank. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding	

Photo No. 66	
Date: October 13, 2020	
Description: Another view of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.	

Photo No. 67

Date: October 13, 2020

Description: Another view of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.

Photo No. 68

Date: October 13, 2020

Description: View of the woodland, located along the southern side of Bridge Street, in proximity to the eastern bank of the Nith River. This area is the property of WRN.

Photo No. 69	
Date: October 13, 2020	
Description: Another view of the woodland, located along the southern side of Bridge Street, in proximity to the eastern bank of the Nith River. This area is the property of Waterloo Nature. A large amount of woody debris is visible, likely a result of past flooding events.	

Photo No. 70	
Date: October 13, 2020	
Description: Another view of the woodland, located along the southern side of Bridge Street, in proximity to the eastern bank of the Nith River. This area is the property of the Waterloo Nature. A large amount of debris is visible, likely a result of past flooding events.	

Photo No. 71 **Date:** October 13, 2020 **Description:** Another view of the woodland, owned by Waterloo Nature.	

Photo No. 72 **Date:** October 13, 2020 **Description:** View of the eastern abutment, looking upstream. At the time of the field inspection, the abutment was not submerged.	

Photo No. 73

Date: October 13, 2020

Description: Another view of the eastern abutment, looking upstream. At the time of the field inspection, the abutment was not submerged.

Photo No. 74

Date: October 13, 2020

Description: View of vegetation along the slope present along the northern side of the eastern abutment.

Photo No. 75	
Date: October 13, 2020	
Description: View of the vegetation, present along the northeastern bank of the Nith River.	

Photo No. 76	
Date: October 13, 2020	
Description: Another view of the vegetation, present along the northeastern bank of the Nith River.	

Photo No. 77	
Date: October 16, 2020	
Description: View, looking west, of the Bridge Street Bridge.	

Photo No. 78	
Date: October 16, 2020	
Description: View, looking upstream, from the edge of Bridge Street.	

Photo No. 79

Date: October 16, 2020

Description: View, looking upstream, from the Bridge Street Bridge.

Photo No. 80

Date: October 16, 2020

Description: View, looking downstream, from the Bridge Street Bridge.

Photo No. 81	
Date: October 16, 2020	
Description: View of a stem of Giant Ragweed (*Ambrosia trifida*), located in proximity to the northwestern abutment.	

Photo No. 82	
Date: October 16, 2020	
Description: View, looking east, from the south side of the western abutment. Water depth (Transect 1) was measured across the River, just under the southern edge of the Bridge Street Bridge.	

Photo No. 83	
Date: October 16, 2020	
Description: View, looking east, from the western bank of the Nith River approximately 30 m downstream of the Bridge Street Bridge. Water depth (Transect 4) was measured across the River at this location.	

Photo No. 84	
Date: October 16, 2020	
Description: View of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.	

Photo No. 85

Date: October 16, 2020

Description: Another view of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.

Photo No. 86

Date: October 16, 2020

Description: View of sedges, documented within the Cultural Woodland, located southeast of the Bridge. Sedges are moisture tolerant species and therefore indicate that waterlogged soil previously existed in this location.

Photo No. 87	
Date: March, 26, 2021	
Description: View of collecting sediment and sand within the nearby woodland. Sediment and sand was likely deposited during past seasonal flooding events	

Photo No. 88	
Date: March, 26, 2021	
Description: View of Area 6, a floodplain located approximately 225 m downstream from the Bridge. Vegetation is visibly flattened in the direction of flowing water as a result of past seasonal and episodic flooding.	

Photo No. 89

Date: March, 26, 2021

Description: View of mussel shells deposited along the banks of the downstream floodplain (Area 6). Mussel shells were collected for in-office identification.

Photo No. 90

Date: March, 27, 2021

Description: Another view of the woodland in proximity to the Bridge. Areas of deposited sticks, trunks, and vegetation are visible as a result of past flooding.

Photo No. 91

Date: March, 27, 2021

Description: View of Area 6 following an overnight rain event. Water depth was documented to be upwards of 45 cm off the bank, fast flowing and turbulent.

Photo No. 92

Date: April 1, 2021

Description: Another view of Area 6, following the receding of water from episodic flooding. Vegetation appears flattened in the direction that the water was flowing.

Photo No. 93	
Date: April 1, 2021	
Description: Another view of Area 6, slightly upstream of the floodplain area. This area appeared to be at least a meter higher in grade than the floodplain, however was documented to still experience episodic flooding patterns.	

Photo No. 94	
Date: April 1, 2021	
Description: View of more mussel shells, deposited following another recent flooding event.	

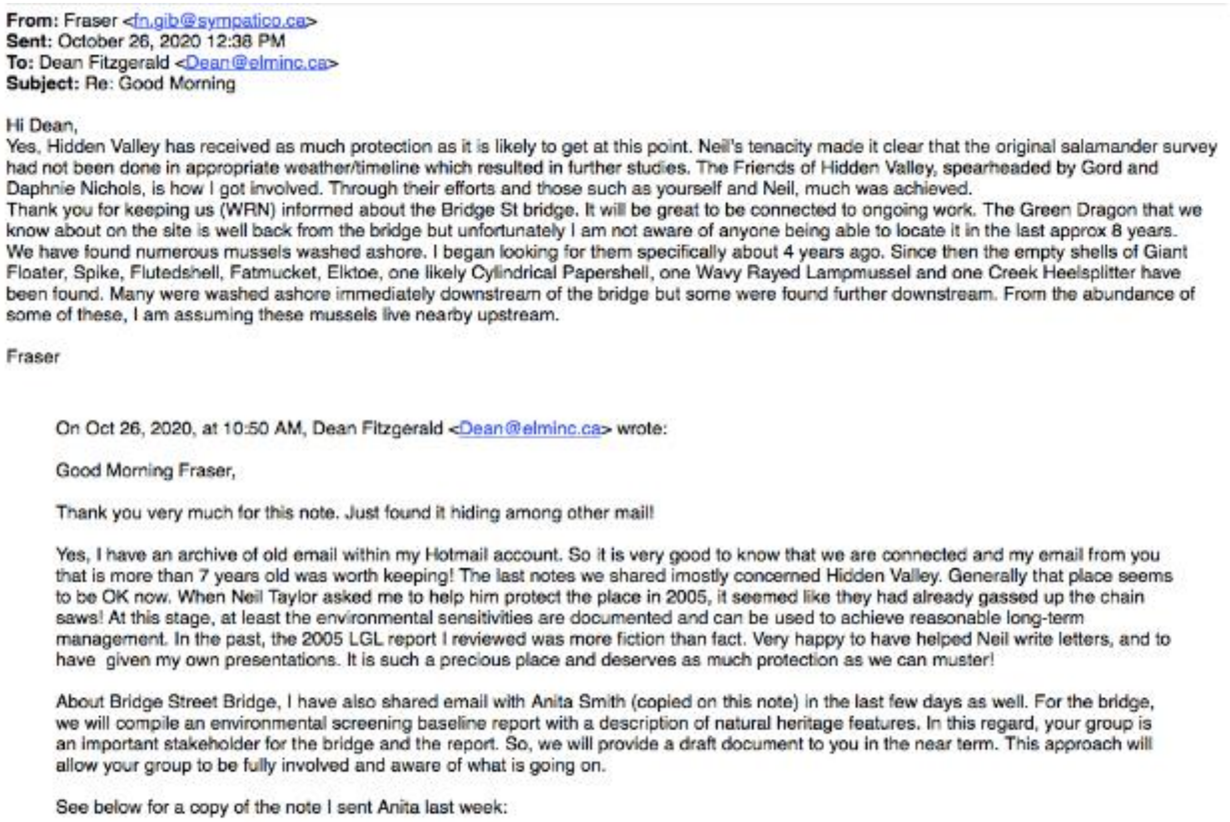
Photo No. 95	
Date: April 21, 2021	
Description: View of Dr. Fitzgerald on a small grassed island just offshore. This area was previously completed overcovered by flowing water.	

Photo No. 96	
Date: April 21, 2021	
Description: View of a Flutedshell mussel, found during surveys completed on April 21, 2021.	

<table>
<tr><td>Photo No. 97</td><td rowspan="3"></td></tr>
<tr><td>Date: May 11, 2021</td></tr>
<tr><td>Description:
View of Area 6 on May 11, following the spring growth of vegetation. Water appeared lower on this day, and limited mussels shells were found in comparison to previous survey dates.</td></tr>
</table>

Appendix B

Relevant Correspondence with Waterloo Region Nature



From: Fraser <fn.gib@sympatico.ca>
Sent: October 26, 2020 12:38 PM
To: Dean Fitzgerald <Dean@elminc.ca>
Subject: Re: Good Morning

Hi Dean,
Yes, Hidden Valley has received as much protection as it is likely to get at this point. Neil's tenacity made it clear that the original salamander survey had not been done in appropriate weather/timeline which resulted in further studies. The Friends of Hidden Valley, spearheaded by Gord and Daphnie Nichols, is how I got involved. Through their efforts and those such as yourself and Neil, much was achieved.
Thank you for keeping us (WRN) informed about the Bridge St bridge. It will be great to be connected to ongoing work. The Green Dragon that we know about on the site is well back from the bridge but unfortunately I am not aware of anyone being able to locate it in the last approx 8 years.
We have found numerous mussels washed ashore. I began looking for them specifically about 4 years ago. Since then the empty shells of Giant Floater, Spike, Flutedshell, Fatmucket, Elktoe, one likely Cylindrical Papershell, one Wavy Rayed Lampmussel and one Creek Heelsplitter have been found. Many were washed ashore immediately downstream of the bridge but some were found further downstream. From the abundance of some of these, I am assuming these mussels live nearby upstream.

Fraser

> On Oct 26, 2020, at 10:50 AM, Dean Fitzgerald <Dean@elminc.ca> wrote:
>
> Good Morning Fraser,
>
> Thank you very much for this note. Just found it hiding among other mail!
>
> Yes, I have an archive of old email within my Hotmail account. So it is very good to know that we are connected and my email from you that is more than 7 years old was worth keeping! The last notes we shared imostly concerned Hidden Valley. Generally that place seems to be OK now. When Neil Taylor asked me to help him protect the place in 2005, it seemed like they had already gassed up the chain saws! At this stage, at least the environmental sensitivities are documented and can be used to achieve reasonable long-term management. In the past, the 2005 LGL report I reviewed was more fiction than fact. Very happy to have helped Neil write letters, and to have given my own presentations. It is such a precious place and deserves as much protection as we can muster!
>
> About Bridge Street Bridge, I have also shared email with Anita Smith (copied on this note) in the last few days as well. For the bridge, we will compile an environmental screening baseline report with a description of natural heritage features. In this regard, your group is an important stakeholder for the bridge and the report. So, we will provide a draft document to you in the near term. This approach will allow your group to be fully involved and aware of what is going on.
>
> See below for a copy of the note I sent Anita last week:

Another topic for the bridge that I want to discuss with you and Anita (and Waterloo Region Nature) concerns the freshwater mussels in the river. For this bridge, it represents a unique challenge, since the freshwater mussels are currently upstream but I have not observed one near the bridge area; not even found a shell at all (after four visits of walking in the river). A key challenge for our work is to provide an explanation of baseline mussel distribution and then to explain how we will avoid and limit disturbance in the bridge area during construction. At this time, myself and Dr. Kott both feel the bridge creates a unique situation where the mussels are washed downstream or in to the woodland. We discussed this process while we stood on the roadway when we met you and the group. Indeed, you mentioned as we stood on the road a list of mussels you identified in the past, attributable to the flood. My feeling is that we need to include a section in the baseline report that documents how flooding regularly displaces mussels downstream and the constriction of the river in combination with the river bend (also called thalweg) causes the mussels to be directed downstream or in to the flood plain forest. Hence, the observation of mussels around the bridge and the deposition of gravel, sand, and silt in this area as well. Let me explain this another way: we need to state to MECP where the mussels are and why we did not see any around the bridge. If we provide a detailed response, based on my observations and your historical context, then it will be more readily understood by the MECP folks.

If you are willing to help us explain the distribution of freshwater mussels around the bridge, I am willing to take this activity one step further. That is, due to the unique situation, I think it is justified to try to publish this natural heritage knowledge. The context would be the opportunity for learning due to the ownership of the woodland and observation of annual or bi-annual flooding. These floods create the learning whereby mussels are naturally displaced in to the flood plain forest and thereby represent a random sample of the mussels evident in the river. So, we could write a manuscript focused on mussel survey results with very little in-water survey efforts. I think the Canadian Field Naturalist or other ecology-themed conservation journal would publish such a manuscript. The data would come from the mussel shells we saw around the bridge and combine these observations with your list of species already available. If you are willing to go down this opportunity, my gut feeling is that we would also survey the woodland next spring, after any 2021 flood (if it happens), to have a recent example of observations close to the flood event.

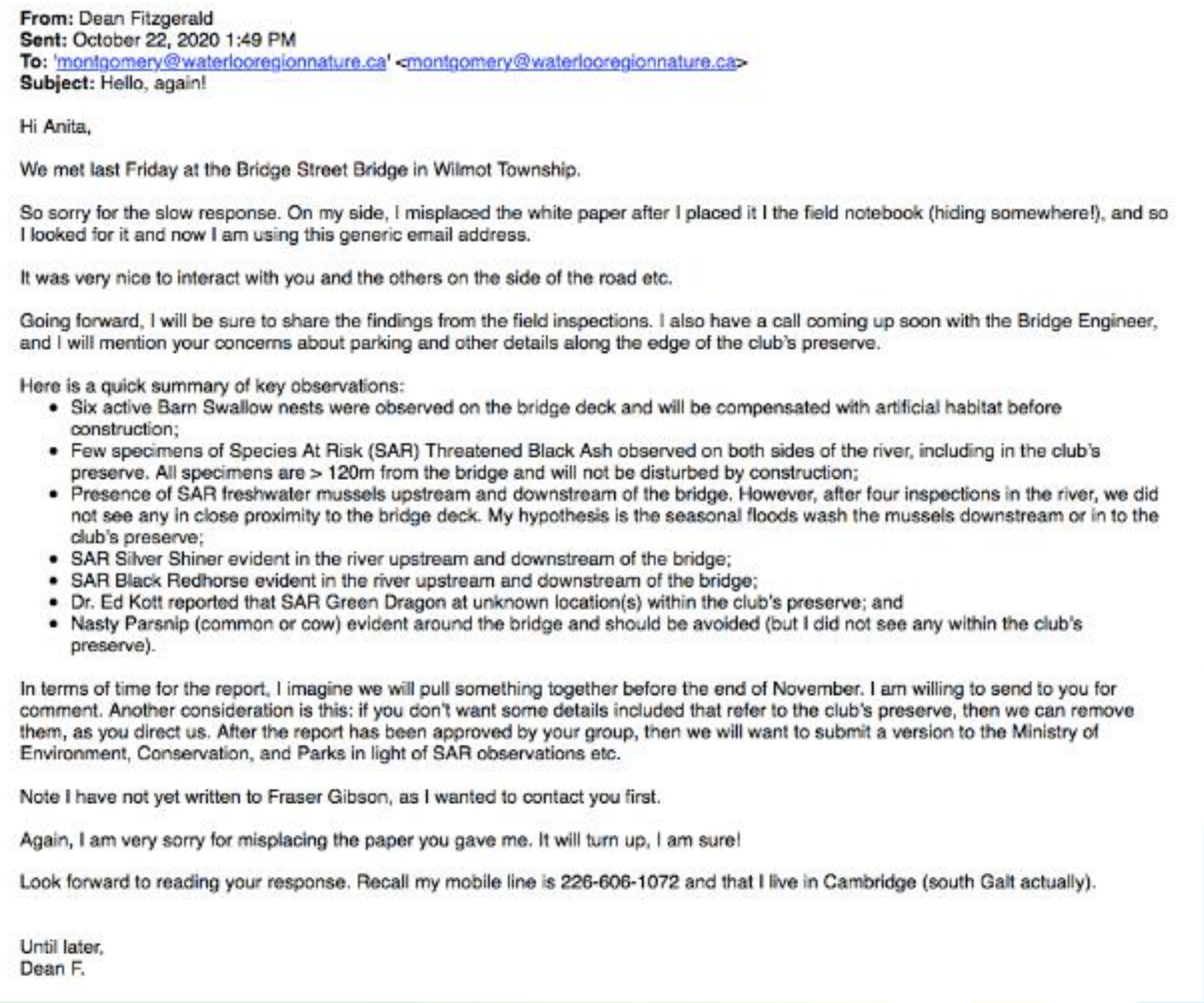
What do you think of the idea of writing a manuscript concerning the freshwater mussels? I mention it now, as we could use information from the baseline study that we will write as the core content of the manuscript. But we cannot do such without direct approval of your group. Plus, we would also engage Dr. Kott, to provide independent validation of the identity of the mussel shells we have handy.

I will leave this note at this stage, pending your response.

Look forward to reading your response.

Until later,
Dean F.

Dean Fitzgerald, M.Sc., Ph.D.
Senior Ecologist
Director of Environmental Services| ELM Inc.



From: Dean Fitzgerald
Sent: October 22, 2020 1:49 PM
To: 'montgomery@waterlooregionnature.ca' <montgomery@waterlooregionnature.ca>
Subject: Hello, again!

Hi Anita,

We met last Friday at the Bridge Street Bridge in Wilmot Township.

So sorry for the slow response. On my side, I misplaced the white paper after I placed it I the field notebook (hiding somewhere!), and so I looked for it and now I am using this generic email address.

It was very nice to interact with you and the others on the side of the road etc.

Going forward, I will be sure to share the findings from the field inspections. I also have a call coming up soon with the Bridge Engineer, and I will mention your concerns about parking and other details along the edge of the club's preserve.

Here is a quick summary of key observations:

- Six active Barn Swallow nests were observed on the bridge deck and will be compensated with artificial habitat before construction;
- Few specimens of Species At Risk (SAR) Threatened Black Ash observed on both sides of the river, including in the club's preserve. All specimens are > 120m from the bridge and will not be disturbed by construction;
- Presence of SAR freshwater mussels upstream and downstream of the bridge. However, after four inspections in the river, we did not see any in close proximity to the bridge deck. My hypothesis is the seasonal floods wash the mussels downstream or in to the club's preserve;
- SAR Silver Shiner evident in the river upstream and downstream of the bridge;
- SAR Black Redhorse evident in the river upstream and downstream of the bridge;
- Dr. Ed Kott reported that SAR Green Dragon at unknown location(s) within the club's preserve; and
- Nasty Parsnip (common or cow) evident around the bridge and should be avoided (but I did not see any within the club's preserve).

In terms of time for the report, I imagine we will pull something together before the end of November. I am willing to send to you for comment. Another consideration is this: if you don't want some details included that refer to the club's preserve, then we can remove them, as you direct us. After the report has been approved by your group, then we will want to submit a version to the Ministry of Environment, Conservation, and Parks in light of SAR observations etc.

Note I have not yet written to Fraser Gibson, as I wanted to contact you first.

Again, I am very sorry for misplacing the paper you gave me. It will turn up, I am sure!

Look forward to reading your response. Recall my mobile line is 226-606-1072 and that I live in Cambridge (south Galt actually).

Until later,
Dean F.

Appendix C

Statement of Limitations

Statement of Limitations

For this study, the information, conclusions and recommendations given herein are specifically for the Client only and for the scope of work described herein completed at the Bridge Street Bridge in Township of Wilmot. The scope of work involves environmental screening for constraints based on a desk top review and focused field study. Hence, the findings from study may not be sufficient for other uses. ELM Inc. does not accept responsibility for this or other uses by third parties.

The data, conclusions and recommendations included within this report, and the quality thereof, are based on the scope authorized by the Client. Note however, that no scope of work, no matter how exhaustive, can identify all environmental constraints, environmental contaminants or all conditions above and below ground that may exist. For example, environmental observations may differ across survey dates. Hence, conditions may differ from those encountered in the investigation. Similarly, flood zone features may vary dramatically from year to year even when the site in question is not mapped as flood plain by government agencies. This report therefore cannot warrant that all conditions on or off the site are presented by those identified at specific locations on the focal inspection date. Also, Species At Risk migrate and could possibly enter the site boundaries at any time, and could have been missed by this review and field survey. Any recommendations and conclusions provided that are based on conditions or assumptions reported herein will inherently include any uncertainty associated with those conditions or assumptions. In fact, many aspects involving professional judgment such as habitat available for Species At Risk, potential for Species At Risk to migrate to the site in question and follow up study recommendations inherently contain a degree of uncertainty that cannot be eliminated. This uncertainty should be managed by periodic review and refinement as additional information becomes available. The same challenges apply to wetland boundaries that change from one year to the next.

Note also that standards, guidelines and practice related to environmental investigations may change with time. Those which are applied at the time of this investigation may be obsolete or unacceptable at a later date. The scope of work and findings reported may not be sufficient to determine all of the factors that may affect construction or other on-site activities. Contractors bidding on future aspects of this undertaking should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the conditions may affect their work. Similarly, ELM Inc. cannot warranty the accuracy of information supplied by the Client regarding the legal boundaries of the site.

9.

LEGAL SURVEY REPORT

- Legal Survey Report prepared by McKechnie Surveying Limited dated November 24, 2020

85 McIntyre Drive
Kitchener, ON N2R 1H6
Tel: (519) 578-5570
email: plans@kwsurveys.ca

November 24, 2020
File 20-029

Allan Garnham, P. Eng
K. Smart Associates Limited

Re: Boundary Survey (No legal plan this time a sketch only is provided.)
Part of Bridge Street Between Tye Road and Puddicombe Road
Township of Wilmot
(Being part of the Road Allowance Between Concessions 3 and 4 Block A Township of Wilmot)
(Part of PIN 22204-0085(LT))
Also see Rev 0 Our Sketch Plan B0936 Sketch_01_20029 dated November 24, 2020.

Dear Alan,

We have completed the finding or setting of iron bars along the boundaries of Bridge Street approximately 300 metres either side of the Nith River, completing this portion of the project.

1. Please refer to the accompanying Sketch_01 (Rev 0 Our Plan B0936) for the position of the monuments. The point number and associated NAD83(CSRS) UTM Zone 17 coordinate indicate the locations of all found or set monuments.[1]
2. The coordinates within the autocad dwg file provided are NAD83(CSRS) UTM Zone 17 grid coordinates for overlay into your base plan.
3. If it can be presumed that the Nith River is a navigable body of water within the meaning of Beds of Navigable Waters Act, then its bed can be considered unpatented Crown land.
4. We have reviewed the crown patent (to the Canada Company) for Lot 21 Concession 3 Block A and Lot 21 Concession 4 Block A and it appears that no river shore line allowance was created by the patent – only the bed remains vested in the Crown if navigable.

Sincerely yours,

Jeff Talbot, OLS
McKechnie Surveying Ltd.

---

[1] The Association of Ontario Land Surveyors does not allow survey monuments to be shown on a "Sketch", so we utilize this letter with the Sketch to create clarity.

INTEGRATED SURVEY INFORMATION

COORDINATES ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS BY REAL TIME NETWORK (CAN-NET) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0)

DISTANCES HEREON ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999558

NOTE RE: SKETCHES IN GENERAL

- THE ASSOCIATION OF ONTARIO LAND SURVEYORS SEVERELY LIMITS THE TYPE OF INFORMATION THAT CAN BE SHOWN ON SKETCHES. AMONG OTHER THINGS, FOUND OR SET SURVEY MONUMENTS ARE NOT NOT PERMITTED ON SKETCHES, DIMENSIONS FROM STRUCTURES TO BOUNDARIES ARE NOT PERMITTED, AND BEARINGS ARE DISCOURAGED.

POINT NUMBER LEGEND TYPICAL – REFER TO ACCOMPANYING LETTER

CAUTION : THIS IS NOT A PLAN OF SURVEY AND SHALL ONLY BE USED FOR THE PURPOSE INDICATED IN THE TITLE BLOCK

SKETCH

PART OF BRIDGE STREET
BETWEEN TYE ROAD AND PUDDICOMBE ROAD
TOWNSHIP OF WILMOT
COUNTY OF WELLINGTON

METRIC

DISTANCES AND COORDINATES ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

REV. 0	NOV. 24/20	INITIAL DRAFT/FIELD WORK COMPLETED NOV. 4/20

McKECHNIE SURVEYING LTD.
SINCE 1982
85 McINTYRE DRIVE
KITCHENER, ONTARIO
N2R 1H6
TEL : (519) 578-5570
email : plans@kwsurveys.ca

FIELD: 20029\1_BASE_GROUND_UTM_BEARINGS
CADD : 20029\SKETCH_01
INTEGRATION: 20029\X_BASE_GRID_CSRS_2010

FOR : K. SMART ASSOCIATES LTD. AND THE TOWNSHIP OF WILMOT

CHECKED BY : JPT
DRAWN BY : J.T.
FILE No. 20-029
PLAN No. B0936

10.

HYDROLOGY REPORT

- Hydrology Report for Bridge Street Bridge (Bridge 34/B-T9) prepared by K. Smart Associates Limited dated November 2021

HYDROLOGY REPORT

BRIDGE 34/B-T9 REPLACEMENT
(BRIDGE STREET BRIDGE)

TOWNSHIP OF WILMOT

LOT 21, CONCESSIONS 3 & 4 (BLK A SGB)

NOVEMBER 2021
REVISED FEBRUARY 2022

K. SMART ASSOCIATES LIMITED
85 McIntyre Drive
Kitchener ON N2R 1H6

INDEX

November 2021
Revised February 2022

File No. 20-145

BRIDGE 34/B-T9 (BRIDGE STREET BRIDGE) REPLACEMENT
TOWNSHIP OF WILMOT
HYDROLOGY REPORT

1.0 INTRODUCTION

The Township of Wilmot intends to replace Bridge 34/B-T9 (Bridge Street Bridge). The existing bridge is a single span steel through truss supported on concrete abutments. It is estimated the structure was built in 1913. There is no record of any previous hydrology studies being done at this structure.

The purpose of this study is to ensure that the new structure would have adequate hydraulic capacity and no significant changes to the level of the Regional Storm will occur upstream of the proposed new structure.

2.0 LOCATION

Bridge 34/B-T9 (Bridge Street Bridge) is located on Bridge Street over Nith River, approximately 1.4 km west of Puddicombe Road at Lot 21 Concessions 3 & 4 (BLK A SGB), in the Township of Wilmot in the Region of Waterloo.

3.0 BACKGROUND INFORMATION AND REFERENCES

3.1 Background Information

The following background information was compiled to prepare this report

- 1:50,000 topographic maps for Brantford, Cambridge, Conestogo, Guelph, Lucan, Seaforth, St Marys, Stratford and Woodstock
- Soil maps for Oxford, Waterloo, Perth and Wellington Counties
- Record of flow from gauging station 02GA010 (Nith River near Canning) for the period 1913-2018
- Topographic engineering survey completed by KSAL in August 2020

3.2 References

The following references were consulted:

- MTO Drainage Management Manual
- Canadian Highway Bridge Design Code 2019
- MTO Highway Drainage Design Standards published January 2008

4.0 EXISTING CONDITIONS

4.1 Roadway Classification

Bridge Street is classified as a Rural Local Undivided with a design speed of 40 km/hr, otherwise known as RLU 40.

4.2 Watershed Characteristics

Area of Watershed = 629.6 km^2
Length of River = 84.49 km
Average Slope of Watershed = 0.093%
CN (AMC II) = 76.3
Time to Peak = 28.51 hrs

4.3 Existing Structure

The existing structure is a single span steel through truss bridge with a span of 46.0m and an overall width of 4.08m. The bridge was constructed in 1913.

The existing stream bed elevation is approximately 309.37 and the soffit elevation is 314.20. The total effective opening area of the structure is approximately 183.6 square metres.

The elevation of the low point of the roadway, to the east of the structure, is 314.38.

4.4 Waterway Adequacy

The opening area is adequate to pass the 10, 25, and 100 year design storms

4.5 Major Flood

After significant rainfall events and during the spring freshet, water is reported to be just below the soffit of the bridge and floods low lying areas on either side of the road.
There are no reports/concerns of water flowing over the roadway.

4.6 Relief Flows

The existing structure is located at the base of a hill. Relief flow is over the west roadway approach.

4.7 Existing Roadside and Structure Drainage

Runoff from the roadway is spills off the road and into low lying areas on either side of the road. Runoff eventually drains back into the river.

Runoff from the structure deck is directed to deck drains. These deck drains outlet directly into the river.

4.8 Upstream Structures

a) Approximately 5.0 km upstream, there is a 61.2m two span concrete girder bridge (Wilmot Bridge 25/B-R2) on Huron Road which was constructed in 2000.
Total Opening area = 234 m^2

b) Approximately 12.0 km upstream, there is a 32.9m single span concrete girder bridge (Wilmot Bridge 17/B-T13) on Holland Mills Road which was constructed in 2018.
Total opening area = 158.9 m^2

4.9 Downstream Structures

a) Approximately 1.2 km downstream, there is a 45.4m single span steel through truss bridge Wilmot Bridge 37/B-OXF and Blandford-Blenheim Bridge 3) on Oxford-Waterloo Road which was constructed in about 1913.
Total opening area = 135 m^2

b) Approximately 4.4 km downstream, there is a 59.5m three span concrete bridge (Blandford-Blenheim Bridge 4) on Township Road 14 which was constructed in 1965.
Total opening area = 254.4 m^2

5.0 ESTIMATED FLOWS

5.1 Flow Estimate Methods

The following methods were used to estimate the flows at this structure:

- Modified Index Flood Method
- Single Station Frequency Analysis
- OTTHYMO
- GRCA*

* Flows provided by GRCA to be used for HEC RAS analysis

5.2 Summary of Estimated Flows

Storm	**Method**	**Flows (m^3/s)**
10 Year	Modified Index Flood Method	183.5
	Single Station Frequency Analysis	72.9
	PCSWMM	--
25 Year	Modified Index Flood Method	223.7
	Single Station Frequency Analysis	315.7
	GRCA*	379.0
	PCSWMM	--
100 Year	Modified Index Flood Method	284.1
	Single Station Frequency Analysis	416.8
	GRCA*	522.0
	PCSWMM	--
Regional	Modified Index Flood Method	--
	Single Station Frequency Analysis	--
	GRCA*	923.0
	PCSWMM	961.2

* These flow rates have been provided by GRCA for use in HEC RAS.

5.3 Design Flows

Reference is made to "Highway Drainage Design Standards" to determine the return period for the normal design flood for this structure. Based on Bridge Street being classified as a local road and the proposed span exceeding 6.0m, a 25 year return period shall be used. A 100 year return period shall be used for the check flood for scour.

As the Nith River is a regulated watercourse, the Regional Storm shall also be considered.

As the data used to compile the flows for the Single Station Frequency Analysis is the most recent and up-to-date, these flow rates will be used. The flow rate generated from OTTHYMO produces the largest flow rate for the Regional Storm and it will be used. Therefore the design flows shall be:

$Q_{10} = 72.9\ m^3/s$
$Q_{25} = 315.7\ m^3/s$
$Q_{100} = 416.8\ m^3/s$
$Q_{REG} = 961.2\ m^3/s$

6.0 DESIGN CRITERIA

The ideal replacement structure would be such that the following design criteria are met:

a) The opening of the proposed structure shall be adequate to convey the estimated design flow for a 25 year design storm without causing any flooding.

b) Consideration of scour adjacent to spread or strip footings.

c) There should not be an increase in the level of the Regional flood plain. An increase of more than 100mm would be considered a significant increase.

d) High water at the 25 year design storm shall have an average vertical clearance of 300mm below the soffit of the proposed structure.

e) The roadway approaches may provide relief flow for storms greater than a 25 year event if the geometry of the roadway profile would permit.

f) The freeboard between the high water level and the low point of the proposed roadway shall not be less than 300mm.

g) A navigable clearance envelope of at least 5.0m wide by 2.4m tall.

h) A longitudinal road grade of at least 0.5% across the structure.

7.0 PROPOSED STRUCTURE

The proposed structure shall be as follows:

3 span semi-continuous slab-on-girder bridge (prestressed concrete box girders)
Construction type to be semi-integral abutment style
Foundation to be driven steel piles
Span = 70.874m (20.958, 28.958, 20.958m centre of bearings)
Skew = 20°
Stream bed elevation = 309.37 (same as existing)
Low soffit elevation = 314.45
Elevation of low point of roadway = 314.504
Effective total opening area = 272.5m^2
High water elevation at 25 year design storm = 313.01
Minimum clearance to soffit at 25 year design storm = 1440mm
Freeboard at 25 year design storm = 1494mm

8.0 ROADWAY IMPROVEMENTS

8.1 Horizontal Alignment

No changes to the horizontal alignment of Bridge Street are required. The current straight alignment is ideal.

The location of the new bridge, however, will be moved so that it is centred in the existing right-of-way.

8.2 Vertical Alignment

The vertical alignment of Bridge Street will be upgraded to an 60 km/hr design speed. This will involve raising the roadway overtop the structure to provide a 1.5% longitudinal grade and providing sag vertical curves to tie-in to the existing longitudinal roadway grades. The changes to the vertical alignment are limited to the roadway approaches on either side of the proposed new structure.

8.3 Cross-Section Elements

Bridge Street will be widened to provide 2 traffic lanes and shoulders over the structure and the roadway approaches adjacent to the structure. 2% cross-fall will be provided for positive roadway drainage, 1.5H to 1.0V sideslopes will be provided to support the roadway embankment and 1.5H to 1.0V backslopes will be used to tie-in to the existing ground. Roadway drainage will be provided by roadside ditches on both sides of Bridge Street Roadside ditches will drain towards the river.

9. SUMMARY OF HYDRAULIC ANALYSIS

Hydraulic analysis using hand calculations has been completed for both the existing and proposed conditions. For flows under and including the 100 design storm, the Open Channel Method of analysis has been used. For the Regional Storm, the Weir Flow Method was used to calculate flow overtop the roadway.

The table below shows a comparison for the existing and proposed conditions.

Location	**Storm Event**	**Flow m^3/s**	**High Water Elevation (m)**	
			Existing	**Proposed**
Bridge	10 Year	72.9	311.20	311.12
	25 Year	315.7	313.39	313.01
	100 Year	416.8	314.04	313.58
	Regional	961.2	315.80	315.86

For further details, see Appendix A.

The above table shows there is a decrease in the water level elevations at the flow rates considered except at the Regional Storm. At the Regional Storm, there is a slight increase in the water level elevation, however this is within the acceptable range.

In general the above table indicates that there would not be significant changes in the hydrology of the proposed conditions.

10. HEC RAS

At the request of Grand River Conservation Authority, HEC RAS modeling was completed for both the existing conditions and the proposed conditions. The table below shows a comparison for the existing conditions and proposed conditions.

Location	Flow (m^3/s)	High Water Elevation (m)		Velocity (m/s)	
		Existing	Proposed	Existing	Proposed
57.5m Upstream (Sta 37770)	379.0	313.43	313.33	2.11	2.10
	522.0	314.05	313.87	1.91	2.05
	923.0	315.98	315.14	1.53	2.08
Bridge (Sta 377712)	379.0	312.94	313.08	3.04	2.44
	522.0	313.26	313.48	3.76	2.91
	923.0	314.40	314.25	4.97	4.09
69.5m Downstream (Sta 37643)	379.0	312.96	312.94	2.15	2.01
	522.0	313.34	313.32	2.38	2.27
	923.0	314.18	314.15	2.83	2.76

For further details, see Appendix A

Overall, the HEC RAS modeling suggests a decrease in the upstream water levels up to the 100 year design storm as well as a decrease in the Regional storm water level. The HEC RAS modeling also confirms no change to the water levels downstream in terms of both elevation and velocity.

What is interesting to note is that the HEC RAS modeling seems to suggest a marked increase in water levels directly at the bridge for the 25 and 100 year storms, but a decrease at the Regional Storm under the proposed conditions. This seems illogical because hand calculations and intuition suggest otherwise. The proposed structure has approximately 50% more opening area and the elevation of the road is higher compared to existing. It would be expected that water levels for the smaller design storms at the bridge would drop given a larger opening and that the Regional Storm water level would increase.

We also note that the area of the increase in water level, should the HEC RAS modeling be correct, is very small (about 127m long centred at the bridge). There is currently no development in this area and given the close proximity of this land to Bridge Street and the river itself, no development is expected.

Disregarding the local results, the overall modeling does agree with the hand calculations in the sense that the proposed structure does not result in significant changes in the hydrology of the proposed conditions.

11. ICE

Reference is made to both the MTO Drainage Management Manual as well as MTO Publication “Guide for Preparing Hydrology Reports for Water Crossings” which states that the design of a crossing should be checked for the potential impact of ice and debris on the flow through the structure. These references further state that ice jams are usually formed during ice break-up and are caused by:

a) Constriction of flow

b) Obstruction of flow

c) Channel bend (radius < 4 times the channel width)

d) Solid-ice sheet downstream acting as an obstruction due to upstream flows experiencing earlier ice break-up (e.g. Rivers flowing north to James Bay or Hudson Bay).

With respect to the proposed structure:

- The proposed structure is quite a bit larger compared to the existing structure and the soffit elevation of the proposed structure is higher. This larger structure should eliminate the possibility of constricted flow through the bridge.

- A 3-span structure is proposed rather than a 2-span structure; a two-span structure would result in a pier being placed at the centre of the watercourse. A centre pier would create an obvious obstruction given that most of the flow occurs through the centre. A 3-span structure with the piers situated close to the existing river banks allows a large central opening to minimize any obstructions to the flow. It is also noted that a single span structure (i.e. no piers in the water) is not realistic for this location given the span and topography.

- Although the Nith River meanders upstream and downstream of this crossing, there are no significant channel bends upstream or downstream. The likelihood of ice jams based on this topography is low.

- The subject site is located in southern Ontario and Nith River flows south into Lake Erie.

12. EROSION PROTECTION

To protect against erosion, rock protection will be placed on embankments underneath the structure and at the corners of the structure to above the 25 year water level. Rock protection will be laid on geotextile underlay.

13. SCOUR PROTECTION

To protect against possible undermining of the structure by scour, the underside of the abutments and pier footings will be located at least 1.6m below grade and the grade will be protected with rock protection. Furthermore, the proposed structure will be supported on a pile foundation. This pile foundation is not susceptible to damage as a result of scour.

14. BRIDGE DECK DRAINAGE

Bridge deck drainage will be accomplished by the following:

a) Concrete curb and gutter as well as gutter outlets will be placed at the west side of the bridge to collect and direct roadway runoff to the roadside ditches. Rip rap spillways will be provided at the end of the gutter outlets to the bottom of the slope.

b) Overtop the bridge, runoff will be directed to the curb line via 2% deck cross-fall. No deck drains will be provided.

c) Runoff will flow along the curb line via longitudinal grade to the west side of the bridge.

d) Concrete curb and gutter as well as gutter outlets will be placed at the east side of the bridge to direct runoff to the roadside ditches. Rip rap spillways will be provided at the end of the gutter outlets to the bottom of the slope.

This methodology prevents salt or pollutant laden runoff from directly entering the Nith River. Directing runoff to roadside ditches allows the possibly of vegetation to filter the runoff prior to said runoff entering the watercourse.

15. EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

A detailed erosion and sediment control drawing will be prepared to control erosion and sedimentation during the construction. This same drawing will also show the proposed dewatering scheme.

16. CONSTRUCTION

It is recommended that construction of the proposed structure occur in single stage construction. Traffic can be detoured around the site using the existing network of roads.

Removal of the existing structure could be accomplished by first removing the concrete deck, steel stringers and railing system. Using cranes to brace each truss, the bridge could be cut into halves where after the trusses could be lifted onto the existing roadway for disposal. The existing concrete abutments and foundations can be removed using a hydraulic excavator equipped with a hydraulic breaker.

Construction of the proposed structure will require in-water work. To minimize effects to the natural environment, all in-water work should be completed within the allowable in-water work timing windows. Sheet pile cofferdams would be constructed to isolate the watercourse from the construction and to permit work to proceed in the dry.

The new bridge would be constructed in stages starting with the east (or west) pier footing, east (or west) pier, east (or west) abutment and wingwalls to bearing seat level, west (or east) pier footing, west (or east) pier, west (or east) abutments and wingwalls to bearing seat level, placement of girders, construction of deck and remaining portions of wingwalls, construction of curbs and finally erection of the steel railing system.

The roadway would be constructed last so that it matches the bridge. Backfill adjacent to the new bridge would be placed in stages and only after the concrete deck was placed.

17. CONCLUSIONS

The hydraulic analysis, based on hand calculations, has indicated that there would not be a significant change in the hydrology for the proposed conditions. Overall, there is improvement in the hydrology at the 10, 25 and 100 year design storms. At the Regional Storm, there is a small increase in the hydrology but this increase is within the allowable range.

The proposed structure satisfies the stated design criteria. There is no increase to flooding at the 25 year design storm as evidenced by the decrease in water level elevation between the existing and proposed conditions. Scour has been addressed by providing rock protection to armour the native streambed and by supporting the proposed structure on a piled foundation. As demonstrated in the summary tables above there is an increase in the water level at the Regional Storm under the proposed condition, however this increase is within an acceptable amount (100mm ±). The clearance to the soffit at the 25 year design storm is 1440mm which is well above the required 300mm. Freeboard at the 25 year design storm is 1494mm which again is well above the required 300mm. A navigation clearance envelope of 15m wide by 4m tall is provided. Finally, the longitudinal road grade overtop the structure is approximately 1.5% which exceeds the minimum recommended grade of 0.5%.

Bridge deck drainage, erosion and sediment control during construction as well as construction details will be provided on the engineering drawings. These drawings are not included with this report.

HEC RAS analysis confirms most of the findings of the hand calculations.

It is our conclusion that the proposed structure would adequately serve the hydrology requirements.

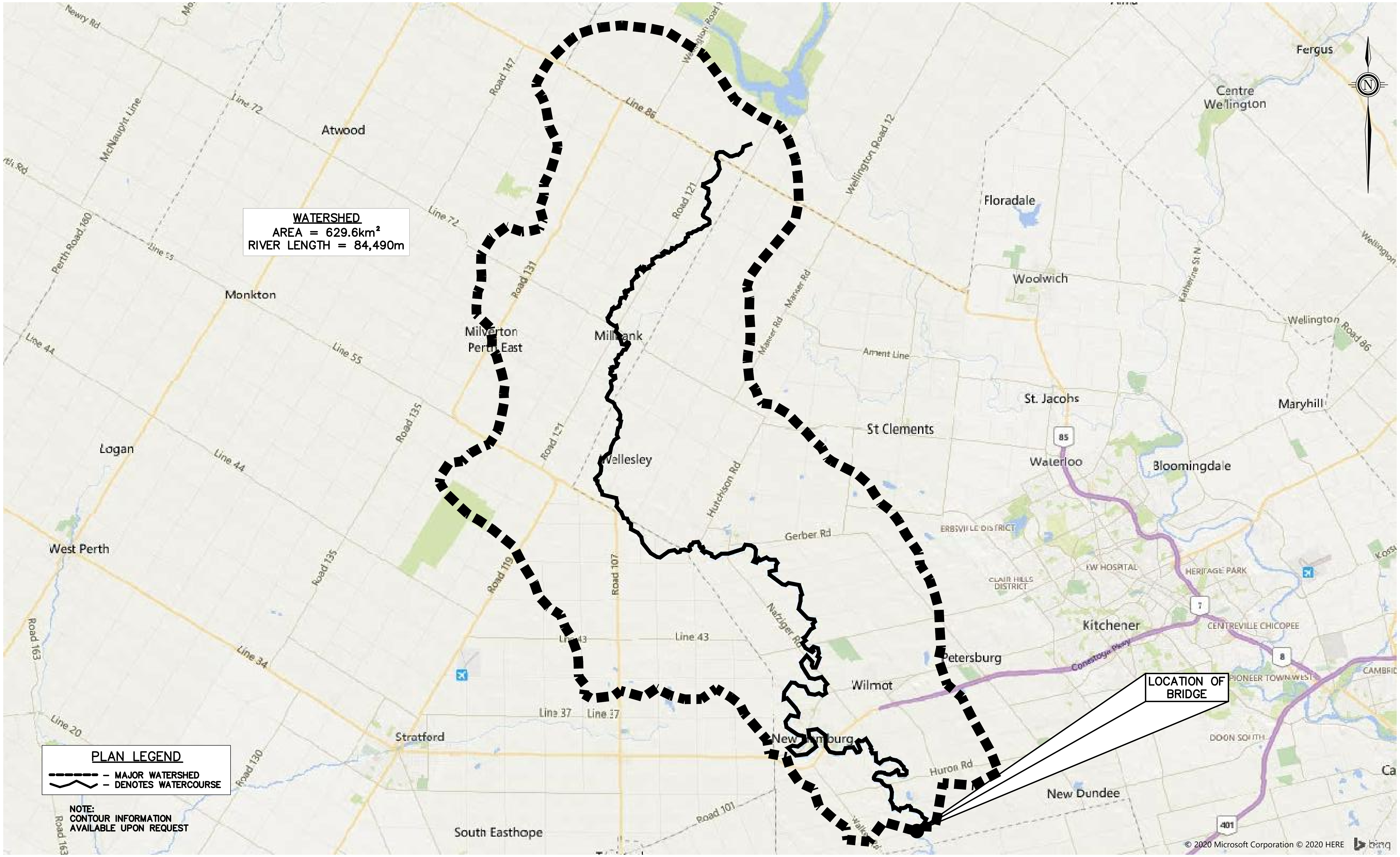
All of which is respectfully submitted.

Allan Garnham, P. Eng.

LICENSED PROFESSIONAL ENGINEER
A. L. GARNHAM
100123077
FEBRUARY 10, 2022
PROVINCE OF ONTARIO

APPENDIX A

- Watershed Plan Area
- Soils Map
- Hydraulic Computations
- Excerpts from HEC RAS modeling output
  (Note – Full results available upon request)



WATERSHED
AREA = 629.6km²
RIVER LENGTH = 84,490m

LOCATION OF BRIDGE

PLAN LEGEND
- - - - - MAJOR WATERSHED
〰 – DENOTES WATERCOURSE

NOTE:
CONTOUR INFORMATION
AVAILABLE UPON REQUEST

No.	REVISION	DATE

DESIGNED BY: --
CHECKED BY: --
DRAWN BY: N.K.
CHECKED BY: A.G.
FIELD BOOK:

SCALE
1:100,000
1000m 0 2000m

BRIDGE STREET BRIDGE REPLACEMENT

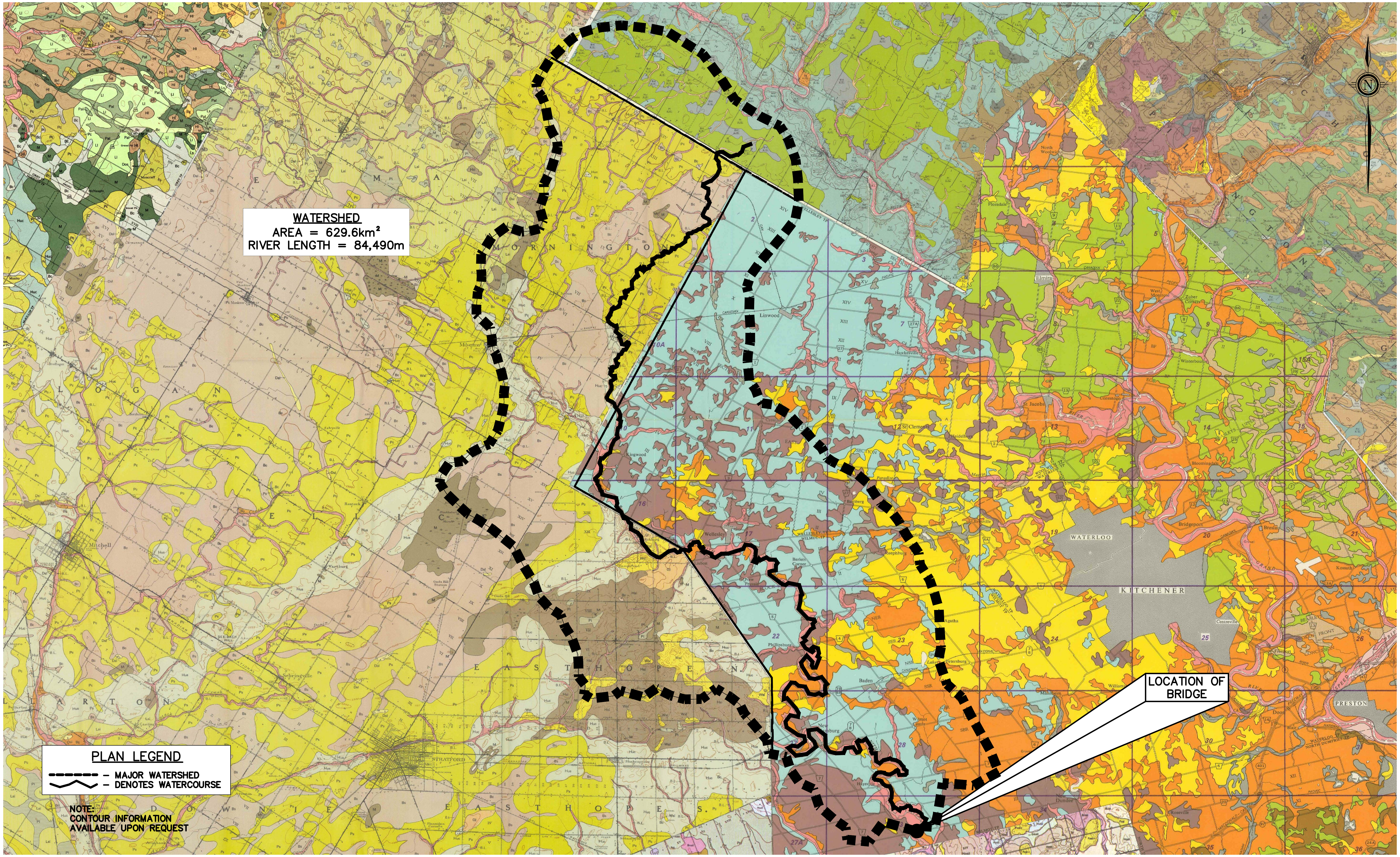
TOWNSHIP OF WILMOT
REGION OF WATERLOO

WATERSHED PLAN

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

JOB NUMBER
20-145
DATE
AUGUST 2020
DRAWING NUMBER
WATERSHD

\\SERVER\Data\2020\20-145\Drafting\WS 20-145.dwg WATERSHED 11-Nov-21 4:04:12 PM



WATERSHED
AREA = 629.6km²
RIVER LENGTH = 84,490m

LOCATION OF BRIDGE

PLAN LEGEND

- MAJOR WATERSHED
- DENOTES WATERCOURSE

NOTE:
CONTOUR INFORMATION
AVAILABLE UPON REQUEST

No.	REVISION	DATE

DESIGNED BY: --
CHECKED BY: --
DRAWN BY: N.K.
CHECKED BY: A.G.
FIELD BOOK:

SCALE
1:100,000
1000m 0 2000m

BRIDGE STREET BRIDGE REPLACEMENT

TOWNSHIP OF WILMOT REGION OF WATERLOO

SOILS MAP

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

JOB NUMBER
20–145
DATE
AUGUST 2020
DRAWING NUMBER
SOIL

\\SERVER\Data\2020\20–145\Drafting\WS 20–145.dwg SOILS 11–Nov–21 4:05:42 PM

Bridge 34/B-T9 (Bridge Street Bridge) Replacement - Hydrology Calculations
(KSAL Job Number 20-145)

Watershed Characteristics:

Watershed Area: 629.6 km² From Ontario Base Map data imported into AutoCAD

Length of River: 84490 m From Ontario Base Map data imported into AutoCAD

Slope of the Main Channel:

By the 85/10 Method

Length at 10% = 84490 x 0.10
Length at 10% = 8449 m

Actual distance = 16984 m
Elevation= 330 m

Length at 85% = 84490 x 0.85
Length at 10% = 71817 m

Actual distance = 70682 m
Elevation= 380 m

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{Slope} = \frac{380 - 330}{70682 - 16984}$$

$$\text{Slope} = \frac{50}{53698}$$

Slope = 0.00093 m/m

Land Use (From MTC Chart H2-7):

Waterloo		Wellington		Perth	
% of Watershed:	43	% of Watershed:	8	% of Watershed:	49
Crop:	71	Crop:	61	Crop:	68
Pasture:	20	Pasture:	30	Pasture:	26
Wood:	9	Wood:	9	Wood:	6

Watershed Land Use:
Crop: 69 %
Pasture: 24 %
Wood: 8 %

Soil Classification:

From Soil Maps of: Wellington County (North Sheet)
Waterloo County
Perth County

Soil Series	Map Symbol	Area	Hydraulic Soil Group
Bennington-Bookton	--	**72.5** km^2	**B**
Bottom Land	B.L.	**25.1** km^2	**L/W**
Brant-Waterloo	--	**38.4** km^2	**A**
Brookston Clay Loam	Bc	**42.5** km^2	**C**
Brookston Silt Loam	Bs	**24.1** km^2	**C**
Burford-Fox	--	**32.4** km^2	**AB**
Grand-Kirkland	--	**30.0** km^2	**B**
Guelph Loam	Gl	**2.7** km^2	**BC**
Harriston Silt Loam	His.	**35.8** km^2	**BC**
Huron Clay loam	Huc	**171.7** km^2	**D**
Huron Silt Loam	Hus	**8.4** km^2	**BC**
Listowel Silt Loam	Lsi	**3.5** km^2	**BC**
Muck	M	**12.2** km^2	**B**
Parkhill Loam	Pl	**1.9** km^2	**BC**
Perth Clay Loam	Pc	**119.8** km^2	**CD**
Waterloo Sandy Loam	Wsl	**8.5** km^2	**A**

Area Sum = 629.6 see MTO Drainage Design Chart 1.09

Watershed Area = 629.6 *check*

Hydraulic Soil Group	Area	% of Watershed
A	46.9 km^2	7.45%
AB	32.4 km^2	5.15%
B	114.7 km^2	18.21%
BC	52.4 km^2	8.32%
C	66.6 km^2	10.58%
CD	119.8 km^2	19.03%
D	171.7 km^2	27.27%
L/W	25.1 km^2	3.98%

Area Sum = 629.6

Watershed Area = 629.6 km^2 *check*

CN Calculation:

		Crop		Pasture		Wood		
HSG	**Area (km^2)**	**Area**	**CN**	**Area**	**CN**	**Area**	**CN**	**Σ Areas x CNs**
A	46.9	32.2	66	11.1	58	3.5	50	2948.3
AB	32.4	22.3	70	7.7	62	2.4	54	2167.4
B	114.7	78.8	74	27.2	65	8.6	58	8102.1
BC	52.4	36.0	78	12.4	71	3.9	65	3948.9
C	66.6	45.8	82	15.8	76	5.0	71	5314.1
CD	119.8	82.3	84	28.4	79	9.0	74	9830.8
D	171.7	118.0	86	40.8	81	12.9	77	14446.0
L/W	25.1	17.2	50	6.0	50	1.9	50	1253.8

Total = 48011.4

$$\text{CNavg} = \frac{\text{Total}}{\text{WS Area}} = \frac{48011.4}{629.6}$$

= 76.3 (AMC II)

Time to Peak:

Use three-parameter HYMO Equation

$t_p = 0.0086 * A^{0.422} * S^{-0.46} * (L/W)^{0.133}$

A = drainage area, hectares

A = 629.6 km^2 * 100

A = 62960 hectares

S = slope, m/m

S = 0.0009 m/m

L = Length of creek, m

L = 84490 m

$W_{avg} = \frac{W_1 + W_2 + W_3}{3}$ = Width of watershed, m

W_1= 13704 m (at creek length = 67300m)

W_2= 13371 m (at creek length = 52650m)

W_3= 17004 m (at creek length = 39100m)

W_{avg}= 14693 m

W_{avg}= 14700 m

t_p = time to peak, hours

$t_p = 0.0086 * A^{0.422} * S^{-0.46} * (L/W)^{0.133}$

$t_p = 0.0086 * (57215)^{0.422} * (0.0009)^{-0.46} * (72805/14700)^{0.133}$

t_p = 28.51 hours

Estimated Flows:

Modified Index Flood Method:

Watershed Type: Southern

Watershed Area: 629.6 km²

Watershed Slope: 0.00093 m/m

CN: 76.3

Base Watershed Class: 8.89 (MTO Drainage Manual Design Chart 1.17)

+

Slope Adjustment: -1 (Design Chart 1.18)

=

Net Watershed Class: 7.89

Class Coefficient, C: 1.78 (Design Chart 1.15)

$Q_{25} = CA^{0.75}$

$Q_{25} = (1.78)(629.6)^{0.75}$

$\mathbf{Q_{25} = 223.7}$ **m³/s**

$Q_{10} = FCF_{10}Q_{25}$ FCF_{10}= 0.82 Chart H5-9(a)

$Q_{10} = (0.82)(223.7)$

$\mathbf{Q_{10} = 183.5}$ **m³/s**

$Q_{100} = FCF_{100}Q_{25}$ FCF_{10}= 1.27 Chart H5-9(a)

$Q_{100} = (1.27)(223.7)$

$\mathbf{Q_{100} = 284.1}$ **m³/s**

Single Station Frequency Analysis:

Use gauging station 02GA010 - Nith River near Canning:

From a regression analysis, R^2= 0.924

y = 105.500 *ln(x) + 117.06

For $Q_{10,}$ y = (105.500)*ln(10) + (117.06)
= 360.0 m³/s

For $Q_{25,}$ y = (105.500)*ln(25) + (117.06)
= 456.7 m³/s

For $Q_{100,}$ y = (105.500)*ln(100) + (117.06)
= 602.9 m³/s

Now transport this discharge back to Bridge Street Bridge:

A_1 = 629.60 km^2
A_2 = 1030.00 km^2

A_1/A_2 = 0.61

$Q_{10} = Q_{10} (A_1/A_2)^{0.75}$
$Q_{10} = (360.0)(0.61)^{0.75}$
Q_{10} = 72.9 m³/s

$Q_{25} = Q_{25} (A_1/A_2)^{0.75}$
$Q_{25} = (456.7)(0.61)^{0.75}$
Q_{25} = 315.7 m³/s

$Q_{100} = Q_{100} (A_1/A_2)^{0.75}$
$Q_{100} = (602.9)(0.61)^{0.75}$
Q_{100} = 416.8 m³/s

Summary of Estimated Flows:

Design Storm	Modified Index	Single Station Frequency Analysis	PCSWMM
10	183.5	72.9	--
25	223.7	315.7	--
100	284.1	416.8	--
Regional	--	--	961.2

Therefore, the design flows for this structure will be:

Q_{10}	**72.9**	m³/s
Q_{25}	**315.7**	m³/s
Q_{100}	**416.8**	m³/s
Q_{REG}	**961.2**	m³/s

Government of Canada Gouvernement du Canada

Annual Maximum and Minimum Instantaneous Discharge Data for NITH RIVER NEAR CANNING (02GA010) [ON]

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

This table provides annual maximum and minimum instantaneous value for a station.

Maximum Instantaneous Discharge			Minimum Instantaneous Discharge		
Date/Time	Timezone	Value (m^3/s)	Date/Time	Timezone	Value (m^3/s)
1913			1913		
1914			1914		
1915			1915		
1916			1916		
1917			1917		
1920			1920		
1921			1921		
1922			1922		
1923			1923		
1924			1924		
1925			1925		
1926			1926		
1947			1947		
1948-03-21 03:00	EST	422	1948		
1949			1949		
1950-04-05 12:00	EST	357	1950		
1951			1951		
1952			1952		
1953			1953		
1954-10-17 11:00	EST	428	1954		
1955			1955		
1956-04-05 23:59	EST	267	1956		

Maximum Instantaneous Discharge			Minimum Instantaneous Discharge		
Date/Time	**Timezone**	**Value (m³/s)**	**Date/Time**	**Timezone**	**Value (m³/s)**
1957-12-22 11:00	EST	179	1957		
1958			1958		
1959			1959		
1960-04-05 07:00	EST	289	1960		
1961-02-23 23:30	EST	184	1961		
1962-03-31 10:00	EST	207	1962		
1963-03-27 12:00	EST	292	1963		
1964-12-26 15:00	EST	91.7	1964		
1965-02-11 22:30	EST	354	1965		
1966-12-09 01:00	EST	228	1966		
1967-04-04 12:00	EST	294	1967		
1968			1968		
1969-04-06 16:00	EST	199	1969		
1970-04-10 13:07	EST	144	1970		
1971-04-04 04:13	EST	121	1971		
1972-04-14 22:18	EST	208	1972		
1973-03-13 08:34	EST	203	1973		
1974-03-06 13:38	EST	275	1974		
1975-04-20 14:38	EST	419	1975		
1976-03-22 12:46	EST	314	1976		
1977-03-14 18:02	EST	362	1977		
1978-04-13 00:57	EST	225	1978		
1979-04-15 14:51	EST	383	1979		
1980-03-23 01:46	EST	275	1980		
1981			1981		
1982-04-02 00:39	EST	377	1982		

Maximum Instantaneous Discharge			Minimum Instantaneous Discharge		
Date/Time	**Timezone**	**Value (m³/s)**	**Date/Time**	**Timezone**	**Value (m³/s)**
1983-05-04 03:52	EST	112	1983		
1984-02-16 07:09	EST	219	1984		
1985			1985		
1986-10-01 15:34	EST	284	1986		
1987-04-06 19:16	EST	102	1987		
1988-03-27 10:05	EST	120	1988		
1989-03-27 05:13	EST	98.1	1989		
1990-12-31 19:09	EST	173	1990		
1991-01-01 00:00	EST	172	1991		
1992-11-14 23:46	EST	244	1992		
1993-01-06 14:38	EST	256	1993		
1994			1994		
1995-11-13 18:23	EST	134	1995		
1996-01-21 06:15	EST	174	1996		
1997			1997		
1998-03-28 15:00	EST	150	1998		
1999-02-13 20:00	EST	77.2	1999-07-29 05:00	EST	1.32
2000-05-15 01:20	EST	175	2000-02-22 00:00	EST	2.46 B
2001-02-12 08:00	EST	177	2001-08-16 04:00	EST	1.48
2002-02-23 00:10	EST	113	2002-09-14 03:00	EST	1.71
2003-03-23 00:05	EST	112	2003-09-13 03:51	EST	1.76
2004-03-07 16:10	EST	302	2004-10-14 18:05	EST	2.01
2005			2005		
2006-03-12 08:59	EST	203	2006-09-12 01:45	EST	2.63
2007-03-24 16:50	EST	135	2007-09-04 21:33	EST	2.00
2008-12-29 23:15	EST	374	2008-09-03 18:59	EST	4.45

Maximum Instantaneous Discharge			Minimum Instantaneous Discharge		
Date/Time	**Timezone**	**Value (m^3/s)**	**Date/Time**	**Timezone**	**Value (m^3/s)**
2009			2009-09-20 10:10	EST	2.80
2010-03-15 10:10	EST	168	2010-09-02 21:45	EST	2.21
2011-03-19 17:19	EST	164	2011-09-17 20:48	EST	1.90
2012-01-03 05:43	EST	74.1	2012-09-04 02:45	EST	1.46
2013-03-13 18:30	EST	167	2013-09-11 15:27	EST	3.03
2014-11-26 11:50	EST	208	2014-08-31 22:45	EST	2.94
2015-04-11 07:31	EST	95.7	2015-09-26 22:00	EST	2.30
2016-04-02 08:35	EST	130	2016-08-10 20:10	EST	1.97
2017-05-07 10:00	EST	125	2017-10-03 21:18	EST	2.64
2018-02-22 08:00	EST	360	2018-07-16 13:55	EST	2.35
2019			2019		

Station Information

Active or discontinued:	Active
Province / Territory:	Ontario
Latitude:	43° 11' 23" N
Longitude:	80° 27' 18" W
Gross drainage area:	1,030 km^2
Effective drainage area:	N/A
Record length:	86 Years
Period of record:	1913 - 2020
Regulation type:	Natural
Regulation length:	N/A
Real-time data available:	Yes
Sediment data available:	Yes
Type of water body:	River
RHBN:	Yes
EC Regional Office:	BURLINGTON
Current Operation Schedule:	Continuous
Data contributed by:	N/A
Operation Period:	JAN - DEC
Datum of published data:	ASSUMED DATUM

Data Collection History

This table contains information pertaining to the historical changes of defined elements in the operation of a station.

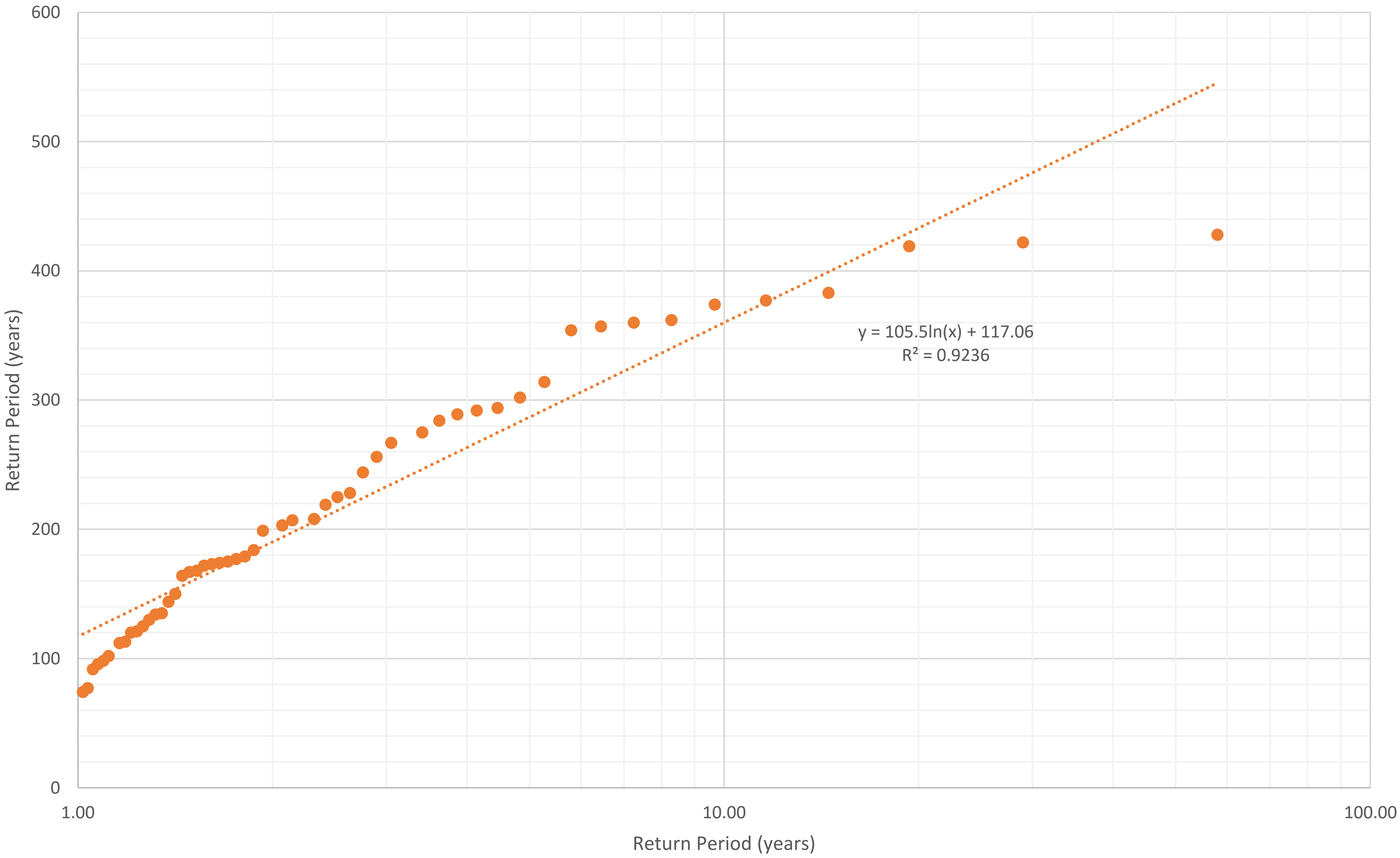
	Type	Operation schedule	Gauge type
1913 - 1917	Flow	Continuous	Manual
1920 - 1923	Flow	Continuous	Manual
1924 - 1926	Flow	Seasonal	Manual
1947 - 1948	Flow	Continuous	Manual
1949 - 2001	Flow	Continuous	Recorder
2002 - 2020	Flow & Level	Continuous	Recorder

Single Station Frequency Analysis - Calculations

Year	Flow	Rank	Probability	Return Period
1948	422	2	0.034	29.00
1950	357	9	0.155	6.44
1954	428	1	0.017	58.00
1956	267	19	0.328	3.05
1957	179	32	0.552	1.81
1960	289	15	0.259	3.87
1961	184	31	0.534	1.87
1962	207	27	0.466	2.15
1963	292	14	0.241	4.14
1964	91.7	55	0.948	1.05
1965	354	10	0.172	5.80
1966	228	22	0.379	2.64
1967	294	13	0.224	4.46
1969	199	30	0.517	1.93
1970	144	42	0.724	1.38
1971	121	47	0.810	1.23
1972	208	25	0.431	2.32
1973	203	28	0.483	2.07
1974	275	17	0.293	3.41
1975	419	3	0.052	19.33
1976	314	11	0.190	5.27
1977	362	7	0.121	8.29
1978	225	23	0.397	2.52
1979	383	4	0.069	14.50
1980	275	17	0.293	3.41
1982	377	5	0.086	11.60
1983	112	50	0.862	1.16
1984	219	24	0.414	2.42
1986	284	16	0.276	3.63
1987	102	52	0.897	1.12
1988	120	48	0.828	1.21
1989	98.1	53	0.914	1.09
1990	173	36	0.621	1.61
1991	172	37	0.638	1.57
1992	244	21	0.362	2.76
1993	256	20	0.345	2.90
1995	134	44	0.759	1.32
1996	174	35	0.603	1.66
1998	150	41	0.707	1.41
1999	77.2	56	0.966	1.04
2000	175	34	0.586	1.71
2001	177	33	0.569	1.76
2002	113	49	0.845	1.18
2003	112	50	0.862	1.16
2004	302	12	0.207	4.83
2006	203	28	0.483	2.07
2007	135	43	0.741	1.35
2008	374	6	0.103	9.67
2010	168	38	0.655	1.53
2011	164	40	0.690	1.45
2012	74.1	57	0.983	1.02
2013	167	39	0.672	1.49
2014	208	25	0.431	2.32
2015	95.7	54	0.931	1.07
2016	130	45	0.776	1.29
2017	125	46	0.793	1.26
2018	360	8	0.138	7.25

count 57

Single Station Frequency Analysis to Estimate Design Flows
Record from Nith River Near Canning
Station No. 02GA010, Drainage Area = 1030 km^2



```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------


*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 10
Number of nodes ........... 9
Number of links ........... 8
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                                    Data       Recording
Name                 Data Source                    Type       Interval 
------------------------------------------------------------------------
48hr_Hazel(576-700km) 48hr_HurricaneHazel_576-700km  INTENSITY   60 min.


********************
Subcatchment Summary
********************
Name                       Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------------------
S1                     15393.45 102623.01      2.00    0.3330 48hr_Hazel(576-700km) J33
S11                     5764.29  76857.18      2.00    0.3000 48hr_Hazel(576-700km) J19
S18                     6243.82  83250.95      2.00    0.5000 48hr_Hazel(576-700km) J33
S22                     5182.29  69097.15      2.00    1.0000 48hr_Hazel(576-700km) J37
S23                     6754.89  90065.26      2.00    0.8000 48hr_Hazel(576-700km) J41
S24                     5119.50  68260.04      2.00    0.2500 48hr_Hazel(576-700km) J43
S27                     3170.82  42277.58      2.00    1.5000 48hr_Hazel(576-700km) J43
S30_2                   4651.94  62025.87      4.00    1.0000 48hr_Hazel(576-700km) J1
S30_3                   6841.00  91213.28      4.00    1.0000 48hr_Hazel(576-700km) Bridge_St
S7                      3085.31  41137.52      2.00    0.3000 48hr_Hazel(576-700km) J19


************
Node Summary
************
                                         Invert      Max.    Ponded    External
```

```
Name                 Type                    Elev.     Depth      Area    Inflow
-------------------------------------------------------------------------------
J1                   JUNCTION            331.89     12.00       0.0
J19                  JUNCTION            373.51     12.00       0.0
J2                   JUNCTION            310.40     12.00       0.0
J33                  JUNCTION            358.69     12.00       0.0
J37                  JUNCTION            344.53     12.00       0.0
J41                  JUNCTION            337.28     12.00       0.0
J43                  JUNCTION            346.62     12.00       0.0
J64                  JUNCTION            355.24     12.00       0.0
Bridge_St            OUTFALL             310.00      7.63       0.0


************
Link Summary
************
Name             From Node        To Node          Type            Length    %Slope Roughness
---------------------------------------------------------------------------------------------
C10              J33              J64              CONDUIT         1513.5    0.2283    0.0280
C12              J19              J33              CONDUIT         9239.2    0.1604    0.0280
C3_1             J1               J2               CONDUIT        21000.0    0.1023    0.0280
C3_2             J41              J1               CONDUIT        11000.0    0.0490    0.0280
C3_3             J2               Bridge_St        CONDUIT          810.3    0.0499    0.0280
C4               J37              J41              CONDUIT         8825.4    0.0822    0.0280
C5               J43              J37              CONDUIT         3538.4    0.0591    0.0280
C7               J64              J43              CONDUIT         8885.6    0.0970    0.0280


*********************
Cross Section Summary
*********************
                                      Full     Full     Hyd.     Max.   No. of     Full
Conduit          Shape               Depth     Area     Rad.    Width  Barrels     Flow
---------------------------------------------------------------------------------------
C10              Transect1            5.74   555.79     3.43   160.53        1  2156.95
C12              Transect1            5.74   555.79     3.43   160.53        1  1808.01
C3_1             Transect2            7.63  1588.93     4.38   359.97        1  4860.50
C3_2             Transect2            7.63  1588.93     4.38   359.97        1  3365.14
C3_3             Transect2            7.63  1588.93     4.38   359.97        1  3393.20
C4               Transect3           11.65  3295.07     6.64   491.93        1 11915.88
C5               Transect4            5.65   868.46     3.09   279.61        1  1598.22
C7               Transect1            5.74   555.79     3.43   160.53        1  1405.78


****************
```

```
Transect Summary
****************

Transect dummy
Area:
            0.0069     0.0144     0.0224     0.0309     0.0400
            0.0496     0.0597     0.0704     0.0816     0.0933
            0.1056     0.1184     0.1317     0.1456     0.1600
            0.1749     0.1904     0.2064     0.2229     0.2400
            0.2576     0.2757     0.2944     0.3136     0.3333
            0.3536     0.3744     0.3957     0.4176     0.4400
            0.4629     0.4864     0.5104     0.5349     0.5600
            0.5856     0.6117     0.6384     0.6656     0.6933
            0.7216     0.7504     0.7797     0.8096     0.8400
            0.8709     0.9024     0.9344     0.9669     1.0000
Hrad:
            0.0348     0.0668     0.0966     0.1247     0.1512
            0.1766     0.2010     0.2246     0.2474     0.2696
            0.2913     0.3125     0.3333     0.3538     0.3739
            0.3938     0.4134     0.4327     0.4519     0.4709
            0.4897     0.5084     0.5270     0.5454     0.5637
            0.5818     0.5999     0.6179     0.6359     0.6537
            0.6715     0.6892     0.7068     0.7244     0.7419
            0.7594     0.7768     0.7942     0.8115     0.8288
            0.8461     0.8633     0.8805     0.8976     0.9148
            0.9319     0.9489     0.9660     0.9830     1.0000
Width:
            0.2160     0.2320     0.2480     0.2640     0.2800
            0.2960     0.3120     0.3280     0.3440     0.3600
            0.3760     0.3920     0.4080     0.4240     0.4400
            0.4560     0.4720     0.4880     0.5040     0.5200
            0.5360     0.5520     0.5680     0.5840     0.6000
            0.6160     0.6320     0.6480     0.6640     0.6800
            0.6960     0.7120     0.7280     0.7440     0.7600
            0.7760     0.7920     0.8080     0.8240     0.8400
            0.8560     0.8720     0.8880     0.9040     0.9200
            0.9360     0.9520     0.9680     0.9840     1.0000

Transect Transect1
Area:
            0.0022     0.0059     0.0101     0.0150     0.0212
            0.0285     0.0370     0.0458     0.0548     0.0639
            0.0737     0.0848     0.0970     0.1097     0.1228
            0.1361     0.1501     0.1649     0.1798     0.1949
            0.2112     0.2288     0.2475     0.2670     0.2872
            0.3082     0.3300     0.3528     0.3773     0.4028
```

```
            0.4291     0.4563     0.4837     0.5113     0.5393
            0.5678     0.5966     0.6256     0.6548     0.6844
            0.7144     0.7447     0.7755     0.8069     0.8388
            0.8707     0.9028     0.9348     0.9671     1.0000
Hrad:
            0.0217     0.0492     0.0752     0.0909     0.1051
            0.1187     0.1396     0.1709     0.2017     0.2258
            0.2347     0.2397     0.2573     0.2813     0.3085
            0.3315     0.3449     0.3678     0.3974     0.4143
            0.4095     0.4162     0.4287     0.4446     0.4629
            0.4781     0.4906     0.4966     0.4945     0.5195
            0.5288     0.5539     0.5832     0.6121     0.6300
            0.6575     0.6847     0.7114     0.7373     0.7620
            0.7855     0.8073     0.8270     0.8435     0.8705
            0.9020     0.9334     0.9648     0.9834     1.0000
Width:
            0.0998     0.1205     0.1346     0.1658     0.2020
            0.2407     0.2655     0.2685     0.2716     0.2830
            0.3142     0.3539     0.3774     0.3903     0.3982
            0.4105     0.4351     0.4477     0.4516     0.4694
            0.5150     0.5492     0.5768     0.6002     0.6201
            0.6442     0.6725     0.7105     0.7633     0.7757
            0.8119     0.8241     0.8295     0.8352     0.8561
            0.8636     0.8713     0.8794     0.8882     0.8983
            0.9096     0.9226     0.9380     0.9569     0.9639
            0.9655     0.9672     0.9688     0.9834     1.0000

Transect Transect2
Area:
            0.0007     0.0016     0.0042     0.0082     0.0125
            0.0170     0.0223     0.0282     0.0347     0.0418
            0.0492     0.0572     0.0665     0.0768     0.0877
            0.1000     0.1138     0.1298     0.1463     0.1638
            0.1824     0.2016     0.2215     0.2420     0.2626
            0.2836     0.3058     0.3293     0.3528     0.3772
            0.4022     0.4282     0.4552     0.4835     0.5125
            0.5425     0.5728     0.6037     0.6351     0.6667
            0.6987     0.7311     0.7637     0.7967     0.8298
            0.8633     0.8970     0.9312     0.9656     1.0000
Hrad:
            0.0309     0.0407     0.0416     0.0664     0.0982
            0.1220     0.1372     0.1576     0.1767     0.1974
            0.2199     0.2356     0.2278     0.2550     0.2616
            0.2684     0.2676     0.2761     0.3007     0.3092
            0.3337     0.3561     0.3796     0.4054     0.4379
            0.4564     0.4565     0.4845     0.5175     0.5223
```

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            0.5444     0.5576     0.5653     0.5864     0.5913
            0.6245     0.6455     0.6676     0.6978     0.7250
            0.7489     0.7759     0.8033     0.8320     0.8607
            0.8881     0.9136     0.9367     0.9695     1.0000
Width:
            0.0224     0.0456     0.1014     0.1232     0.1277
            0.1396     0.1624     0.1786     0.1959     0.2112
            0.2234     0.2424     0.2918     0.3011     0.3350
            0.3725     0.4252     0.4703     0.4865     0.5301
            0.5469     0.5666     0.5837     0.5970     0.5997
            0.6215     0.6701     0.6796     0.6815     0.7219
            0.7385     0.7675     0.8049     0.8243     0.8667
            0.8686     0.8871     0.9043     0.9101     0.9194
            0.9329     0.9422     0.9507     0.9575     0.9641
            0.9721     0.9819     0.9942     0.9960     1.0000

Transect Transect3
Area:
            0.0005     0.0019     0.0040     0.0065     0.0097
            0.0136     0.0181     0.0231     0.0284     0.0347
            0.0411     0.0482     0.0559     0.0645     0.0780
            0.0981     0.1182     0.1385     0.1590     0.1798
            0.2010     0.2223     0.2436     0.2649     0.2864
            0.3081     0.3299     0.3520     0.3747     0.3981
            0.4237     0.4499     0.4763     0.5029     0.5301
            0.5585     0.5871     0.6158     0.6451     0.6751
            0.7059     0.7368     0.7678     0.7994     0.8316
            0.8648     0.8980     0.9313     0.9655     1.0000
Hrad:
            0.0227     0.0335     0.0604     0.0823     0.0930
            0.1137     0.1303     0.1576     0.1719     0.1880
            0.2204     0.2193     0.2400     0.2452     0.2030
            0.1699     0.2044     0.2369     0.2682     0.2982
            0.3288     0.3632     0.3975     0.4318     0.4617
            0.4931     0.5244     0.5470     0.5780     0.5760
            0.5650     0.5946     0.6285     0.6483     0.6694
            0.6799     0.7140     0.7481     0.7556     0.7737
            0.7945     0.8284     0.8623     0.8679     0.8793
            0.9064     0.9401     0.9651     0.9764     1.0000
Width:
            0.0246     0.0562     0.0664     0.0784     0.1046
            0.1193     0.1389     0.1463     0.1652     0.1841
            0.1859     0.2190     0.2321     0.2626     0.5662
            0.5782     0.5790     0.5850     0.5933     0.6035
            0.6119     0.6125     0.6131     0.6136     0.6204
            0.6248     0.6291     0.6444     0.6558     0.7108
```

```
               0.7499     0.7567     0.7577     0.7756     0.7919
               0.8215     0.8222     0.8229     0.8536     0.8725
               0.8884     0.8893     0.8902     0.9209     0.9458
               0.9540     0.9551     0.9648     0.9888     1.0000

Transect Transect4
Area:
               0.0015     0.0060     0.0111     0.0165     0.0227
               0.0302     0.0385     0.0474     0.0567     0.0664
               0.0764     0.0867     0.0970     0.1081     0.1200
               0.1327     0.1461     0.1603     0.1752     0.1904
               0.2061     0.2227     0.2399     0.2578     0.2762
               0.2950     0.3148     0.3360     0.3599     0.3846
               0.4094     0.4347     0.4610     0.4885     0.5161
               0.5438     0.5724     0.6023     0.6325     0.6630
               0.6939     0.7259     0.7587     0.7919     0.8256
               0.8593     0.8935     0.9285     0.9639     1.0000
Hrad:
               0.0167     0.0439     0.0780     0.1073     0.1187
               0.1390     0.1599     0.1904     0.2184     0.2452
               0.2717     0.3060     0.3317     0.3415     0.3560
               0.3692     0.3830     0.3990     0.4237     0.4493
               0.4637     0.4788     0.4965     0.5190     0.5362
               0.5602     0.5624     0.5440     0.5293     0.5647
               0.5971     0.6153     0.6172     0.6443     0.6794
               0.7121     0.7080     0.7262     0.7603     0.7851
               0.8085     0.8063     0.8404     0.8558     0.8907
               0.9254     0.9391     0.9580     0.9800     1.0000
Width:
               0.0955     0.1378     0.1428     0.1541     0.1915
               0.2173     0.2408     0.2494     0.2598     0.2707
               0.2813     0.2830     0.2922     0.3164     0.3367
               0.3591     0.3813     0.4016     0.4132     0.4235
               0.4442     0.4649     0.4829     0.4964     0.5147
               0.5262     0.5592     0.6173     0.6796     0.6808
               0.6853     0.7061     0.7467     0.7579     0.7593
               0.7633     0.8081     0.8291     0.8316     0.8443
               0.8580     0.9002     0.9027     0.9252     0.9268
               0.9284     0.9513     0.9691     0.9836     1.0000


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************
```

```
****************
Analysis Options
****************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... MODIFIED_GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 12/03/2020 01:00:00
Ending Date .............. 12/08/2020 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......     14892.431       239.400
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........     11314.358       181.881
Surface Runoff ...........      3577.269        57.506
Final Storage ............         1.474         0.024
Continuity Error (%) .....        -0.004


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......      3577.269     35773.062
Groundwater Inflow .......         0.000         0.000
```

```
RDII Inflow .............          0.000          0.000
External Inflow .........          0.000          0.000
External Outflow ........       3564.506      35645.427
Flooding Loss ...........          0.000          0.000
Evaporation Loss ........          0.000          0.000
Exfiltration Loss .......          0.000          0.000
Initial Stored Volume ...          0.001          0.011
Final Stored Volume .....         11.036        110.365
Continuity Error (%) ....          0.048


*************************
Highest Continuity Errors
*************************
Node J2 (3.67%)
Node J1 (-1.47%)
Node J37 (-1.25%)


***************************
Time-Step Critical Elements
***************************
None


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     4.50 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00
Time Step Frequencies       :
    5.000 -  3.155 sec      :   100.00 %
    3.155 -  1.991 sec      :     0.00 %
    1.991 -  1.256 sec      :     0.00 %
    1.256 -  0.792 sec      :     0.00 %
    0.792 -  0.500 sec      :     0.00 %
```

```
***************************
Subcatchment Runoff Summary
***************************

------------------------------------------------------------------------------------------------------------------------------
                          Total      Total      Total      Total     Imperv       Perv      Total       Total     Peak  Runoff
                         Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff   Runoff   Coeff
Subcatchment                 mm         mm         mm         mm         mm         mm         mm    10^6 ltr      CMS
------------------------------------------------------------------------------------------------------------------------------
S1                       239.40       0.00       0.00     171.54       4.77      63.08      67.85    10443.97   526.47   0.283
S11                      239.40       0.00       0.00     147.72       4.77      86.90      91.67     5284.14   302.55   0.383
S18                      239.40       0.00       0.00     175.19       4.77      59.43      64.20     4008.72   293.04   0.268
S22                      239.40       0.00       0.00     193.61       4.77      41.01      45.78     2372.54   223.46   0.191
S23                      239.40       0.00       0.00     198.08       4.77      36.54      41.32     2790.82   264.44   0.173
S24                      239.40       0.00       0.00     193.31       4.77      41.30      46.07     2358.82   174.63   0.192
S27                      239.40       0.00       0.00     195.59       4.77      39.03      43.80     1388.92   141.43   0.183
S30_2                    239.40       0.00       0.00     207.52       9.54      22.32      31.86     1482.20   148.84   0.133
S30_3                    239.40       0.00       0.00     207.52       9.54      22.32      31.86     2179.68   218.87   0.133
S7                       239.40       0.00       0.00     127.15       4.77     107.47     112.24     3463.08   179.15   0.469


******************
Node Depth Summary
******************

---------------------------------------------------------------------------------
                               Average  Maximum  Maximum  Time of Max    Reported
                                 Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type       Meters   Meters   Meters  days hr:min      Meters
---------------------------------------------------------------------------------
J1                   JUNCTION     0.97     4.90   336.78     2  05:01        4.90
J19                  JUNCTION     0.35     3.33   376.84     2  00:23        3.33
J2                   JUNCTION     1.03     4.83   315.24     2  07:19        4.83
J33                  JUNCTION     0.51     4.50   363.19     2  00:22        4.50
J37                  JUNCTION     0.84     5.43   349.96     2  01:18        5.43
J41                  JUNCTION     0.98     5.99   343.27     2  02:51        5.99
J43                  JUNCTION     0.63     5.24   351.86     2  01:15        5.24
J64                  JUNCTION     0.64     5.45   360.69     2  00:40        5.45
Bridge_St            OUTFALL      1.03     4.83   314.83     2  07:19        4.83


*******************
Node Inflow Summary
*******************
```

```
  -------------------------------------------------------------------------------------------------
                                 Maximum  Maximum                  Lateral       Total        Flow
                                 Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                  Inflow   Inflow  Occurrence       Volume      Volume       Error
  Node                 Type          CMS      CMS  days hr:min    10^6 ltr    10^6 ltr     Percent
  -------------------------------------------------------------------------------------------------
  J1                   JUNCTION  148.835 1246.408      2  03:36    1.48e+03    3.42e+04      -1.453
  J19                  JUNCTION  481.696  481.696      2  00:00    8.75e+03    8.75e+03      -0.291
  J2                   JUNCTION    0.000 1223.164      2  06:18           0    3.47e+04       3.812
  J33                  JUNCTION  819.511 1231.677      2  00:00    1.45e+04    2.32e+04       0.075
  J37                  JUNCTION  223.459 1450.221      2  01:00    2.37e+03    2.94e+04      -1.239
  J41                  JUNCTION  264.444 1663.127      2  01:38    2.79e+03    3.25e+04      -0.686
  J43                  JUNCTION  316.065 1399.259      2  00:47    3.75e+03    2.71e+04       0.306
  J64                  JUNCTION    0.000 1167.835      2  00:22           0    2.32e+04      -0.535
  Bridge_St            OUTFALL   218.873  961.156      2  07:19    2.18e+03    3.56e+04       0.000


  **********************
  Node Surcharge Summary
  **********************

  No nodes were surcharged.


  *********************
  Node Flooding Summary
  *********************

  No nodes were flooded.


  ***********************
  Outfall Loading Summary
  ***********************

  -----------------------------------------------------------
                         Flow       Avg       Max       Total
                         Freq      Flow      Flow      Volume
  Outfall Node           Pcnt       CMS       CMS    10^6 ltr
  -----------------------------------------------------------
  Bridge_St             98.67    84.337   961.156   35645.264
  -----------------------------------------------------------
  System                98.67    84.337   961.156   35645.264
```

```
********************
Link Flow Summary
********************

-----------------------------------------------------------------------------
                               Maximum  Time of Max   Maximum    Max/    Max/
                                |Flow|   Occurrence   |Veloc|    Full    Full
Link                 Type          CMS  days hr:min     m/sec    Flow   Depth
-----------------------------------------------------------------------------
C10                  CHANNEL  1167.835     2  00:22      2.74    0.54    0.87
C12                  CHANNEL   428.259     2  00:23      1.50    0.24    0.68
C3_1                 CHANNEL  1223.164     2  06:18      2.01    0.25    0.61
C3_2                 CHANNEL  1246.405     2  03:36      1.67    0.37    0.68
C3_3                 CHANNEL   961.156     2  07:19      1.44    0.28    0.63
C4                   CHANNEL  1567.484     2  01:38      1.95    0.13    0.47
C5                   CHANNEL  1327.121     2  01:15      1.70    0.83    0.94
C7                   CHANNEL  1173.164     2  00:56      2.40    0.83    0.93


***************************
Flow Classification Summary
***************************

-------------------------------------------------------------------------------------
                    Adjusted    ---------- Fraction of Time in Flow Class ----------
                     /Actual         Up    Down  Sub   Sup   Up    Down  Norm  Inlet
Conduit               Length    Dry  Dry   Dry   Crit  Crit  Crit  Crit  Ltd   Ctrl
-------------------------------------------------------------------------------------
C10                     1.00   0.01  0.00  0.00  0.99  0.00  0.00  0.00  0.89  0.00
C12                     1.00   0.01  0.00  0.00  0.99  0.00  0.00  0.00  0.99  0.00
C3_1                    1.00   0.01  0.00  0.00  0.99  0.00  0.00  0.00  0.54  0.00
C3_2                    1.00   0.01  0.00  0.00  0.99  0.00  0.00  0.00  0.66  0.00
C3_3                    1.00   0.02  0.00  0.00  0.98  0.00  0.00  0.00  0.48  0.00
C4                      1.00   0.01  0.00  0.00  0.99  0.00  0.00  0.00  0.80  0.00
C5                      1.00   0.01  0.00  0.00  0.99  0.00  0.00  0.00  0.86  0.00
C7                      1.00   0.01  0.00  0.00  0.98  0.00  0.00  0.00  0.63  0.00


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.

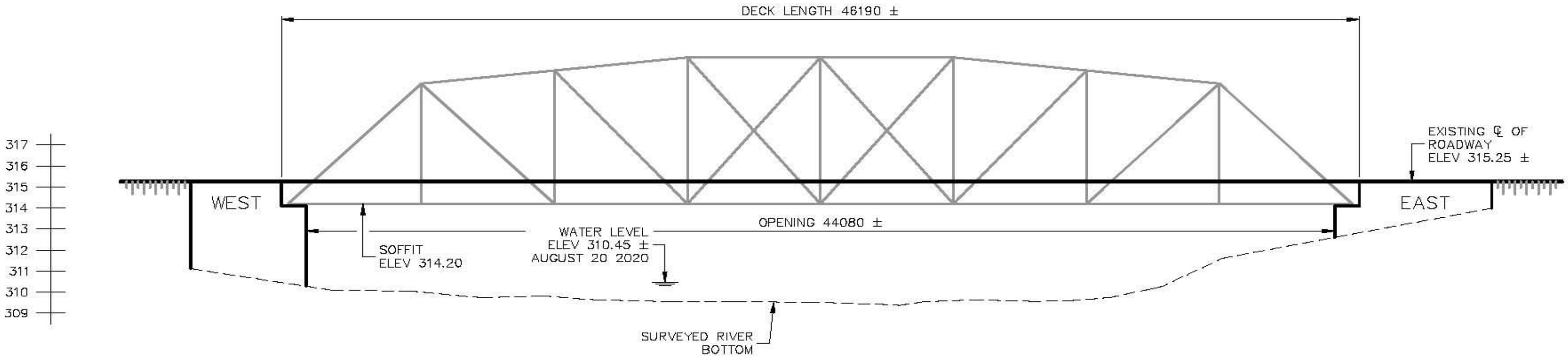

Analysis begun on:  Tue Dec  8 15:45:33 2020
```

```
Analysis ended on:  Tue Dec  8 15:45:33 2020
Total elapsed time: < 1 sec
```

Open Channel Flow Method for Existing Conditions

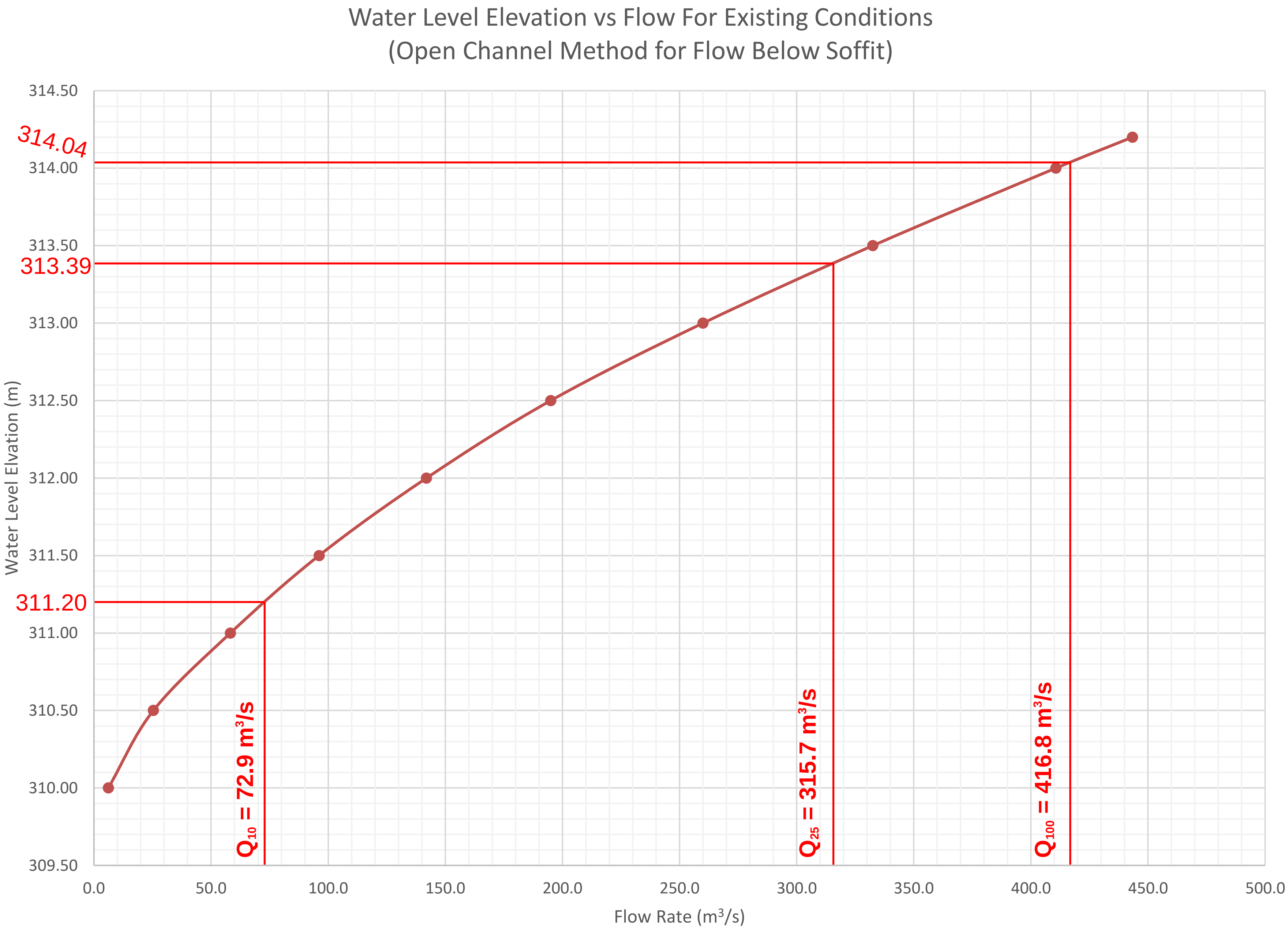
(Flow Below Soffit)

Water Level (m)	Area (m^2)	Perimeter (m)	R (m)	Slope (m/m)	"n"	Velocity (m/s)	Flow (m^3/s)
310.00	11.584	30.728	0.377	0.00093	0.03	0.530	6.1
310.50	29.394	37.555	0.783	0.00093	0.03	0.863	25.4
311.00	49.208	39.145	1.257	0.00093	0.03	1.184	58.3
311.50	67.507	40.735	1.657	0.00093	0.03	1.424	96.1
312.00	87.512	43.409	2.016	0.00093	0.03	1.622	142.0
312.50	108.713	46.385	2.344	0.00093	0.03	1.794	195.0
313.00	130.731	47.764	2.737	0.00093	0.03	1.989	260.0
313.50	152.771	48.764	3.133	0.00093	0.03	2.176	332.5
314.00	174.811	49.764	3.513	0.00093	0.03	2.349	410.6
314.20	183.627	50.164	3.661	0.00093	0.03	2.414	443.4



EXISTING STRUCTURE

SCALE 1:150


Water Level Elevation vs Flow For Existing Conditions
(Open Channel Method for Flow Below Soffit)
Water Level Elvation (m)
Flow Rate (m³/s)
314.50
314.00
313.50
313.00
312.50
312.00
311.50
311.00
310.50
310.00
309.50
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
314.04
313.39
311.20
Q10 = 72.9 m³/s
Q25 = 315.7 m³/s
Q100 = 416.8 m³/s

Existing Conditions - Weir Flow
Water Level Elevation = 315.00
Page 1 of 3

Assume B = 5.0m
Q_{BRIDGE} = 443.4 m^3/s

Height (h)
0

Area 1

L = 1.070
b = 5.00

h_{avg} = (0.000 + 0.042)/2
h_{avg} = 0.021

h/b = 0.021/5.00
h/b = 0.004

C = 2.86 (D.C. 2.09)

Assume k_t = 1.0

$Q_1 = 0.55CLH^{1.5}k_t$
Q_1 = 0.55(2.86)(1.070)(0.021^1.5)*(1.0)
Q_1 = 0.0 m^3/s

Height (h)
0.042

Area 2

L = 25.000
b = 5.00

h_{avg} = (0.042 + 0.609)/2
h_{avg} = 0.326

h/b = 0.326/5.00
h/b = 0.065

C = 3.03 (D.C. 2.09)

Assume k_t = 1.0

$Q_2 = 0.55CLH^{1.5}k_t$
Q_2 = 0.55(3.03)(25.000)(0.326^1.5)*(1.0)
Q_2 = 7.7 m^3/s

Height (h)
0.609

Area 3

L = 25.000
b = 5.00

h_{avg} = (0.609 + 0.513)/2
h_{avg} = 0.561

h/b = 0.561/5.00
h/b = 0.112

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.561^1.5)*(1.0)
Q_3 = 17.6 m^3/s

Q_{WEIR} = Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8 + Q9
Q_{WEIR} = (0.0) + (7.7) + (17.6)+ (15.0) + (13.0) + (11.8) + (11.2) + (7.6)+ (1.6)
Q_{WEIR} = 85.6 m^3/s

$Q_{TOTAL} = Q_{BRIDGE} + Q_{WEIR}$
Q_{TOTAL} = (443.4) + (85.6)
Q_{TOTAL} = 529.0 m^3/s

Existing Conditions - Weir Flow
Water Level Elevation = 315.00
Page 2 of 3

Height (h)
0.513

Area 4

L = 25.000
b = 5.00

$h_{avg} = (0.513 + 0.499)/2$
$h_{avg} = 0.506$

h/b = 0.506/5.00
h/b = 0.101

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
$Q_3 = 0.55(3.04)(25.000)(0.506\verb|^|1.5)*(1.0)$
$Q_3 =$ 15.0 m^3/s

Height (h)
0.499

Area 5

L = 25.000
b = 5.00

$h_{avg} = (0.499 + 0.418)/2$
$h_{avg} = 0.459$

h/b = 0.459/5.00
h/b = 0.092

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
$Q_3 = 0.55(3.04)(25.000)(0.459\verb|^|1.5)*(1.0)$
$Q_3 =$ 13.0 m^3/s

Height (h)
0.418

Area 6

L = 25.000
b = 5.00

$h_{avg} = (0.418 + 0.442)/2$
$h_{avg} = 0.430$

h/b = 0.430/5.00
h/b = 0.086

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
$Q_3 = 0.55(3.04)(25.000)(0.430\verb|^|1.5)*(1.0)$
$Q_3 =$ 11.8 m^3/s

Existing Conditions - Weir Flow
Water Level Elevation = 315.00
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Height (h)
0.442

Area 7

L = 25.000
b = 5.00

h_{avg} = (0.442 + 0.391)/2
h_{avg} = 0.417

h/b = 0.417/5.00
h/b = 0.083

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.417^1.5)*(1.0)
Q_3 = 11.2 m^3/s

Height (h)
0.391

Area 8

L = 25.000
b = 5.00

h_{avg} = (0.391 + 0.252)/2
h_{avg} = 0.322

h/b = 0.322/5.00
h/b = 0.064

C = 3.03 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.03)(25.000)(0.322^1.5)*(1.0)
Q_3 = 7.6 m^3/s

Height (h)
0.252

Area 9

L = 22.280
b = 5.00

h_{avg} = (0.252 + 0.000)/2
h_{avg} = 0.126

h/b = 0.126/5.00
h/b = 0.025

C = 3 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.00)(22.280)(0.126^1.5)*(1.0)
Q_3 = 1.6 m^3/s

Height (h)
0.000

Existing Conditions - Weir Flow
Water Level Elevation = 315.25
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Assume B = 5.0m

Q_{BRIDGE} = 443.4 m^3/s

Height (h)

0

Area 1

L = 11.660
b = 5.00

h_{avg} = (0.000 + 0.292)/2
h_{avg} = 0.146

h/b = 0.146/5.00
h/b = 0.029

C = 3.01 (D.C. 2.09)

Assume k_t = 1.0

$Q_1 = 0.55CLH^{1.5}k_t$
Q_1 = 0.55(3.01)(11.660)(0.146^1.5)*(1.0)
Q_1 = 1.1 m^3/s

Height (h)

0.292

Area 2

L = 25.000
b = 5.00

h_{avg} = (0.292 + 0.859)/2
h_{avg} = 0.576

h/b = 0.576/5.00
h/b = 0.115

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_2 = 0.55CLH^{1.5}k_t$
Q_2 = 0.55(3.04)(25.000)(0.576^1.5)*(1.0)
Q_2 = 18.2 m^3/s

Height (h)

0.859

Area 3

L = 25.000
b = 5.00

h_{avg} = (0.859 + 0.763)/2
h_{avg} = 0.811

h/b = 0.811/5.00
h/b = 0.162

C = 3.06 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.06)(25.000)(0.811^1.5)*(1.0)
Q_3 = 30.7 m^3/s

Q_{WEIR} = Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8 + Q9 + Q10
Q_{WEIR} = (1.1) + (18.2) + (30.7)+ (27.6) + (24.9) + (23.4) + (22.7)+ (18.1) + (8.8) + (0.7)
Q_{WEIR} = 176.3 m^3/s

$Q_{TOTAL} = Q_{BRIDGE} + Q_{WEIR}$
Q_{TOTAL} = (443.4) + (176.3)
Q_{TOTAL} = 619.7 m^3/s

Height (h)
0.763

Area 4

L = 25.000
b = 5.00

h_{avg} = (0.763 + 0.749)/2
h_{avg} = 0.756

h/b = 0.756/5.00
h/b = 0.151

C = 3.05 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.05)(25.000)(0.756^1.5)*(1.0)
Q_3 = 27.6 m^3/s

Height (h)
0.749

Area 5

L = 25.000
b = 5.00

h_{avg} = (0.749 + 0.668)/2
h_{avg} = 0.709

h/b = 0.709/5.00
h/b = 0.142

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.709^1.5)*(1.0)
Q_3 = 24.9 m^3/s

Height (h)
0.668

Area 6

L = 25.000
b = 5.00

h_{avg} = (0.668 + 0.692)/2
h_{avg} = 0.680

h/b = 0.680/5.00
h/b = 0.136

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.680^1.5)*(1.0)
Q_3 = 23.4 m^3/s

Existing Conditions - Weir Flow
Water Level Elevation = 315.25

Height (h)
0.692

Area 7

L = 25.000
b = 5.00

h_{avg} = (0.692 + 0.641)/2
h_{avg} = 0.667

h/b = 0.667/5.00
h/b = 0.133

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.667^1.5)*(1.0)
Q_3 = 22.7 m^3/s

Height (h)
0.641

Area 8

L = 25.000
b = 5.00

h_{avg} = (0.641 + 0.502)/2
h_{avg} = 0.572

h/b = 0.572/5.00
h/b = 0.114

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.572^1.5)*(1.0)
Q_3 = 18.1 m^3/s

Height (h)
0.502

Area 9

L = 25.000
b = 5.00

h_{avg} = (0.502 + 0.204)/2
h_{avg} = 0.353

h/b = 0.353/5.00
h/b = 0.071

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.353^1.5)*(1.0)
Q_3 = 8.8 m^3/s

Existing Conditions - Weir Flow
Water Level Elevation = 315.25
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Height (h)
0.204

Area 10

L = 12.890
b = 5.00

h_{avg} = (0.204 + 0.000)/2
h_{avg} = 0.102

h/b = 0.102/5.00
h/b = 0.020

C = 2.99 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(2.99)(12.890)(0.102^1.5)*(1.0)
Q_3 = 0.7 m^3/s

Height (h)
0.000

Existing Conditions - Weir Flow
Water Level Elevation = 315.50
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Assume B = 5.0m

Q_{BRIDGE} = 443.4 m^3/s

Height (h)

0.021

Area 1

L = 25.000
b = 5.00

h_{avg} = (0.021 + 0.275)/2
h_{avg} = 0.148

h/b = 0.148/5.00
h/b = 0.030

C = 3.01 (D.C. 2.09)

Assume k_t = 1.0

$Q_1 = 0.55CLH^{1.5}k_t$
Q_1 = 0.55(3.01)(25.000)(0.148^1.5)*(1.0)
Q_1 = 2.4 m^3/s

Height (h)

0.275

Area 2

L = 25.000
b = 5.00

h_{avg} = (0.275 + 0.190)/2
h_{avg} = 0.233

h/b = 0.233/5.00
h/b = 0.047

C = 3.03 (D.C. 2.09)

Assume k_t = 1.0

$Q_2 = 0.55CLH^{1.5}k_t$
Q_2 = 0.55(3.03)(25.000)(0.233^1.5)*(1.0)
Q_2 = 4.7 m^3/s

Height (h)

0.190

Area 3

L = 25.000
b = 5.00

h_{avg} = (0.190 + 0.542)/2
h_{avg} = 0.366

h/b = 0.366/5.00
h/b = 0.073

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.366^1.5)*(1.0)
Q_3 = 9.3 m^3/s

Q_{WEIR} = Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8 + Q9 + Q10 + Q11 + Q12
Q_{WEIR} = (2.4) + (4.7) + (9.3)+ (31.5) + (46.3) + (42.7) + (39.6) + (37.9) + (37.0) + (31.3) + (19.6) + (5.2)
Q_{WEIR} = 307.2 m^3/s

$Q_{TOTAL} = Q_{BRIDGE} + Q_{WEIR}$
Q_{TOTAL} = (443.4) + (307.2)
Q_{TOTAL} = 750.6 m^3/s

Existing Conditions - Weir Flow
Water Level Elevation = 315.50
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Height (h)
0.542

Area 4

L = 25.000
b = 5.00

h_{avg} = (0.542 + 1.109)/2
h_{avg} = 0.826

h/b = 0.826/5.00
h/b = 0.165

C = 3.05 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.05)(25.000)(0.826^1.5)*(1.0)
Q_3 = 31.5 m^3/s

Height (h)
1.109

Area 5

L = 25.000
b = 5.00

h_{avg} = (1.109 + 1.013)/2
h_{avg} = 1.061

h/b = 1.061/5.00
h/b = 0.212

C = 3.08 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.08)(25.000)(1.061^1.5)*(1.0)
Q_3 = 46.3 m^3/s

Height (h)
1.013

Area 6

L = 25.000
b = 5.00

h_{avg} = (1.013 + 0.999)/2
h_{avg} = 1.006

h/b = 1.006/5.00
h/b = 0.201

C = 3.075 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.08)(25.000)(1.006^1.5)*(1.0)
Q_3 = 42.7 m^3/s

Height (h)
0.999

Existing Conditions - Weir Flow
Water Level Elevation = 315.50

Area 7

L = 25.000
b = 5.00

h_{avg} = (0.999 + 0.918)/2
h_{avg} = 0.959

h/b = 0.959/5.00
h/b = 0.192

C = 3.07 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.07)(25.000)(0.959^1.5)*(1.0)
Q_3 = 39.6 m^3/s

Height (h)
0.918

Area 8

L = 25.000
b = 5.00

h_{avg} = (0.918 + 0.942)/2
h_{avg} = 0.930

h/b = 0.930/5.00
h/b = 0.186

C = 3.07 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.07)(25.000)(0.930^1.5)*(1.0)
Q_3 = 37.9 m^3/s

Height (h)
0.942

Area 9

L = 25.000
b = 5.00

h_{avg} = (0.942 + 0.891)/2
h_{avg} = 0.917

h/b = 0.917/5.00
h/b = 0.183

C = 3.068 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.07)(25.000)(0.917^1.5)*(1.0)
Q_3 = 37.0 m^3/s

Height (h)
0.891

Existing Conditions - Weir Flow
Water Level Elevation = 315.50

Area 10

L = 25.000
b = 5.00

h_{avg} = (0.891 + 0.752)/2
h_{avg} = 0.822

h/b = 0.822/5.00
h/b = 0.164

C = 3.06 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.06)(25.000)(0.822^1.5)*(1.0)
Q_3 = 31.3 m^3/s

Height (h)
0.752

Area 11

L = 25.000
b = 5.00

h_{avg} = (0.752 + 0.454)/2
h_{avg} = 0.603

h/b = 0.603/5.00
h/b = 0.121

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.603^1.5)*(1.0)
Q_3 = 19.6 m^3/s

Height (h)
0.454

Area 12

L = 25.000
b = 5.00

h_{avg} = (0.454 + 0.044)/2
h_{avg} = 0.249

h/b = 0.249/5.00
h/b = 0.050

C = 3.03 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.03)(25.000)(0.249^1.5)*(1.0)
Q_3 = 5.2 m^3/s

Height (h)
0.044

Existing Conditions - Weir Flow
Water Level Elevation = 315.75
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Assume B = 5.0m
Q_{BRIDGE} = 443.4 m^3/s

Height (h)
0

Area 1

L = 8.340
b = 5.00

h_{avg} = (0.000 + 0.271)/2
h_{avg} = 0.136

h/b = 0.136/5.00
h/b = 0.027

C = 3.01 (D.C. 2.09)

Assume k_t = 1.0

$Q_1 = 0.55CLH^{1.5}k_t$
Q_1 = 0.55(3.01)(8.340)(0.136^1.5)*(1.0)
Q_1 = 0.7 m^3/s

Height (h)
0.271

Area 2

L = 25.000
b = 5.00

h_{avg} = (0.271 + 0.525)/2
h_{avg} = 0.398

h/b = 0.398/5.00
h/b = 0.080

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_2 = 0.55CLH^{1.5}k_t$
Q_2 = 0.55(3.04)(25.000)(0.398^1.5)*(1.0)
Q_2 = 10.5 m^3/s

Height (h)
0.525

Area 3

L = 25.000
b = 5.00

h_{avg} = (0.525 + 0.440)/2
h_{avg} = 0.483

h/b = 0.483/5.00
h/b = 0.097

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.483^1.5)*(1.0)
Q_3 = 14.0 m^3/s

Q_{WEIR} = Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8 + Q9 + Q10 + Q11 + Q12 + Q13 + Q14
Q_{WEIR} = (0.7) + (10.5) + (14.0)+ (20.2) + (47.2) + (63.8) + (59.7) + (56.1) + (54.3) + (53.4) + (46.9)+ (33.2)+ (14.7) + (2.1)
Q_{WEIR} = 476.8 m^3/s

$Q_{TOTAL} = Q_{BRIDGE} + Q_{WEIR}$
Q_{TOTAL} = (443.4) + (476.8)
Q_{TOTAL} = 920.2 m^3/s

Height (h)

0.440

Area 4

L = 25.000
b = 5.00

h_{avg} = (0.440 + 0.792)/2
h_{avg} = 0.616

h/b = 0.616/5.00
h/b = 0.123

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.616^1.5)*(1.0)
Q_3 = 20.2 m^3/s

Height (h)

0.792

Area 5

L = 25.000
b = 5.00

h_{avg} = (0.792 + 1.359)/2
h_{avg} = 1.076

h/b = 1.076/5.00
h/b = 0.215

C = 3.078 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.08)(25.000)(1.076^1.5)*(1.0)
Q_3 = 47.2 m^3/s

Height (h)

1.359

Area 6

L = 25.000
b = 5.00

h_{avg} = (1.359 + 1.263)/2
h_{avg} = 1.311

h/b = 1.311/5.00
h/b = 0.262

C = 3.09 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.09)(25.000)(1.311^1.5)*(1.0)
Q_3 = 63.8 m^3/s

Height (h)
1.263

Area 7

L = 25.000
b = 5.00

h_{avg} = (1.263 + 1.249)/2
h_{avg} = 1.256

h/b = 1.256/5.00
h/b = 0.251

C = 3.085 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.09)(25.000)(1.256^1.5)*(1.0)
Q_3 = 59.7 m^3/s

Height (h)
1.249

Area 8

L = 25.000
b = 5.00

h_{avg} = (1.249 + 1.168)/2
h_{avg} = 1.209

h/b = 1.209/5.00
h/b = 0.242

C = 3.07 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.07)(25.000)(1.209^1.5)*(1.0)
Q_3 = 56.1 m^3/s

Height (h)
1.168

Area 9

L = 25.000
b = 5.00

h_{avg} = (1.168 + 1.192)/2
h_{avg} = 1.180

h/b = 1.180/5.00
h/b = 0.236

C = 3.083 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.08)(25.000)(1.180^1.5)*(1.0)
Q_3 = 54.3 m^3/s

Existing Conditions - Weir Flow
Water Level Elevation = 315.75
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Height (h)
1.192

Area 10

L = 25.000
b = 5.00

h_{avg} = (1.192 + 1.141)/2
h_{avg} = 1.167

h/b = 1.167/5.00
h/b = 0.233

C = 3.081 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.08)(25.000)(1.167^1.5)*(1.0)
Q_3 = 53.4 m^3/s

Height (h)
1.141

Area 11

L = 25.000
b = 5.00

h_{avg} = (1.141 + 1.002)/2
h_{avg} = 1.072

h/b = 1.072/5.00
h/b = 0.214

C = 3.078 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.08)(25.000)(1.072^1.5)*(1.0)
Q_3 = 46.9 m^3/s

Height (h)
1.002

Area 12

L = 25.000
b = 5.00

h_{avg} = (1.002 + 0.704)/2
h_{avg} = 0.853

h/b = 0.853/5.00
h/b = 0.171

C = 3.062 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.06)(25.000)(0.853^1.5)*(1.0)
Q_3 = 33.2 m^3/s

Height (h)
0.704

Area 13

L = 25.000
b = 5.00

h_{avg} = (0.704 + 0.294)/2
h_{avg} = 0.499

h/b = 0.499/5.00
h/b = 0.100

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.499^1.5)*(1.0)
Q_3 = 14.7 m^3/s

Height (h)
0.294

Area 14

L = 22.250
b = 5.00

h_{avg} = (0.294 + 0.000)/2
h_{avg} = 0.147

h/b = 0.147/5.00
h/b = 0.029

C = 3.01 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.01)(22.250)(0.147^1.5)*(1.0)
Q_3 = 2.1 m^3/s

Height (h)
0.000

Existing Conditions - Weir Flow
Water Level Elevation = 315.85

Assume B = 5.0m
Q_{BRIDGE} = 443.4 m^3/s

Height (h)
0

Area 1

L = 10.530
b = 5.00

h_{avg} = (0.000 + 0.371)/2
h_{avg} = 0.186

h/b = 0.186/5.00
h/b = 0.037

C = 3.02 (D.C. 2.09)

Assume k_t = 1.0

$Q_1 = 0.55CLH^{1.5}k_t$
Q_1 = 0.55(3.02)(10.530)(0.186^1.5)*(1.0)
Q_1 = 1.4 m^3/s

Height (h)
0.371

Area 2

L = 25.000
b = 5.00

h_{avg} = (0.371 + 0.625)/2
h_{avg} = 0.498

h/b = 0.498/5.00
h/b = 0.100

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_2 = 0.55CLH^{1.5}k_t$
Q_2 = 0.55(3.04)(25.000)(0.498^1.5)*(1.0)
Q_2 = 14.7 m^3/s

Height (h)
0.625

Area 3

L = 25.000
b = 5.00

h_{avg} = (0.625 + 0.540)/2
h_{avg} = 0.583

h/b = 0.583/5.00
h/b = 0.117

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.583^1.5)*(1.0)
Q_3 = 18.6 m^3/s

Q_{WEIR} = Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8 + Q9 + Q10 + Q11 + Q12 + Q13 + Q14 + Q15
Q_{WEIR} = (1.4) + (14.7) + (18.6)+ (25.3) + (54.0) + (71.2) + (67.1) + (63.2) + (61.5) + (60.5) + (53.7) + (39.3) + (19.4) + (4.6) + (0.0)
Q_{WEIR} = 554.4 m^3/s

$Q_{TOTAL} = Q_{BRIDGE} + Q_{WEIR}$
Q_{TOTAL} = (443.4) + (554.4)
Q_{TOTAL} = 997.8 m^3/s

Height (h)

0.540

Area 4

L = 25.000
b = 5.00

h_{avg} = (0.540 + 0.892)/2
h_{avg} = 0.716

h/b = 0.716/5.00
h/b = 0.143

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.716^1.5)*(1.0)
Q_3 = 25.3 m^3/s

Height (h)

0.892

Area 5

L = 25.000
b = 5.00

h_{avg} = (0.892 + 1.459)/2
h_{avg} = 1.176

h/b = 1.176/5.00
h/b = 0.235

C = 3.082 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.08)(25.000)(1.176^1.5)*(1.0)
Q_3 = 54.0 m^3/s

Height (h)

1.459

Area 6

L = 25.000
b = 5.00

h_{avg} = (1.459 + 1.363)/2
h_{avg} = 1.411

h/b = 1.411/5.00
h/b = 0.282

C = 3.09 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.09)(25.000)(1.411^1.5)*(1.0)
Q_3 = 71.2 m^3/s

Existing Conditions - Weir Flow
Water Level Elevation = 315.85
Page 3 of 5

Height (h)
1.363

Area 7

L = 25.000
b = 5.00

h_{avg} = (1.363 + 1.349)/2
h_{avg} = 1.356

h/b = 1.356/5.00
h/b = 0.271

C = 3.09 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.09)(25.000)(1.356^1.5)*(1.0)
Q_3 = 67.1 m^3/s

Height (h)
1.349

Area 8

L = 25.000
b = 5.00

h_{avg} = (1.349 + 1.268)/2
h_{avg} = 1.309

h/b = 1.309/5.00
h/b = 0.262

C = 3.07 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.07)(25.000)(1.309^1.5)*(1.0)
Q_3 = 63.2 m^3/s

Height (h)
1.268

Area 9

L = 25.000
b = 5.00

h_{avg} = (1.268 + 1.292)/2
h_{avg} = 1.280

h/b = 1.280/5.00
h/b = 0.256

C = 3.087 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.09)(25.000)(1.280^1.5)*(1.0)
Q_3 = 61.5 m^3/s

Existing Conditions - Weir Flow
Water Level Elevation = 315.85
Page 4 of 5

Height (h)
1.292

Area 10

L = 25.000
b = 5.00

h_{avg} = (1.292 + 1.241)/2
h_{avg} = 1.267

h/b = 1.267/5.00
h/b = 0.253

C = 3.086 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.09)(25.000)(1.267^1.5)*(1.0)
Q_3 = 60.5 m^3/s

Height (h)
1.241

Area 11

L = 25.000
b = 5.00

h_{avg} = (1.241 + 1.102)/2
h_{avg} = 1.172

h/b = 1.172/5.00
h/b = 0.234

C = 3.082 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.08)(25.000)(1.172^1.5)*(1.0)
Q_3 = 53.7 m^3/s

Height (h)
1.102

Area 12

L = 25.000
b = 5.00

h_{avg} = (1.102 + 0.804)/2
h_{avg} = 0.953

h/b = 0.953/5.00
h/b = 0.191

C = 3.07 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.07)(25.000)(0.953^1.5)*(1.0)
Q_3 = 39.3 m^3/s

Height (h)
0.804

Area 13

L = 25.000
b = 5.00

h_{avg} = (0.804 + 0.394)/2
h_{avg} = 0.599

h/b = 0.599/5.00
h/b = 0.120

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.599^1.5)*(1.0)
Q_3 = 19.4 m^3/s

Height (h)
0.394

Area 14

L = 25.000
b = 5.00

h_{avg} = (0.394 + 0.064)/2
h_{avg} = 0.229

h/b = 0.229/5.00
h/b = 0.046

C = 3.03 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.03)(25.000)(0.229^1.5)*(1.0)
Q_3 = 4.6 m^3/s

Height (h)
0.064

Area 15

L = 4.810
b = 5.00

h_{avg} = (0.064 + 0.000)/2
h_{avg} = 0.032

h/b = 0.032/5.00
h/b = 0.006

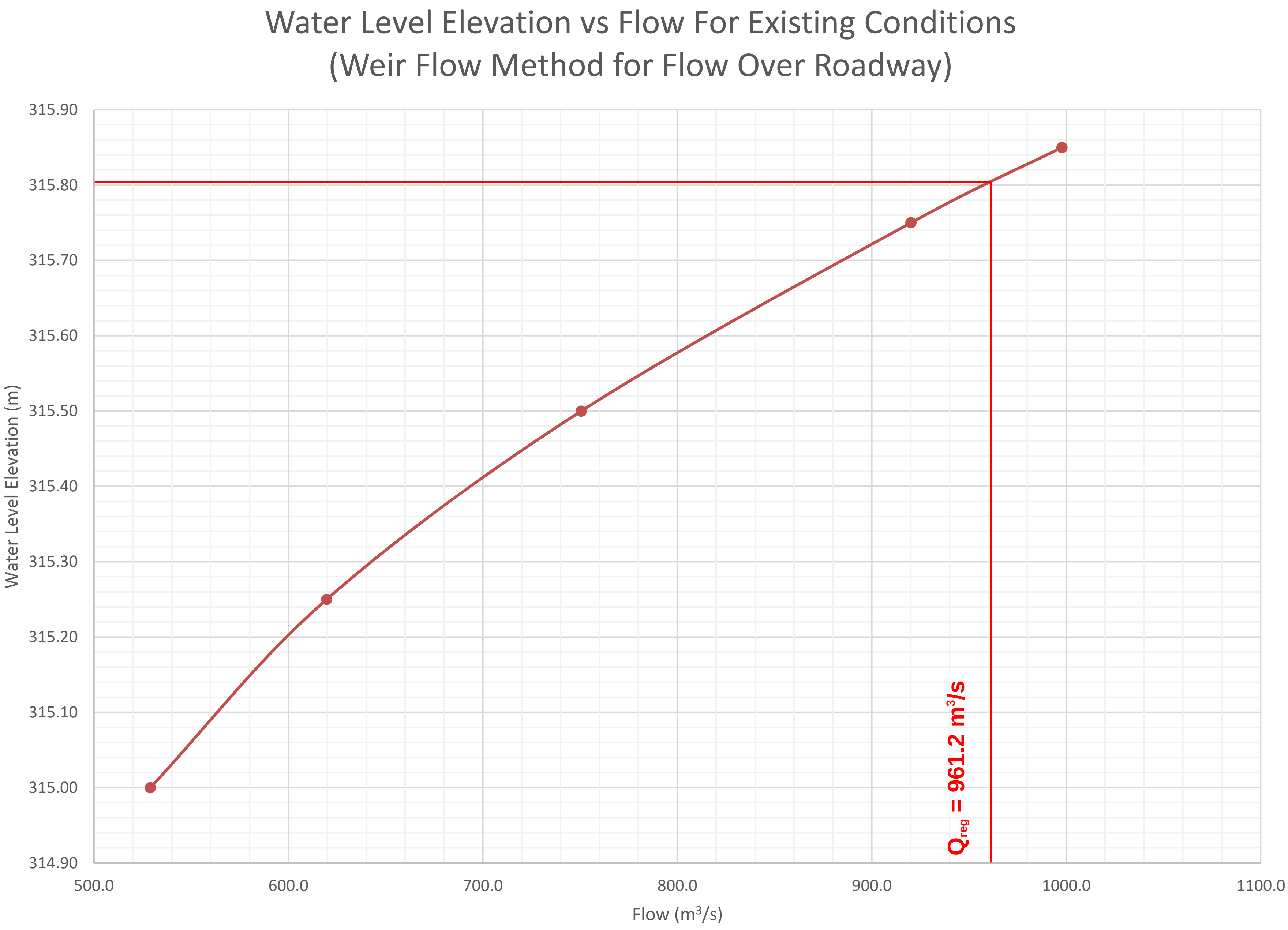
C = 3.01 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.01)(4.810)(0.032^1.5)*(1.0)
Q_3 = 0.0 m^3/s

Height (h)
0.000

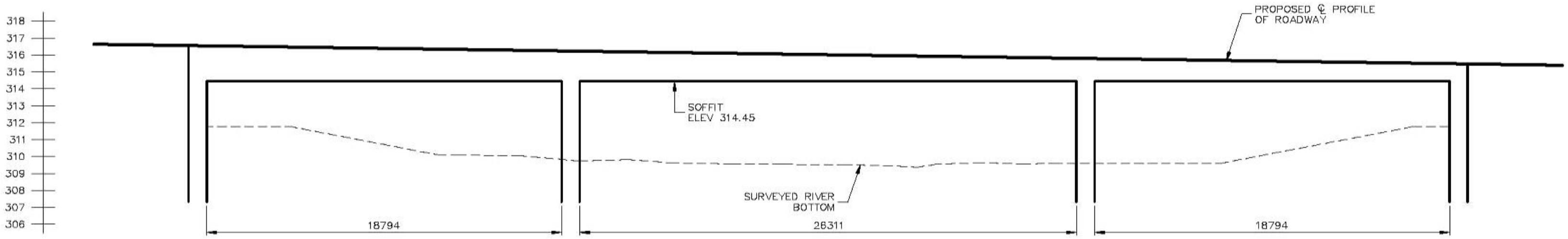
<table>
<tr><th colspan="2">Existing Conditions</th></tr>
<tr><th>Water Level Elevation (m)</th><th>Total Flow (Weir + Bridge) (m³/s)</th></tr>
<tr><td>315.00</td><td>529.0</td></tr>
<tr><td>315.25</td><td>619.7</td></tr>
<tr><td>315.50</td><td>750.6</td></tr>
<tr><td>315.75</td><td>920.2</td></tr>
<tr><td>315.85</td><td>997.8</td></tr>
</table>


Water Level Elevation vs Flow For Existing Conditions
(Weir Flow Method for Flow Over Roadway)
Water Level Elevation (m)
315.90
315.80
315.70
315.60
315.50
315.40
315.30
315.20
315.10
315.00
314.90
500.0
600.0
700.0
800.0
900.0
1000.0
1100.0
Flow (m³/s)
Q_reg = 961.2 m³/s

Summary of Existing Conditions		
Design Storm	**Flow m^3/s**	**Existing High Water Elevation (m)**
10 Year	72.9	311.20
25 Year	315.7	313.39
100 Year	416.8	314.04
Regional	961.2	315.80

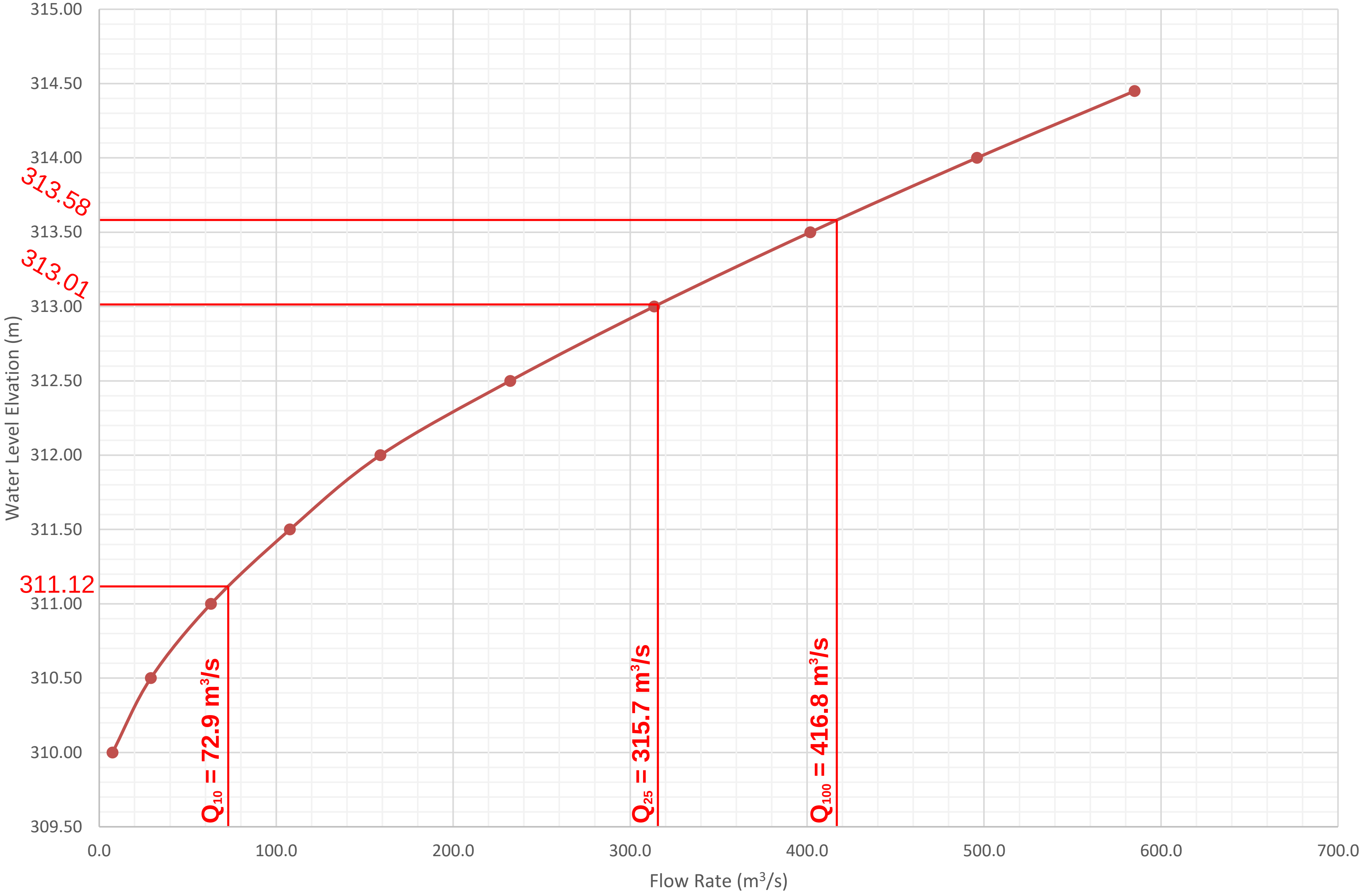
Open Channel Flow Method for Proposed Conditions
(Flow Below Soffit)

	Span 1		Span 2		Span 3								
Water Level (m)	Area 1 (m^2)	Perimeter 1 (m)	Area 2 (m^2)	Perimeter 2 (m)	Area 3 (m^2)	Perimeter 3 (m)	Total Area (m^2)	Total Perimeter (m)	R (m)	Slope (m/m)	"n"	Velocity (m/s)	Flow (m^3/s)
310.00	0.148	1.884	10.971	27.005	3.087	9.035	14.206	37.924	0.375	0.00093	0.03	0.528	7.5
310.50	3.468	9.152	24.127	28.005	7.968	11.937	35.563	49.094	0.724	0.00093	0.03	0.820	29.2
311.00	8.267	12.054	37.283	29.005	14.024	14.838	59.574	55.897	1.066	0.00093	0.03	1.061	63.2
311.50	14.240	14.956	50.438	30.005	21.254	17.740	85.932	62.701	1.371	0.00093	0.03	1.254	107.8
312.00	22.365	21.405	63.594	31.005	30.009	21.675	115.968	74.085	1.565	0.00093	0.03	1.370	158.9
312.50	31.762	22.405	76.750	32.005	39.406	22.675	147.918	77.085	1.919	0.00093	0.03	1.570	232.2
313.00	41.159	23.405	89.906	33.005	48.803	23.675	179.868	80.085	2.246	0.00093	0.03	1.743	313.6
313.50	50.556	24.405	103.061	34.005	58.200	24.675	211.817	83.085	2.549	0.00093	0.03	1.897	401.8
314.00	59.953	25.405	116.217	35.005	67.596	25.675	243.766	86.085	2.832	0.00093	0.03	2.035	496.0
314.45	68.410	26.305	128.057	35.905	76.054	26.575	272.521	88.785	3.069	0.00093	0.03	2.147	585.1



PROPOSED STRUCTURE
SCALE 1:150

Water Level Elevation vs Flow For Proposed Conditions
(Open Channel Method for Flow Below Soffit)



PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.25
PAGE 1 OF 3

Assume B = 10.0m

Q_{BRIDGE} = 585.1 m^3/s

Height (h)

0

Area 1

L = 17.507
b = 10.00

h_{avg} = (0.000 + 0.257)/2
h_{avg} = 0.129

h/b = 0.129/10.00
h/b = 0.013

C = 3.01 (D.C. 2.09)

Assume k_t = 1.0

Q_1 = $0.55CLH^{1.5}k_t$
Q_1 = 0.55(3.01)(17.507)(0.129^1.5)*(1.0)
Q_1 = 1.3 m^3/s

Height (h)

0.257

Area 2

L = 25.000
b = 10.00

h_{avg} = (0.257 + 0.534)/2
h_{avg} = 0.396

h/b = 0.396/10.00
h/b = 0.040

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_2 = $0.55CLH^{1.5}k_t$
Q_2 = 0.55(3.04)(25.000)(0.396^1.5)*(1.0)
Q_2 = 10.4 m^3/s

Height (h)

0.534

Q_{WEIR} = Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8
Q_{WEIR} = (1.3) + (10.4) + (20.2)+ (25.6) + (25.2) + (19.0) + (8.9) + (0.8)
Q_{WEIR} = 111.4 m^3/s

Q_{TOTAL} = Q_{BRIDGE} + Q_{WEIR}
Q_{TOTAL} = (585.1) + (111.4)
Q_{TOTAL} = 696.5 **m^3/s**

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.25
PAGE 2 OF 3

Area 3

L = 25.000
b = 10.00

h_{avg} = (0.534 + 0.696)/2
h_{avg} = 0.615

h/b = 0.615/10.00
h/b = 0.062

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.615^1.5)*(1.0)
Q_3 = 20.2 m^3/s

Height (h)

0.696

Area 4

L = 25.000
b = 10.00

h_{avg} = (0.696 + 0.745)/2
h_{avg} = 0.721

h/b = 0.721/10.00
h/b = 0.072

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.721^1.5)*(1.0)
Q_3 = 25.6 m^3/s

Height (h)

0.745

Area 5

L = 25.000
b = 10.00

h_{avg} = (0.745 + 0.681)/2
h_{avg} = 0.713

h/b = 0.713/10.00
h/b = 0.071

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.713^1.5)*(1.0)
Q_3 = 25.2 m^3/s

Height (h)

0.681

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.25
PAGE 3 OF 3

Area 6

L = 25.000
b = 10.00

h_{avg} = (0.681 + 0.503)/2
h_{avg} = 0.592

h/b = 0.592/10.00
h/b = 0.059

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.592^1.5)*(1.0)
Q_3 = 19.0 m^3/s

Height (h)

0.503

Area 7

L = 25.000
b = 10.00

h_{avg} = (0.503 + 0.211)/2
h_{avg} = 0.357

h/b = 0.357/10.00
h/b = 0.036

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.357^1.5)*(1.0)
Q_3 = 8.9 m^3/s

Height (h)

0.211

Area 8

L = 14.180
b = 10.00

h_{avg} = (0.211 + 0.000)/2
h_{avg} = 0.106

h/b = 0.106/10.00
h/b = 0.011

C = 3 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.00)(14.180)(0.106^1.5)*(1.0)
Q_3 = 0.8 m^3/s

Height (h)

0.000

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.50
PAGE 1 OF 4

Assume B = 10.0m
Q_{BRIDGE} = 585.1 m^3/s

Height (h)
0

Area 1

L = 9.330
b = 10.00

h_{avg} = (0.000 + 0.140)/2
h_{avg} = 0.070

h/b = 0.070/10.00
h/b = 0.007

C = 2.97 (D.C. 2.09)

Assume k_t = 1.0

$Q_1 = 0.55CLH^{1.5}k_t$
Q_1 = 0.55(2.97)(9.330)(0.070^1.5)*(1.0)
Q_1 = 0.3 m^3/s

Height (h)
0.14

Area 2

L = 25.000
b = 10.00

h_{avg} = (0.140 + 0.507)/2
h_{avg} = 0.324

h/b = 0.324/10.00
h/b = 0.032

C = 3.03 (D.C. 2.09)

Assume k_t = 1.0

$Q_2 = 0.55CLH^{1.5}k_t$
Q_2 = 0.55(3.03)(25.000)(0.324^1.5)*(1.0)
Q_2 = 7.7 m^3/s

Height (h)
0.507

Q_{WEIR} = Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8 + Q9 + Q10
Q_{WEIR} = (0.3) + (7.7) + (21.7)+ (33.6) + (40.0) + (39.5) + (32.3) + (19.7) + (6.0) + (0.1)
Q_{WEIR} = 200.8 m^3/s

Q_{TOTAL} = Q_{BRIDGE} + Q_{WEIR}
Q_{TOTAL} = (585.1) + (200.8)
Q_{TOTAL} = 785.9 m^3/s

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.50
PAGE 2 OF 4

Area 3

L = 25.000
b = 10.00

h_{avg} = (0.507 + 0.784)/2
h_{avg} = 0.646

h/b = 0.646/10.00
h/b = 0.065

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.646^1.5)*(1.0)
Q_3 = 21.7 m^3/s

Height (h)

0.784

Area 4

L = 25.000
b = 10.00

h_{avg} = (0.784 + 0.946)/2
h_{avg} = 0.865

h/b = 0.865/10.00
h/b = 0.087

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.865^1.5)*(1.0)
Q_3 = 33.6 m^3/s

Height (h)

0.946

Area 5

L = 25.000
b = 10.00

h_{avg} = (0.946 + 0.995)/2
h_{avg} = 0.971

h/b = 0.971/10.00
h/b = 0.097

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.971^1.5)*(1.0)
Q_3 = 40.0 m^3/s

Height (h)

0.995

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.50
PAGE 3 OF 4

Area 6

L = 25.000
b = 10.00

h_{avg} = (0.995 + 0.931)/2
h_{avg} = 0.963

h/b = 0.963/10.00
h/b = 0.096

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.963^1.5)*(1.0)
Q_3 = 39.5 m^3/s

Height (h)
0.931

Area 7

L = 25.000
b = 10.00

h_{avg} = (0.931 + 0.752)/2
h_{avg} = 0.842

h/b = 0.842/10.00
h/b = 0.084

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.842^1.5)*(1.0)
Q_3 = 32.3 m^3/s

Height (h)
0.752

Area 8

L = 25.000
b = 10.00

h_{avg} = (0.752 + 0.461)/2
h_{avg} = 0.607

h/b = 0.607/10.00
h/b = 0.061

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.607^1.5)*(1.0)
Q_3 = 19.7 m^3/s

Height (h)
0.461

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.50
PAGE 4 OF 4

Area 9

L = 25.000
b = 10.00

h_{avg} = (0.461 + 0.089)/2
h_{avg} = 0.275

h/b = 0.275/10.00
h/b = 0.028

C = 3.03 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.03)(25.000)(0.275^1.5)*(1.0)
Q_3 = 6.0 m^3/s

Height (h)

0.089

Area 10

L = 5.930
b = 10.00

h_{avg} = (0.089 + 0.000)/2
h_{avg} = 0.045

h/b = 0.045/10.00
h/b = 0.004

C = 2.96 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(2.96)(5.930)(0.045^1.5)*(1.0)
Q_3 = 0.1 m^3/s

Height (h)

0.000

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.75
PAGE 1 OF 4

Assume B = 10.0m

Q_{BRIDGE} = 585.1 m^3/s

Height (h)

0.015

Area 1

L = 25.000

b = 10.00

h_{avg} = (0.015 + 0.390)/2

h_{avg} = 0.203

h/b = 0.203/10.00

h/b = 0.020

C = 3.02 (D.C. 2.09)

Assume k_t = 1.0

$Q_1 = 0.55CLH^{1.5}k_t$

Q_1 = 0.55(3.02)(25.000)(0.203^1.5)*(1.0)

Q_1 = 3.8 m^3/s

Height (h)

0.39

Area 2

L = 25.000

b = 10.00

h_{avg} = (0.390 + 0.757)/2

h_{avg} = 0.574

h/b = 0.574/10.00

h/b = 0.057

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_2 = 0.55CLH^{1.5}k_t$

Q_2 = 0.55(3.04)(25.000)(0.574^1.5)*(1.0)

Q_2 = 18.2 m^3/s

Height (h)

0.757

Q_{WEIR} = Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8 + Q9 + Q10

Q_{WEIR} = (3.8) + (18.2) + (35.4)+ (49.2) + (56.4) + (55.8) + (47.7) + (33.1) + (15.9) + (2.6)

Q_{WEIR} = 318.1 m^3/s

$Q_{TOTAL} = Q_{BRIDGE} + Q_{WEIR}$

Q_{TOTAL} = (585.1) + (318.1)

Q_{TOTAL} = 903.2 **m^3/s**

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.75
PAGE 2 OF 4

Area 3

L = 25.000
b = 10.00

h_{avg} = (0.757 + 1.034)/2
h_{avg} = 0.896

h/b = 0.896/10.00
h/b = 0.090

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.896^1.5)*(1.0)
Q_3 = 35.4 m^3/s

Height (h)

1.034

Area 4

L = 25.000
b = 10.00

h_{avg} = (1.034 + 1.196)/2
h_{avg} = 1.115

h/b = 1.115/10.00
h/b = 0.112

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(1.115^1.5)*(1.0)
Q_3 = 49.2 m^3/s

Height (h)

1.196

Area 5

L = 25.000
b = 10.00

h_{avg} = (1.196 + 1.245)/2
h_{avg} = 1.221

h/b = 1.221/10.00
h/b = 0.122

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(1.221^1.5)*(1.0)
Q_3 = 56.4 m^3/s

Height (h)

1.245

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.75
PAGE 3 OF 4

Area 6

L = 25.000
b = 10.00

h_{avg} = (1.245 + 1.181)/2
h_{avg} = 1.213

h/b = 1.213/10.00
h/b = 0.121

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(1.213^1.5)*(1.0)
Q_3 = 55.8 m^3/s

Height (h)

1.181

Area 7

L = 25.000
b = 10.00

h_{avg} = (1.181 + 1.002)/2
h_{avg} = 1.092

h/b = 1.092/10.00
h/b = 0.109

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(1.092^1.5)*(1.0)
Q_3 = 47.7 m^3/s

Height (h)

1.002

Area 8

L = 25.000
b = 10.00

h_{avg} = (1.002 + 0.711)/2
h_{avg} = 0.857

h/b = 0.857/10.00
h/b = 0.086

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.857^1.5)*(1.0)
Q_3 = 33.1 m^3/s

Height (h)

0.711

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.75
PAGE 4 OF 4

Area 9

L = 25.000
b = 10.00

h_{avg} = (0.711 + 0.339)/2
h_{avg} = 0.525

h/b = 0.525/10.00
h/b = 0.053

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.525^1.5)*(1.0)
Q_3 = 15.9 m^3/s

Height (h)

0.339

Area 10

L = 22.600
b = 10.00

h_{avg} = (0.339 + 0.000)/2
h_{avg} = 0.170

h/b = 0.170/10.00
h/b = 0.017

C = 3.02 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.02)(22.600)(0.170^1.5)*(1.0)
Q_3 = 2.6 m^3/s

Height (h)

0.000

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.90
PAGE 1 OF 5

Assume B = 10.0m
Q_{BRIDGE} = 585.1 m^3/s

Height (h)
0

Area 1

L = 11.000
b = 10.00

h_{avg} = (0.000 + 0.165)/2
h_{avg} = 0.083

h/b = 0.083/10.00
h/b = 0.008

C = 2.99 (D.C. 2.09)

Assume k_t = 1.0

$Q_1 = 0.55CLH^{1.5}k_t$
Q_1 = 0.55(2.99)(11.000)(0.083^1.5)*(1.0)
Q_1 = 0.4 m^3/s

Height (h)
0.165

Area 2

L = 25.000
b = 10.00

h_{avg} = (0.165 + 0.540)/2
h_{avg} = 0.353

h/b = 0.353/10.00
h/b = 0.035

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_2 = 0.55CLH^{1.5}k_t$
Q_2 = 0.55(3.04)(25.000)(0.353^1.5)*(1.0)
Q_2 = 8.7 m^3/s

Height (h)
0.540

Q_{WEIR} = Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8 + Q9 + Q10 + Q11 + Q12
Q_{WEIR} = (0.4) + (8.7) + (25.7)+ (44.7) + (59.5) + (67.1) + (66.5) + (57.8) + (42.2) + (23.2) + (6.9) + (0.2)
Q_{WEIR} = 402.9 m^3/s

Q_{TOTAL} = Q_{BRIDGE} + Q_{WEIR}
Q_{TOTAL} = (585.1) + (402.9)
Q_{TOTAL} = 988.0 m^3/s

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.90
PAGE 2 OF 5

Area 3

L = 25.000
b = 10.00

h_{avg} = (0.540 + 0.907)/2
h_{avg} = 0.724

h/b = 0.724/10.00
h/b = 0.072

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.724^1.5)*(1.0)
Q_3 = 25.7 m^3/s

Height (h)
0.907

Area 4

L = 25.000
b = 10.00

h_{avg} = (0.907 + 1.184)/2
h_{avg} = 1.046

h/b = 1.046/10.00
h/b = 0.105

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(1.046^1.5)*(1.0)
Q_3 = 44.7 m^3/s

Height (h)
1.184

Area 5

L = 25.000
b = 10.00

h_{avg} = (1.184 + 1.346)/2
h_{avg} = 1.265

h/b = 1.265/10.00
h/b = 0.127

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

Q_3 = $0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(1.265^1.5)*(1.0)
Q_3 = 59.5 m^3/s

Height (h)
1.346

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.90
PAGE 3 OF 5

Area 6

L = 25.000
b = 10.00

h_{avg} = (1.346 + 1.395)/2
h_{avg} = 1.371

h/b = 1.371/10.00
h/b = 0.137

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(1.371^1.5)*(1.0)
Q_3 = 67.1 m^3/s

Height (h)

1.395

Area 7

L = 25.000
b = 10.00

h_{avg} = (1.395 + 1.331)/2
h_{avg} = 1.363

h/b = 1.363/10.00
h/b = 0.136

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(1.363^1.5)*(1.0)
Q_3 = 66.5 m^3/s

Height (h)

1.331

Area 8

L = 25.000
b = 10.00

h_{avg} = (1.331 + 1.152)/2
h_{avg} = 1.242

h/b = 1.242/10.00
h/b = 0.124

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(1.242^1.5)*(1.0)
Q_3 = 57.8 m^3/s

Height (h)

1.152

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.90
PAGE 4 OF 5

Area 9

L = 25.000
b = 10.00

h_{avg} = (1.152 + 0.861)/2
h_{avg} = 1.007

h/b = 1.007/10.00
h/b = 0.101

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(1.007^1.5)*(1.0)
Q_3 = 42.2 m^3/s

Height (h)

0.861

Area 10

L = 25.000
b = 10.00

h_{avg} = (0.861 + 0.489)/2
h_{avg} = 0.675

h/b = 0.675/10.00
h/b = 0.068

C = 3.04 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.04)(25.000)(0.675^1.5)*(1.0)
Q_3 = 23.2 m^3/s

Height (h)

0.489

Area 11

L = 25.000
b = 10.00

h_{avg} = (0.489 + 0.114)/2
h_{avg} = 0.302

h/b = 0.302/10.00
h/b = 0.030

C = 3.03 (D.C. 2.09)

Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(3.03)(25.000)(0.302^1.5)*(1.0)
Q_3 = 6.9 m^3/s

Height (h)

0.114

PROPOSED CONDITIONS - WEIR FLOW
WATER LEVEL ELEVATION = 315.90
PAGE 5 OF 5

Area 12

L = 8.590
b = 10.00

h_{avg} = (0.114 + 0.000)/2
h_{avg} = 0.057

h/b = 0.057/10.00
h/b = 0.006

C = 2.96 (D.C. 2.09)

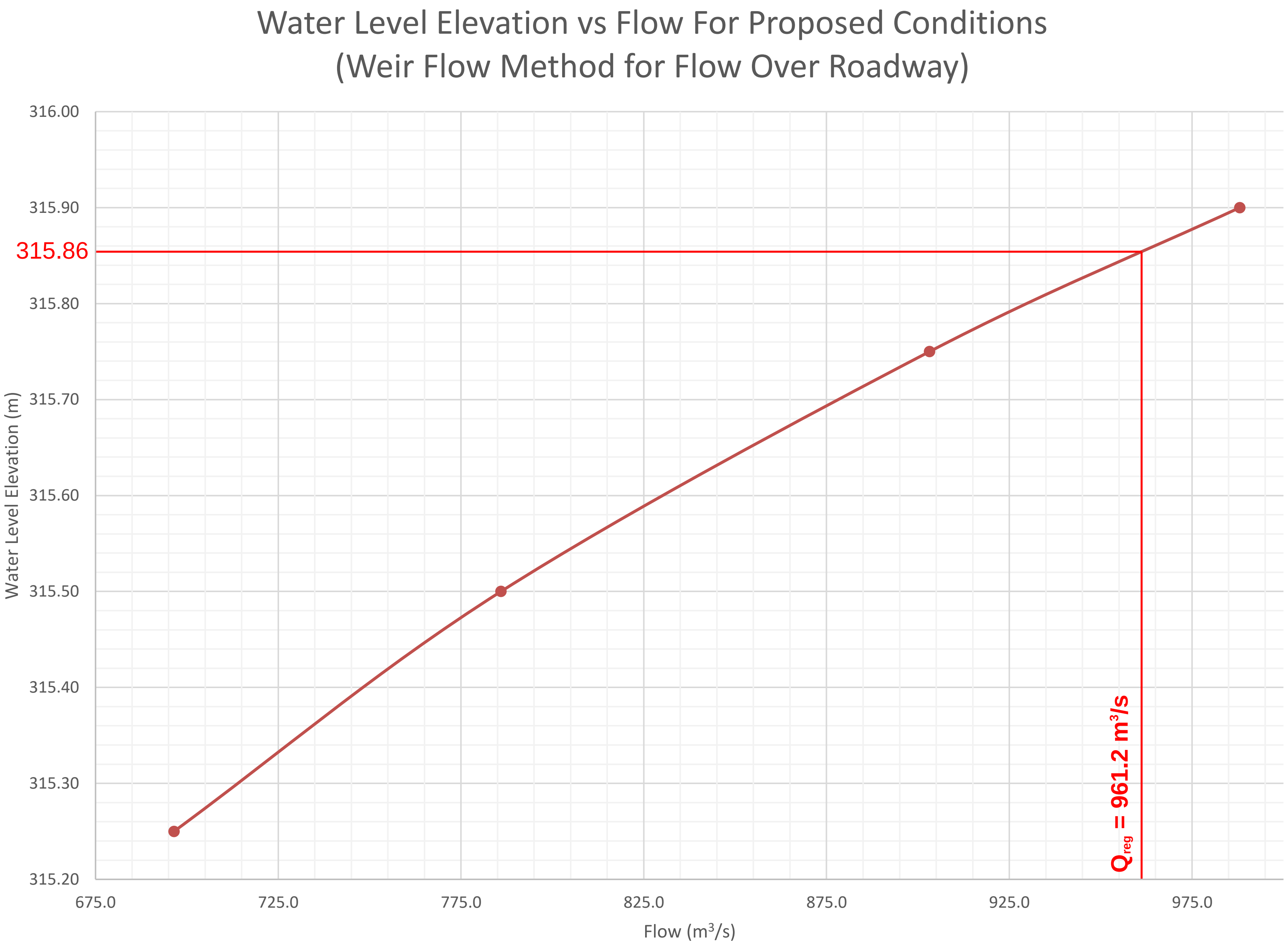
Assume k_t = 1.0

$Q_3 = 0.55CLH^{1.5}k_t$
Q_3 = 0.55(2.96)(8.590)(0.057^1.5)*(1.0)
Q_3 = 0.2 m^3/s

Height (h)

0.000

Proposed Conditions	
Water Level Elevation (m)	Total Flow (Weir + Bridge) (m³/s)
315.25	696.5
315.50	785.9
315.75	903.2
315.90	988.0


Water Level Elevation vs Flow For Proposed Conditions
(Weir Flow Method for Flow Over Roadway)
316.00
315.90
315.86
315.80
315.70
315.60
315.50
315.40
315.30
315.20
Water Level Elevation (m)
675.0
725.0
775.0
825.0
875.0
925.0
975.0
Flow (m3/s)
Qreg = 961.2 m3/s

Summary of Proposed Conditions		
Design Storm	**Flow m³/s**	**Proposed High Water Elevation (m)**
10 Year	72.9	311.12
25 Year	315.7	313.01
100 Year	416.8	313.58
Regional	961.2	315.86

EXISTING CONDITIONS

```
                        HEC-RAS HEC-RAS 6.0.0 May 2021
                         U.S. Army Corps of Engineers
                        Hydrologic Engineering Center
                              609 Second Street
                              Davis, California


            X     X  XXXXXX    XXXX        XXXX       XX      XXXX
            X     X  X        X    X       X   X     X  X    X
            X     X  X        X            X   X    X    X   X
            XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
            X     X  X        X            X  X     X    X        X
            X     X  X        X    X       X   X    X    X        X
            X     X  XXXXXX    XXXX        X    X   X    X   XXXXX




PROJECT DATA
Project Title: Middle Nith - Ayr to Philipsburg
Project File : HRMidNith.prj
Run Date and Time: 2021-12-23 10:29:15 AM

Project in SI units

Project Description:
NITH RIVER FPM STUDY FOR GRAND RIVER C.A.
Original Study by Dillon 1985 -
Combined H2NITH1.DAT and H2NITH2.DAT
Updated to HEC-RAS - GRCA 2010
Bridge
updates per GRCA permits - Haysville, Bender - Bleams Road, New Hamburg
Walkway, New Hamburg Channel refinements 2006, Oxford Blanford Blenheim Road 11
P288/05, Watson Factory Ineffective area Ayr
H2NITH1.DAT flows added November
2011. Original Reg flows are best, GRHS flows U/S of Canning not documented
(JSP)




PLAN DATA

Plan Title: Regulatory
Plan File : C:\Users\tjackson\Documents\20-145\HECRAS Model\Existing\Alder_Plattsville\HRMidNith.p06

           Geometry Title: 8sept2006 r5 - shallow channel u/s
           Geometry File : C:\Users\tjackson\Documents\20-145\HECRAS Model\Existing\Alder_Plattsville\HRMidNith.g17

           Flow Title    : Reg_100_20
           Flow File     : C:\Users\tjackson\Documents\20-145\HECRAS Model\Existing\Alder_Plattsville\HRMidNith.f04

Plan Summary Information:
Number of:  Cross Sections =  253    Multiple Openings  =    0
```

EXISTING CONDITIONS

```
            Culverts       =    0    Inline Structures  =    1
            Bridges        =   29    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.003
    Critical depth calculation tolerance =  0.003
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.1
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Mixed Flow



FLOW DATA

Flow Title: Reg_100_20
Flow File : C:\Users\tjackson\Documents\20-145\HECRAS Model\Existing\Alder_Plattsville\HRMidNith.f04

Flow Data (m3/s)

  River           Reach           RS                  20 yr          100 yr             Reg
  RIVER-1         Reach-1         73584                 379             522             923
  RIVER-1         Reach-1         36588                 414             531             923
  RIVER-1         Reach-1         27396                 416             526             923
  RIVER-1         Reach-1         16084                 419             518             923


Boundary Conditions

  River           Reach           Profile                        Upstream                Downstream

  RIVER-1         Reach-1         20 yr                       Normal S = 0.001         Normal S = 0.001
  RIVER-1         Reach-1         100 yr                      Normal S = 0.001         Normal S = 0.001
  RIVER-1         Reach-1         Reg                         Normal S = 0.001         Normal S = 0.001



GEOMETRY DATA

Geometry Title: 8sept2006 r5 - shallow channel u/s
Geometry File : C:\Users\tjackson\Documents\20-145\HECRAS Model\Existing\Alder_Plattsville\HRMidNith.g17

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 37770

INPUT
```

EXISTING CONDITIONS

```
Description:
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000   319.5 1062.65     317 1095.12   316.5 1107.55     316 1200.21   315.5
 1280.62   315.5 1302.99     316 1376.68     316 1413.25     315  1418.5     313
 1489.88   312.5 1527.33   312.5 1553.11     312 1570.14   311.4 1582.83   310.6
 1585.25   309.7 1608.25   309.7 1610.39   310.7  1615.4     312 1712.47     313
 1781.25   326.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06 1582.83     .04 1610.39     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       1582.83 1610.39               70      55      20             .1       .3

CROSS SECTION OUTPUT  Profile #20 yr

  E.G. Elev (m)           313.56    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.14    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           313.43    Reach Len. (m)           70.00      55.00      20.00
  Crit W.S. (m)                     Flow Area (m2)          173.59     100.52     100.70
  E.G. Slope (m/m)      0.001297    Area (m2)               173.59     100.52     100.70
  Q Total (m3/s)          379.00    Flow (m3/s)             107.54     212.47      58.98
  Top Width (m)           297.25    Top Width (m)           165.45      27.56     104.25
  Vel Total (m/s)           1.01    Avg. Vel. (m/s)           0.62       2.11       0.59
  Max Chl Dpth (m)          3.73    Hydr. Depth (m)           1.05       3.65       0.97
  Conv. Total (m3/s)     10523.0    Conv. (m3/s)            2985.9     5899.4     1637.7
  Length Wtd. (m)          54.40    Wetted Per. (m)         165.57      27.94     104.46
  Min Ch El (m)           309.70    Shear (N/m2)             13.34      45.76      12.26
  Alpha                     2.61    Stream Power (N/m s)      8.26      96.72       7.18
  Frctn Loss (m)            0.11    Cum Volume (1000 m3)   6773.25    4822.93    5320.78
  C & E Loss (m)            0.03    Cum SA (1000 m2)       5947.00    1283.29    4451.37


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (m)           314.14    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.09    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           314.05    Reach Len. (m)           70.00      55.00      20.00
  Crit W.S. (m)                     Flow Area (m2)          276.75     117.62     166.36
  E.G. Slope (m/m)      0.000858    Area (m2)               276.75     117.62     166.36
  Q Total (m3/s)          522.00    Flow (m3/s)             188.96     224.51     108.53
  Top Width (m)           302.04    Top Width (m)           167.08      27.56     107.41
  Vel Total (m/s)           0.93    Avg. Vel. (m/s)           0.68       1.91       0.65
  Max Chl Dpth (m)          4.35    Hydr. Depth (m)           1.66       4.27       1.55
  Conv. Total (m3/s)     17821.9    Conv. (m3/s)            6451.3     7665.2     3705.3
  Length Wtd. (m)          54.08    Wetted Per. (m)         167.31      27.94     107.68
  Min Ch El (m)           309.70    Shear (N/m2)             13.92      35.41      13.00
  Alpha                     2.11    Stream Power (N/m s)      9.50      67.59       8.48
  Frctn Loss (m)            0.09    Cum Volume (1000 m3)   8816.01    5268.45    6885.47
```

```
  C & E Loss (m)            0.06    Cum SA (1000 m2)       6340.73    1283.42    4980.17


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #Reg

  E.G. Elev (m)           316.03    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.05    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           315.98    Reach Len. (m)           70.00      55.00      20.00
  Crit W.S. (m)                     Flow Area (m2)          686.62     170.95     383.74
  E.G. Slope (m/m)      0.000334    Area (m2)               686.62     170.95     383.74
  Q Total (m3/s)          923.00    Flow (m3/s)             404.86     261.21     256.92
  Top Width (m)           541.40    Top Width (m)           396.57      27.56     117.27
  Vel Total (m/s)           0.74    Avg. Vel. (m/s)           0.59       1.53       0.67
  Max Chl Dpth (m)          6.28    Hydr. Depth (m)           1.73       6.20       3.27
  Conv. Total (m3/s)     50511.9    Conv. (m3/s)           22156.5    14295.0    14060.4
  Length Wtd. (m)          55.40    Wetted Per. (m)         397.00      27.94     117.73
  Min Ch El (m)           309.70    Shear (N/m2)              5.66      20.03      10.67
  Alpha                     1.70    Stream Power (N/m s)      3.34      30.61       7.15
  Frctn Loss (m)            0.03    Cum Volume (1000 m3)  15830.07    6657.18   12417.91
  C & E Loss (m)            0.01    Cum SA (1000 m2)       7348.39    1281.87    5924.15


Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 37715

INPUT
Description: This is a REPEATED section.
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000     320    1115   316.6    1213     316    1378   315.5    1426   314.5
    1526   314.3  1623.9   310.6    1624   310.6  1639.8   309.6  1654.8   309.7
  1668.9   311.9    1669   311.9    1692   315.5    1732     319    1746     319
    1779   324.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06  1623.9     .04    1669     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1623.9    1669                7       7       7             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000  1623.9   314.5       F
    1669    1779   315.5       F
```

EXISTING CONDITIONS

```
CROSS SECTION OUTPUT  Profile #20 yr

  E.G. Elev (m)           313.42    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.47    Wt. n-Val.                          0.040
  W.S. Elev (m)           312.95    Reach Len. (m)            1.00       1.00       1.00
  Crit W.S. (m)           312.10    Flow Area (m2)                     125.10
  E.G. Slope (m/m)      0.003791    Area (m2)                72.94     125.10       3.51
  Q Total (m3/s)          379.00    Flow (m3/s)                        379.00
  Top Width (m)           113.92    Top Width (m)            62.13      45.10       6.70
  Vel Total (m/s)           3.03    Avg. Vel. (m/s)                      3.03
  Max Chl Dpth (m)          3.35    Hydr. Depth (m)                      2.77
  Conv. Total (m3/s)      6155.6    Conv. (m3/s)                       6155.6
  Length Wtd. (m)           1.00    Wetted Per. (m)                     45.30
  Min Ch El (m)           309.60    Shear (N/m2)                       102.65
  Alpha                     1.00    Stream Power (N/m s)               311.00
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)   6764.62    4816.72    5319.73
  C & E Loss (m)            0.00    Cum SA (1000 m2)       5939.04    1281.30    4450.26


Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (m)           313.98    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.71    Wt. n-Val.                          0.040
  W.S. Elev (m)           313.27    Reach Len. (m)            1.00       1.00       1.00
  Crit W.S. (m)           312.57    Flow Area (m2)                     139.77
  E.G. Slope (m/m)      0.004968    Area (m2)                94.55     139.77       6.03
  Q Total (m3/s)          522.00    Flow (m3/s)                        522.00
  Top Width (m)           124.61    Top Width (m)            70.74      45.10       8.77
  Vel Total (m/s)           3.73    Avg. Vel. (m/s)                      3.73
  Max Chl Dpth (m)          3.67    Hydr. Depth (m)                      3.10
  Conv. Total (m3/s)      7405.6    Conv. (m3/s)                       7405.6
  Length Wtd. (m)           1.00    Wetted Per. (m)                     45.30
  Min Ch El (m)           309.60    Shear (N/m2)                       150.33
  Alpha                     1.00    Stream Power (N/m s)               561.42
  Frctn Loss (m)            0.01    Cum Volume (1000 m3)   8803.01    5261.38    6883.75
  C & E Loss (m)            0.00    Cum SA (1000 m2)       6332.41    1281.42    4979.01


Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Reg

  E.G. Elev (m)           315.99    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.16    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           315.83    Reach Len. (m)            1.00       1.00       1.00
  Crit W.S. (m)           313.67    Flow Area (m2)          531.96     255.11      49.63
  E.G. Slope (m/m)      0.000781    Area (m2)               531.96     255.11      49.63
  Q Total (m3/s)          923.00    Flow (m3/s)             324.33     564.05      34.62
  Top Width (m)           426.94    Top Width (m)           355.06      45.10      26.78
  Vel Total (m/s)           1.10    Avg. Vel. (m/s)           0.61       2.21       0.70
  Max Chl Dpth (m)          6.23    Hydr. Depth (m)           1.50       5.66       1.85
  Conv. Total (m3/s)     33032.3    Conv. (m3/s)           11607.0    20186.3     1239.0
  Length Wtd. (m)           1.00    Wetted Per. (m)         355.14      45.30      27.07
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  Min Ch El (m)           309.60    Shear (N/m2)             11.47      43.12      14.04
  Alpha                     2.58    Stream Power (N/m s)      6.99      95.33       9.79
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)  15787.42    6645.47   12413.58
  C & E Loss (m)            0.33    Cum SA (1000 m2)       7322.09    1279.87    5922.71


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

BRIDGE


RIVER: RIVER-1
REACH: Reach-1            RS: 37712.5

INPUT
Description: Bridge Street - Bridge #1

Distance from Upstream XS =       1
Deck/Roadway Width        =       5
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      14
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    1000     320     320    1115   316.6   316.6    1213     316     316
    1378   315.5   315.5    1426   314.5   314.5    1526   314.3   314.3
  1623.9   315.3   310.6    1624   315.3   314.3  1668.9   315.3   314.3
    1669   315.3   311.9    1692   315.5   315.5    1732     319     319
    1746     319     319    1779   324.5   324.5

Upstream Bridge Cross Section Data
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000     320    1115   316.6    1213     316    1378   315.5    1426   314.5
    1526   314.3  1623.9   310.6    1624   310.6  1639.8   309.6  1654.8   309.7
  1668.9   311.9    1669   311.9    1692   315.5    1732     319    1746     319
    1779   324.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06  1623.9     .04    1669     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
        1623.9    1669             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000  1623.9   314.5       F
    1669    1779   315.5       F

Downstream  Deck/Roadway Coordinates
    num=      14
```

EXISTING CONDITIONS

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     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    1000     320     320    1115   316.6   316.6    1213     316     316
    1378   315.5   315.5    1426   314.5   314.5    1526   314.3   314.3
  1623.9   315.3   310.6    1624   315.3   314.3  1668.9   315.3   314.3
    1669   315.3   311.9    1692   315.5   315.5    1732     319     319
    1746     319     319    1779   324.5   324.5

Downstream Bridge Cross Section Data
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000     320    1115   316.6    1213     316    1378   315.5    1426   314.5
    1526   314.3  1623.9   310.6    1624   310.6  1639.8   309.6  1654.8   309.7
  1668.9   311.9    1669   311.9    1692   315.5    1732     319    1746     319
    1779   324.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06  1623.9     .04    1669     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
        1623.9    1669             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000  1623.9   314.3       F
    1669    1779   315.5       F

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #20 yr

  E.G. US. (m)               313.42    Element               Inside BR US  Inside BR DS
  W.S. US. (m)               312.95    E.G. Elev (m)              313.41        313.39
  Q Total (m3/s)             379.00    W.S. Elev (m)              312.94        312.90
  Q Bridge (m3/s)            379.00    Crit W.S. (m)              312.11        312.11
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  Q Weir (m3/s)                         Max Chl Dpth (m)            3.34          3.30
  Weir Sta Lft (m)                      Vel Total (m/s)             3.04          3.08
  Weir Sta Rgt (m)                      Flow Area (m2)            124.69        122.93
  Weir Submerg                          Froude # Chl                0.53          0.54
  Weir Max Depth (m)                    Specif Force (m3)         298.58        295.40
  Min El Weir Flow (m)       314.50     Hydr Depth (m)              2.77          2.73
  Min El Prs (m)             314.30     W.P. Total (m)             48.69         48.61
  Delta EG (m)                 0.03     Conv. Total (m3/s)        5835.5        5704.4
  Delta WS (m)                 0.05     Top Width (m)              44.99         45.00
  BR Open Area (m2)          185.77     Frctn Loss (m)              0.02          0.00
  BR Open Vel (m/s)            3.08     C & E Loss (m)              0.00          0.00
  BR Sluice Coef                        Shear Total (N/m2)        105.94        109.47
  BR Sel Method         Energy only     Power Total (N/m s)       322.01        337.53


Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT  Profile #100 yr

  E.G. US. (m)               313.98     Element               Inside BR US  Inside BR DS
  W.S. US. (m)               313.27     E.G. Elev (m)             313.98        313.94
  Q Total (m3/s)             522.00     W.S. Elev (m)             313.26        313.18
  Q Bridge (m3/s)            522.00     Crit W.S. (m)             312.56        312.56
  Q Weir (m3/s)                         Max Chl Dpth (m)            3.66          3.58
  Weir Sta Lft (m)                      Vel Total (m/s)             3.76          3.86
  Weir Sta Rgt (m)                      Flow Area (m2)            139.00        135.37
  Weir Submerg                          Froude # Chl                0.63          0.65
  Weir Max Depth (m)                    Specif Force (m3)         422.94        417.23
  Min El Weir Flow (m)       314.50     Hydr Depth (m)              3.09          3.01
  Min El Prs (m)             314.30     W.P. Total (m)             49.32         49.16
  Delta EG (m)                 0.05     Conv. Total (m3/s)        6933.3        6648.7
  Delta WS (m)                 0.10     Top Width (m)              44.97         44.98
  BR Open Area (m2)          185.77     Frctn Loss (m)              0.03          0.01
  BR Open Vel (m/s)            3.86     C & E Loss (m)              0.01          0.00
  BR Sluice Coef                        Shear Total (N/m2)        156.65        166.45
  BR Sel Method         Energy only     Power Total (N/m s)       588.29        641.85


Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT  Profile #Reg

  E.G. US. (m)               315.99     Element               Inside BR US  Inside BR DS
  W.S. US. (m)               315.83     E.G. Elev (m)             315.66        315.58
  Q Total (m3/s)             923.00     W.S. Elev (m)             314.40        314.32
  Q Bridge (m3/s)            923.00     Crit W.S. (m)             313.67        313.67
  Q Weir (m3/s)                         Max Chl Dpth (m)            4.80          4.72
  Weir Sta Lft (m)                      Vel Total (m/s)             4.97          4.97
  Weir Sta Rgt (m)                      Flow Area (m2)            185.77        185.86
  Weir Submerg                          Froude # Chl                0.72          0.73
  Weir Max Depth (m)                    Specif Force (m3)         878.29        863.01
  Min El Weir Flow (m)       314.50     Hydr Depth (m)                           17.37
  Min El Prs (m)             314.30     W.P. Total (m)             96.31        107.01
  Delta EG (m)                 0.57     Conv. Total (m3/s)        7196.4        7196.4
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  Delta WS (m)                 2.16    Top Width (m)                           10.70
  BR Open Area (m2)          185.77    Frctn Loss (m)               0.08          0.01
  BR Open Vel (m/s)            4.97    C & E Loss (m)               0.00          0.15
  BR Sluice Coef                       Shear Total (N/m2)         311.17        280.19
  BR Sel Method         Energy only    Power Total (N/m s)       1546.10       1391.44


Warning: Multiple water surfaces were found that could balance the energy equation. The program selected the water
         surface whose main channel velocity head was the closest to the previously computed cross section.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 37710

INPUT
Description:
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000     320    1115   316.6    1213     316    1378   315.5    1426   314.5
    1526   314.3  1623.9   310.6    1624   310.6  1639.8   309.6  1654.8   309.7
  1668.9   311.9    1669   311.9    1692   315.5    1732     319    1746     319
    1779   324.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06  1623.9     .04    1669     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1623.9    1669               48      38      73             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000  1623.9   314.3       F
    1669    1779   315.5       F

CROSS SECTION OUTPUT  Profile #20 yr

  E.G. Elev (m)           313.38    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.49    Wt. n-Val.                           0.040
  W.S. Elev (m)           312.90    Reach Len. (m)           48.00      38.00      73.00
  Crit W.S. (m)           312.10    Flow Area (m2)                      122.82
  E.G. Slope (m/m)      0.004030    Area (m2)                69.84     122.82       3.18
  Q Total (m3/s)          379.00    Flow (m3/s)                         379.00
  Top Width (m)           112.27    Top Width (m)            60.79      45.10       6.37
  Vel Total (m/s)           3.09    Avg. Vel. (m/s)                       3.09
  Max Chl Dpth (m)          3.30    Hydr. Depth (m)                       2.72
  Conv. Total (m3/s)      5970.1    Conv. (m3/s)                        5970.1
  Length Wtd. (m)          40.82    Wetted Per. (m)                      45.30
  Min Ch El (m)           309.60    Shear (N/m2)                        107.15
  Alpha                     1.00    Stream Power (N/m s)                330.63
  Frctn Loss (m)            0.10    Cum Volume (1000 m3)   6764.55    4815.85    5319.73
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  C & E Loss (m)            0.16    Cum SA (1000 m2)       5938.97    1280.98    4450.25


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (m)           313.93    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.76    Wt. n-Val.                          0.040
  W.S. Elev (m)           313.17    Reach Len. (m)           48.00      38.00      73.00
  Crit W.S. (m)           312.57    Flow Area (m2)                     135.17
  E.G. Slope (m/m)      0.005555    Area (m2)                87.47     135.17       5.16
  Q Total (m3/s)          522.00    Flow (m3/s)                        522.00
  Top Width (m)           121.26    Top Width (m)            68.04      45.10       8.12
  Vel Total (m/s)           3.86    Avg. Vel. (m/s)                      3.86
  Max Chl Dpth (m)          3.57    Hydr. Depth (m)                      3.00
  Conv. Total (m3/s)      7003.4    Conv. (m3/s)                       7003.4
  Length Wtd. (m)          41.30    Wetted Per. (m)                     45.30
  Min Ch El (m)           309.60    Shear (N/m2)                       162.55
  Alpha                     1.00    Stream Power (N/m s)               627.74
  Frctn Loss (m)            0.11    Cum Volume (1000 m3)   8802.92    5260.42    6883.74
  C & E Loss (m)            0.29    Cum SA (1000 m2)       6332.34    1281.10    4979.00


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Reg

  E.G. Elev (m)           315.42    Element                 Left OB    Channel   Right OB
  Vel Head (m)              1.75    Wt. n-Val.                          0.040
  W.S. Elev (m)           313.67    Reach Len. (m)           48.00      38.00      73.00
  Crit W.S. (m)           313.67    Flow Area (m2)                     157.73
  E.G. Slope (m/m)      0.010382    Area (m2)               124.82     157.73      10.03
  Q Total (m3/s)          923.00    Flow (m3/s)                        923.00
  Top Width (m)           137.69    Top Width (m)            81.27      45.10      11.32
  Vel Total (m/s)           5.85    Avg. Vel. (m/s)                      5.85
  Max Chl Dpth (m)          4.07    Hydr. Depth (m)                      3.50
  Conv. Total (m3/s)      9058.5    Conv. (m3/s)                       9058.5
  Length Wtd. (m)          41.97    Wetted Per. (m)                     45.30
  Min Ch El (m)           309.60    Shear (N/m2)                       354.49
  Alpha                     1.00    Stream Power (N/m s)              2074.34
  Frctn Loss (m)            0.15    Cum Volume (1000 m3)  15787.09    6644.15   12413.55
  C & E Loss (m)            0.76    Cum SA (1000 m2)       7321.84    1279.82    5922.69


Warning: The energy equation could not be balanced within the specified number of iterations.  The program used critical
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         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is not a valid subcritical answer.  The
         program defaulted to critical depth.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 37643

INPUT
Description:
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000   316.5  1053.7   315.5 1138.29   315.5 1179.38     315 1294.28   315.5
 1343.82   315.5 1360.06     315 1455.38     313 1471.59   312.5 1475.83     312
 1516.49     312 1599.04     312 1605.57     311 1609.22   309.5 1638.72   309.5
 1641.99   311.1 1643.69     311 1672.23     312 1704.35   324.5 1738.22     326

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06 1605.57     .04 1641.99     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       1605.57 1641.99              465     465     255             .1       .3

CROSS SECTION OUTPUT  Profile #20 yr

  E.G. Elev (m)           313.13    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.17    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           312.96    Reach Len. (m)          465.00     465.00     255.00
  Crit W.S. (m)                     Flow Area (m2)          134.23     120.65      46.10
  E.G. Slope (m/m)      0.001536    Area (m2)               134.23     120.65      46.10
  Q Total (m3/s)          379.00    Flow (m3/s)              81.78     259.53      37.69
  Top Width (m)           218.01    Top Width (m)           148.89      36.42      32.71
  Vel Total (m/s)           1.26    Avg. Vel. (m/s)           0.61       2.15       0.82
  Max Chl Dpth (m)          3.46    Hydr. Depth (m)           0.90       3.31       1.41
  Conv. Total (m3/s)      9671.3    Conv. (m3/s)            2086.9     6622.6      961.8
  Length Wtd. (m)         448.14    Wetted Per. (m)         149.00      37.09      32.91
  Min Ch El (m)           309.50    Shear (N/m2)             13.57      48.99      21.10
  Alpha                     2.09    Stream Power (N/m s)      8.27     105.39      17.25
  Frctn Loss (m)            0.65    Cum Volume (1000 m3)   6759.65    4811.23    5317.93
  C & E Loss (m)            0.00    Cum SA (1000 m2)       5933.94    1279.43    4448.83


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.
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EXISTING CONDITIONS

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CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (m)           313.53    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.19    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           313.34    Reach Len. (m)          465.00     465.00     255.00
  Crit W.S. (m)                     Flow Area (m2)          194.68     134.63      58.84
  E.G. Slope (m/m)      0.001621    Area (m2)               194.68     134.63      58.84
  Q Total (m3/s)          522.00    Flow (m3/s)             144.90     320.14      56.96
  Top Width (m)           236.68    Top Width (m)           166.57      36.42      33.69
  Vel Total (m/s)           1.34    Avg. Vel. (m/s)           0.74       2.38       0.97
  Max Chl Dpth (m)          3.84    Hydr. Depth (m)           1.17       3.70       1.75
  Conv. Total (m3/s)     12963.2    Conv. (m3/s)            3598.4     7950.4     1414.5
  Length Wtd. (m)         446.95    Wetted Per. (m)         166.69      37.09      33.97
  Min Ch El (m)           309.50    Shear (N/m2)             18.57      57.73      27.55
  Alpha                     2.06    Stream Power (N/m s)     13.82     137.26      26.67
  Frctn Loss (m)            0.75    Cum Volume (1000 m3)   8796.15    5255.29    6881.40
  C & E Loss (m)            0.00    Cum SA (1000 m2)       6326.71    1279.56    4977.48


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #Reg

  E.G. Elev (m)           314.41    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.23    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           314.18    Reach Len. (m)          465.00     465.00     255.00
  Crit W.S. (m)           313.16    Flow Area (m2)          349.89     164.96      87.79
  E.G. Slope (m/m)      0.001747    Area (m2)               349.89     164.96      87.79
  Q Total (m3/s)          923.00    Flow (m3/s)             346.55     466.19     110.25
  Top Width (m)           278.50    Top Width (m)           206.25      36.42      35.83
  Vel Total (m/s)           1.53    Avg. Vel. (m/s)           0.99       2.83       1.26
  Max Chl Dpth (m)          4.68    Hydr. Depth (m)           1.70       4.53       2.45
  Conv. Total (m3/s)     22083.1    Conv. (m3/s)            8291.5    11153.8     2637.9
  Length Wtd. (m)         445.45    Wetted Per. (m)         206.38      37.09      36.26
  Min Ch El (m)           309.50    Shear (N/m2)             29.04      76.20      41.47
  Alpha                     1.96    Stream Power (N/m s)     28.77     215.35      52.09
  Frctn Loss (m)            0.87    Cum Volume (1000 m3)  15775.69    6638.02   12409.98
  C & E Loss (m)            0.00    Cum SA (1000 m2)       7314.94    1278.28    5920.97


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Hydraulic jump has occurred between this cross section and the previous upstream section.
```

```
Profile Output Table - Standard Table 1

  Reach         River Sta                  Profile      Q Total   Min Ch El   W.S. Elev   Crit W.S.   E.G. Elev   E.G. Slope   Vel Chnl   Flow Area   Top Width   Froude # Chl
                                                         (m3/s)         (m)         (m)         (m)         (m)        (m/m)      (m/s)        (m2)         (m)

  Reach-1       37770                      20 yr         379.00      309.70      313.43                  313.56     0.001297       2.11      374.80      297.25           0.35
  Reach-1       37770                      100 yr        522.00      309.70      314.05                  314.14     0.000858       1.91      560.73      302.04           0.30
  Reach-1       37770                      Reg           923.00      309.70      315.98                  316.03     0.000334       1.53     1241.31      541.40           0.20
```

EXISTING CONDITIONS

```
  Reach-1       37715                       20 yr         379.00      309.60      312.95      312.10      313.42     0.003791       3.03      125.10      113.92           0.58
  Reach-1       37715                       100 yr        522.00      309.60      313.27      312.57      313.98     0.004968       3.73      139.77      124.61           0.68
  Reach-1       37715                       Reg           923.00      309.60      315.83      313.67      315.99     0.000781       2.21      836.70      426.94           0.30

  Reach-1       37712.5                                   Bridge

  Reach-1       37710                       20 yr         379.00      309.60      312.90      312.10      313.38     0.004030       3.09      122.82      112.27           0.60
  Reach-1       37710                       100 yr        522.00      309.60      313.17      312.57      313.93     0.005555       3.86      135.17      121.26           0.71
  Reach-1       37710                       Reg           923.00      309.60      313.67      313.67      315.42     0.010382       5.85      157.73      137.69           1.00

  Reach-1       37643                       20 yr         379.00      309.50      312.96                  313.13     0.001536       2.15      300.98      218.01           0.38
  Reach-1       37643                       100 yr        522.00      309.50      313.34                  313.53     0.001621       2.38      388.15      236.68           0.39
  Reach-1       37643                       Reg           923.00      309.50      314.18      313.16      314.41     0.001747       2.83      602.64      278.50           0.42
```

```
Profile Output Table - Standard Table 2

  Reach         River Sta                   Profile    E.G. Elev   W.S. Elev   Vel Head   Frctn Loss   C & E Loss   Q Left   Q Channel   Q Right   Top Width
                                                             (m)         (m)        (m)          (m)          (m)  (m3/s)      (m3/s)    (m3/s)         (m)

  Reach-1       37770                       20 yr         313.56      313.43       0.14         0.11         0.03   107.54      212.47     58.98      297.25
  Reach-1       37770                       100 yr        314.14      314.05       0.09         0.09         0.06   188.96      224.51    108.53      302.04
  Reach-1       37770                       Reg           316.03      315.98       0.05         0.03         0.01   404.86      261.21    256.92      541.40

  Reach-1       37715                       20 yr         313.42      312.95       0.47         0.00         0.00               379.00                113.92
  Reach-1       37715                       100 yr        313.98      313.27       0.71         0.01         0.00               522.00                124.61
  Reach-1       37715                       Reg           315.99      315.83       0.16         0.00         0.33   324.33      564.05     34.62      426.94

  Reach-1       37712.5                                   Bridge

  Reach-1       37710                       20 yr         313.38      312.90       0.49         0.10         0.16               379.00                112.27
  Reach-1       37710                       100 yr        313.93      313.17       0.76         0.11         0.29               522.00                121.26
  Reach-1       37710                       Reg           315.42      313.67       1.75         0.15         0.76               923.00                137.69

  Reach-1       37643                       20 yr         313.13      312.96       0.17         0.65         0.00    81.78      259.53     37.69      218.01
  Reach-1       37643                       100 yr        313.53      313.34       0.19         0.75         0.00   144.90      320.14     56.96      236.68
  Reach-1       37643                       Reg           314.41      314.18       0.23         0.87         0.00   346.55      466.19    110.25      278.50
```

```
Profile Output Table - Six XS Bridge

  Reach         River Sta                       Profile      E.G. Elev   W.S. Elev   Crit W.S.   Frctn Loss   C & E Loss   Top Width   Q Left   Q Channel   Q Right   Vel Chnl
                                                                   (m)         (m)         (m)          (m)          (m)         (m)  (m3/s)      (m3/s)    (m3/s)      (m/s)

  Reach-1       37770                           20 yr           313.56      313.43                    0.11         0.03      297.25   107.54      212.47     58.98       2.11
  Reach-1       37770                           100 yr          314.14      314.05                    0.09         0.06      302.04   188.96      224.51    108.53       1.91
  Reach-1       37770                           Reg             316.03      315.98                    0.03         0.01      541.40   404.86      261.21    256.92       1.53

  Reach-1       37715                           20 yr           313.42      312.95      312.10        0.00         0.00      113.92               379.00                 3.03
  Reach-1       37715                           100 yr          313.98      313.27      312.57        0.01         0.00      124.61               522.00                 3.73
  Reach-1       37715                           Reg             315.99      315.83      313.67        0.00         0.33      426.94   324.33      564.05     34.62       2.21

  Reach-1       37712.5 BR U                    20 yr           313.41      312.94      312.11        0.02         0.00       44.99               379.00                 3.04
  Reach-1       37712.5 BR U                    100 yr          313.98      313.26      312.56        0.03         0.01       44.97               522.00                 3.76
```

EXISTING CONDITIONS

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  Reach-1     37712.5 BR U                      Reg          315.66      314.40      313.67         0.08         0.00                           923.00                 4.97

  Reach-1     37712.5 BR D                      20 yr        313.39      312.90      312.11         0.00         0.00       45.00                379.00                 3.08
  Reach-1     37712.5 BR D                      100 yr       313.94      313.18      312.56         0.01         0.00       44.98                522.00                 3.86
  Reach-1     37712.5 BR D                      Reg          315.58      314.32      313.67         0.01         0.15       10.70     0.01      922.99                 4.97

  Reach-1     37710                             20 yr        313.38      312.90      312.10         0.10         0.16      112.27                379.00                 3.09
  Reach-1     37710                             100 yr       313.93      313.17      312.57         0.11         0.29      121.26                522.00                 3.86
  Reach-1     37710                             Reg          315.42      313.67      313.67         0.15         0.76      137.69                923.00                 5.85

  Reach-1     37643                             20 yr        313.13      312.96                     0.65         0.00      218.01    81.78      259.53     37.69       2.15
  Reach-1     37643                             100 yr       313.53      313.34                     0.75         0.00      236.68   144.90      320.14     56.96       2.38
  Reach-1     37643                             Reg          314.41      314.18      313.16         0.87         0.00      278.50   346.55      466.19    110.25       2.83


Profile Output Table - Bridge Only

  Reach       River Sta                     Profile   E.G. US.   Min El Prs   BR Open Area   Prs O WS   Q Total   Min El Weir Flow   Q Weir   Delta EG   BR Sluice Coef
                                                           (m)          (m)           (m2)        (m)    (m3/s)                (m)   (m3/s)        (m)

  Reach-1     37712.5                       20 yr       313.42       314.30         185.77               379.00             314.50                  0.03
  Reach-1     37712.5                       100 yr      313.98       314.30         185.77               522.00             314.50                  0.05
  Reach-1     37712.5                       Reg         315.99       314.30         185.77               923.00             314.50                  0.57
```

PROPOSED CONDITIONS

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                         HEC-RAS HEC-RAS 6.0.0 May 2021
                          U.S. Army Corps of Engineers
                         Hydrologic Engineering Center
                               609 Second Street
                               Davis, California


            X     X  XXXXXX    XXXX        XXXX       XX      XXXX
            X     X  X        X    X       X   X     X  X    X
            X     X  X        X            X   X    X    X   X
            XXXXXXX  XXXX     X      XXX  XXXX     XXXXXX    XXXX
            X     X  X        X            X  X     X    X        X
            X     X  X        X    X       X   X    X    X        X
            X     X  XXXXXX    XXXX        X    X   X    X   XXXXX





PROJECT DATA
Project Title: Middle Nith - Ayr to Philipsburg PROP
Project File : PROPOSED.prj
Run Date and Time: 2021-12-23 11:20:18 AM

Project in SI units

Project Description:
NITH RIVER FPM STUDY FOR GRAND RIVER C.A.
Original Study by Dillon 1985 -
Combined H2NITH1.DAT and H2NITH2.DAT
Updated to HEC-RAS - GRCA 2010
Bridge
updates per GRCA permits - Haysville, Bender - Bleams Road, New Hamburg
Walkway, New Hamburg Channel refinements 2006, Oxford Blanford Blenheim Road 11
P288/05, Watson Factory Ineffective area Ayr
H2NITH1.DAT flows added November
2011. Original Reg flows are best, GRHS flows U/S of Canning not documented
(JSP)
Bridge street Bridge updated 2021 per K.Smart design





PLAN DATA

Plan Title: Regulatory
Plan File : C:\Users\tjackson\Documents\20-145\HECRAS Model\Proposed\PROPOSED.p06

           Geometry Title: 8sept2006 r5 - shallow channel u/s
           Geometry File : C:\Users\tjackson\Documents\20-145\HECRAS Model\Proposed\PROPOSED.g17

           Flow Title    : Reg_100_20
           Flow File     : C:\Users\tjackson\Documents\20-145\HECRAS Model\Proposed\PROPOSED.f04

Plan Summary Information:
Number of:  Cross Sections =  253    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    1
            Bridges        =   29    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.003
    Critical depth calculation tolerance =  0.003
```

```
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.1
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Mixed Flow




FLOW DATA

Flow Title: Reg_100_20
Flow File : C:\Users\tjackson\Documents\20-145\HECRAS Model\Proposed\PROPOSED.f04

Flow Data (m3/s)

  River           Reach           RS                  25 yr          100 yr             Reg
  RIVER-1         Reach-1         73584                 379             522             923
  RIVER-1         Reach-1         36588                 414             531             923
  RIVER-1         Reach-1         27396                 416             526             923
  RIVER-1         Reach-1         16084                 419             518             923


Boundary Conditions

  River           Reach           Profile                       Upstream                 Downstream

  RIVER-1         Reach-1         25 yr                      Normal S = 0.001         Normal S = 0.001
  RIVER-1         Reach-1         100 yr                     Normal S = 0.001         Normal S = 0.001
  RIVER-1         Reach-1         Reg                        Normal S = 0.001         Normal S = 0.001




GEOMETRY DATA

Geometry Title: 8sept2006 r5 - shallow channel u/s
Geometry File : C:\Users\tjackson\Documents\20-145\HECRAS Model\Proposed\PROPOSED.g17

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1            RS: 37770

INPUT
Description: Cross section about 55m upstream of proposed bridge replacement.
             Revised with survey data collected by K. Smart Associates in
             August of 2020
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000   319.5 1062.65     317 1095.12   316.5 1107.55     316 1200.21   315.5
 1280.62   315.5 1302.99     316 1376.68     316 1413.25     315  1418.5     313
 1489.88   312.5    1550  311.91    1562  311.94    1582  311.01    1585  310.19
    1588  309.96    1600  310.13    1612   310.1    1617  310.23    1620  312.24
    1635  312.27    1650  312.32 1781.25   326.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06    1582     .04    1620     .06
```

PROPOSED CONDITIONS

```
Bank Sta: Left   Right    Lengths: Left Channel    Right     Coeff Contr.   Expan.
          1582    1620               70      55      20             .1       .3

CROSS SECTION OUTPUT  Profile #25 yr

  E.G. Elev (m)           313.49    Element                Left OB    Channel   Right OB
  Vel Head (m)              0.15    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           313.33    Reach Len. (m)           70.00      55.00      20.00
  Crit W.S. (m)                     Flow Area (m2)          163.28     118.10      36.40
  E.G. Slope (m/m)      0.001594    Area (m2)               163.28     118.10      36.40
  Q Total (m3/s)          379.00    Flow (m3/s)             108.14     247.88      22.98
  Top Width (m)           241.72    Top Width (m)           164.37      38.00      39.36
  Vel Total (m/s)           1.19    Avg. Vel. (m/s)           0.66       2.10       0.63
  Max Chl Dpth (m)          3.37    Hydr. Depth (m)           0.99       3.11       0.92
  Conv. Total (m3/s)      9491.9    Conv. (m3/s)            2708.4     6208.0      575.5
  Length Wtd. (m)          55.96    Wetted Per. (m)         164.46      38.73      39.41
  Min Ch El (m)           309.96    Shear (N/m2)             15.52      47.67      14.44
  Alpha                     2.13    Stream Power (N/m s)     10.28     100.06       9.12
  Frctn Loss (m)            0.10    Cum Volume (1000 m3)   6769.91    4842.43    5318.91
  C & E Loss (m)            0.01    Cum SA (1000 m2)       5956.19    1289.63    4451.71


CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (m)           314.00    Element                Left OB    Channel   Right OB
  Vel Head (m)              0.13    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           313.87    Reach Len. (m)           70.00      55.00      20.00
  Crit W.S. (m)                     Flow Area (m2)          252.78     138.70      59.10
  E.G. Slope (m/m)      0.001230    Area (m2)               252.78     138.70      59.10
  Q Total (m3/s)          522.00    Flow (m3/s)             195.59     284.64      41.77
  Top Width (m)           248.17    Top Width (m)           165.79      38.00      44.37
  Vel Total (m/s)           1.16    Avg. Vel. (m/s)           0.77       2.05       0.71
  Max Chl Dpth (m)          3.91    Hydr. Depth (m)           1.52       3.65       1.33
  Conv. Total (m3/s)     14883.6    Conv. (m3/s)            5576.8     8116.0     1190.9
  Length Wtd. (m)          56.22    Wetted Per. (m)         165.98      38.73      44.46
  Min Ch El (m)           309.96    Shear (N/m2)             18.37      43.19      16.04
  Alpha                     1.91    Stream Power (N/m s)     14.21      88.65      11.33
  Frctn Loss (m)            0.09    Cum Volume (1000 m3)   8816.20    5290.53    6883.56
  C & E Loss (m)            0.02    Cum SA (1000 m2)       6350.89    1289.76    4980.82


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.

CROSS SECTION OUTPUT  Profile #Reg

  E.G. Elev (m)           315.26    Element                Left OB    Channel   Right OB
  Vel Head (m)              0.12    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           315.14    Reach Len. (m)           70.00      55.00      20.00
  Crit W.S. (m)                     Flow Area (m2)          464.92     186.76     122.64
  E.G. Slope (m/m)      0.000849    Area (m2)               464.92     186.76     122.64
  Q Total (m3/s)          923.00    Flow (m3/s)             434.48     388.35     100.17
  Top Width (m)           267.87    Top Width (m)           173.79      38.00      56.08
  Vel Total (m/s)           1.19    Avg. Vel. (m/s)           0.93       2.08       0.82
  Max Chl Dpth (m)          5.18    Hydr. Depth (m)           2.68       4.91       2.19
  Conv. Total (m3/s)     31673.2    Conv. (m3/s)           14909.5    13326.5     3437.3
  Length Wtd. (m)          59.01    Wetted Per. (m)         174.19      38.73      56.23
  Min Ch El (m)           309.96    Shear (N/m2)             22.23      40.16      18.16
  Alpha                     1.62    Stream Power (N/m s)     20.77      83.50      14.83
  Frctn Loss (m)            0.05    Cum Volume (1000 m3)  15825.36    6683.08   12415.88
  C & E Loss (m)            0.00    Cum SA (1000 m2)       7348.22    1288.48    5925.61
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PROPOSED CONDITIONS

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CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 37715

INPUT
Description: Cross section directly upstream of proposed bridge replacement.
             Updated using survey collected by K. Smart Associates in August of
             2020
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000     320    1115   315.5    1213     316  1282.9  315.64  1311.9  315.51
  1360.2     315  1398.7  312.28  1437.2  312.31  1455.5  312.21  1485.2  312.38
  1511.2  311.98    1525  311.91    1528  311.46    1530  309.69    1540  309.66
    1550  309.56    1560  309.84    1570  309.92    1575  311.961587.801   312.2
  1596.9  314.96  1601.3  315.15  1629.6  314.85  1663.8   320.3  1704.9  324.94
    1735  327.16  1760.3  328.83

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06    1528     .04    1575     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         1528    1575               15      15      15             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1514   314.1       F
    1586  1760.3   315.1       F
Skew Angle = 20

CROSS SECTION OUTPUT  Profile #25 yr

  E.G. Elev (m)           313.38    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.27    Wt. n-Val.                0.060      0.040      0.060
  W.S. Elev (m)           313.11    Reach Len. (m)             1.00       1.00       1.00
  Crit W.S. (m)           311.77    Flow Area (m2)            17.17     151.69      11.52
  E.G. Slope (m/m)      0.001905    Area (m2)                120.60     151.69      14.56
  Q Total (m3/s)          379.00    Flow (m3/s)               14.29     356.07       8.64
  Top Width (m)           203.86    Top Width (m)            141.05      47.00      15.80
  Vel Total (m/s)           2.10    Avg. Vel. (m/s)            0.83       2.35       0.75
  Max Chl Dpth (m)          3.55    Hydr. Depth (m)            1.23       3.23       1.05
  Conv. Total (m3/s)      8683.5    Conv. (m3/s)              327.5     8158.0      198.0
  Length Wtd. (m)           1.00    Wetted Per. (m)           14.03      48.08      11.00
  Min Ch El (m)           309.56    Shear (N/m2)              22.86      58.94      19.56
  Alpha                     1.18    Stream Power (N/m s)      19.03     138.36      14.67
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)    6759.97    4835.01    5318.40
  C & E Loss (m)            0.01    Cum SA (1000 m2)        5945.50    1287.30    4451.16


Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (m)           313.89    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.38    Wt. n-Val.                0.060      0.040      0.060
  W.S. Elev (m)           313.51    Reach Len. (m)             1.00       1.00       1.00
  Crit W.S. (m)           312.33    Flow Area (m2)            22.75     170.39      15.90
  E.G. Slope (m/m)      0.002352    Area (m2)                177.86     170.39      21.11
  Q Total (m3/s)          522.00    Flow (m3/s)               25.37     480.21      16.42
  Top Width (m)           210.80    Top Width (m)            146.69      47.00      17.11
  Vel Total (m/s)           2.50    Avg. Vel. (m/s)            1.12       2.82       1.03
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  Max Chl Dpth (m)          3.95    Hydr. Depth (m)          1.62       3.63       1.45
  Conv. Total (m3/s)     10764.3    Conv. (m3/s)            523.1     9902.6      338.7
  Length Wtd. (m)           1.00    Wetted Per. (m)         14.03      48.08      11.00
  Min Ch El (m)           309.56    Shear (N/m2)            37.38      81.74      33.32
  Alpha                     1.19    Stream Power (N/m s)    41.68     230.35      34.42
  Frctn Loss (m)            0.00    Cum Volume (1000 m3)  8801.12    5282.03    6882.76
  C & E Loss (m)            0.01    Cum SA (1000 m2)      6339.95    1287.42    4980.20


Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Reg

  E.G. Elev (m)           315.20    Element                Left OB    Channel   Right OB
  Vel Head (m)              0.15    Wt. n-Val.              0.060      0.040      0.060
  W.S. Elev (m)           315.05    Reach Len. (m)           1.00       1.00       1.00
  Crit W.S. (m)           313.31    Flow Area (m2)         421.39     242.98      32.89
  E.G. Slope (m/m)      0.000845    Area (m2)              421.39     242.98      53.63
  Q Total (m3/s)          923.00    Flow (m3/s)            369.78     520.15      33.07
  Top Width (m)           264.24    Top Width (m)          172.79      47.00      44.45
  Vel Total (m/s)           1.32    Avg. Vel. (m/s)          0.88       2.14       1.01
  Max Chl Dpth (m)          5.49    Hydr. Depth (m)          2.44       5.17       2.99
  Conv. Total (m3/s)     31745.7    Conv. (m3/s)          12718.2    17890.1     1137.4
  Length Wtd. (m)           1.00    Wetted Per. (m)        172.92      48.08      11.00
  Min Ch El (m)           309.56    Shear (N/m2)            20.20      41.90      24.78
  Alpha                     1.67    Stream Power (N/m s)    17.73      89.69      24.92
  Frctn Loss (m)            0.00    Cum Volume (1000 m3) 15794.34    6671.26   12414.12
  C & E Loss (m)            0.19    Cum SA (1000 m2)      7336.09    1286.14    5924.60


Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

BRIDGE


RIVER: RIVER-1
REACH: Reach-1            RS: 37712.5

INPUT
Description: Bridge Street Bridge (Bridge 34/ B-T9) Updated from design for
             Bridge Street Bridge replacment.Design done by K. Smart Associates
Distance from Upstream XS =       1
Deck/Roadway Width        =      10
Weir Coefficient          =     2.6
Bridge Deck/Roadway Skew  =      20
Upstream  Deck/Roadway Coordinates
    num=      17
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
 939.693     320     3201047.757   316.6   316.61139.847     316     316
1294.896   315.5   315.5    1390 314.505     311    1440 314.716     311
  1474.3 315.123     311    1510   315.7     311 1514.56 315.728   314.5
 1535.52 316.043   314.8    1550  316.26     315 1564.48 316.477  315.24
 1585.44 316.905  315.23    1590  317.05     311    1640   318.3     311
    1690   319.1   319.1    1740  322.67  322.67

Upstream Bridge Cross Section Data
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

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    1000     320    1115   315.5    1213     316  1282.9  315.64  1311.9  315.51
  1360.2     315  1398.7  312.28  1437.2  312.31  1455.5  312.21  1485.2  312.38
  1511.2  311.98    1525  311.91    1528  311.46    1530  309.69    1540  309.66
    1550  309.56    1560  309.84    1570  309.92    1575  311.961587.801   312.2
  1596.9  314.96  1601.3  315.15  1629.6  314.85  1663.8   320.3  1704.9  324.94
    1735  327.16  1760.3  328.83

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06    1528     .04    1575     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1528    1575             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1514   314.1       F
    1586  1760.3   315.1       F
Skew Angle = 20

Downstream  Deck/Roadway Coordinates
    num=      17
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
 939.693     320     3201047.757   316.6   316.61139.847     316     316
1294.896   315.5     314    1390 314.505     311    1440 314.716     311
  1474.3 315.123     311    1510   315.7     311 1514.56  315.78   314.5
1526.061 316.043   314.8    1550  316.26     315 1564.48 316.477  315.24
 1585.44 316.905  315.23    1590  317.05     311    1640   318.3     311
    1690   319.1   319.1    1740  322.67  322.67

Downstream Bridge Cross Section Data
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000     320    1115   315.5    1213     316    1276   314.5    1301  314.26
    1325  314.14    1345  314.06    1390  313.81    1410  313.45    1435  312.06
    1460   312.1    1500   312.5    1518  312.83    1528  311.62    1530  310.05
    1540  309.46    1550  309.42    1560  309.62    1570  310.03    1575  311.68
1587.801  312.13    1618   312.8    1638  315.15    1658  319.54    1688  322.77
    1721  325.36    1750  327.39    1804  329.67

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06    1528     .04    1575     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1528    1575             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1514   314.1       F
    1586    1804   315.1       F
Skew Angle = 20

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=1534.229    Downstream=1535.867
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PROPOSED CONDITIONS

```
Upstream     num=       2
    Width   Elev    Width   Elev
    .958     311    .958  322.67
Downstream     num=       2
    Width   Elev    Width   Elev
    .958     311    .958  322.67

Pier Data
Pier Station     Upstream=1565.356    Downstream=1563.604
Upstream     num=       2
    Width   Elev    Width   Elev
    .958 307.977    .958  315.24
Downstream     num=       2
    Width   Elev    Width   Elev
    .958 307.977    .958  315.24

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #25 yr

  E.G. US. (m)               313.38    Element               Inside BR US  Inside BR DS
  W.S. US. (m)               313.11    E.G. Elev (m)              313.37        313.33
  Q Total (m3/s)             379.00    W.S. Elev (m)              313.08        313.03
  Q Bridge (m3/s)            379.00    Crit W.S. (m)              311.81        311.76
  Q Weir (m3/s)                        Max Chl Dpth (m)             3.52          3.61
  Weir Sta Lft (m)                     Vel Total (m/s)              2.20          2.27
  Weir Sta Rgt (m)                     Flow Area (m2)             172.05        166.62
  Weir Submerg                         Froude # Chl                 0.44          0.44
  Weir Max Depth (m)                   Specif Force (m3)          341.50        343.03
  Min El Weir Flow (m)       314.51    Hydr Depth (m)               2.45          2.38
  Min El Prs (m)             316.29    W.P. Total (m)              84.41         84.18
  Delta EG (m)                 0.06    Conv. Total (m3/s)         7007.3        6928.8
  Delta WS (m)                 0.08    Top Width (m)               75.29         74.60
  BR Open Area (m2)          332.49    Frctn Loss (m)               0.03          0.01
  BR Open Vel (m/s)            2.27    C & E Loss (m)               0.00          0.01
  BR Sluice Coef                       Shear Total (N/m2)          58.48         58.07
  BR Sel Method         Energy only    Power Total (N/m s)        128.81        132.09


BRIDGE OUTPUT  Profile #100 yr

  E.G. US. (m)               313.89    Element               Inside BR US  Inside BR DS
  W.S. US. (m)               313.51    E.G. Elev (m)              313.88        313.83
  Q Total (m3/s)             522.00    W.S. Elev (m)              313.48        313.40
  Q Bridge (m3/s)            522.00    Crit W.S. (m)              312.41        312.30
  Q Weir (m3/s)                        Max Chl Dpth (m)             3.92          3.98
  Weir Sta Lft (m)                     Vel Total (m/s)              2.61          2.72
  Weir Sta Rgt (m)                     Flow Area (m2)             199.65        192.13
  Weir Submerg                         Froude # Chl                 0.49          0.51
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  Weir Max Depth (m)                   Specif Force (m3)          471.37        468.34
  Min El Weir Flow (m)       314.51    Hydr Depth (m)               2.85          2.74
  Min El Prs (m)             316.29    W.P. Total (m)              85.98         85.64
  Delta EG (m)                 0.08    Conv. Total (m3/s)         8588.6        8350.0
  Delta WS (m)                 0.12    Top Width (m)               75.29         74.60
  BR Open Area (m2)          332.49    Frctn Loss (m)               0.04          0.01
  BR Open Vel (m/s)            2.72    C & E Loss (m)               0.01          0.01
  BR Sluice Coef                       Shear Total (N/m2)          84.12         85.98
  BR Sel Method         Energy only    Power Total (N/m s)        219.92        233.61


BRIDGE OUTPUT  Profile #Reg

  E.G. US. (m)               315.20    Element               Inside BR US  Inside BR DS
  W.S. US. (m)               315.05    E.G. Elev (m)              315.01        314.92
  Q Total (m3/s)             923.00    W.S. Elev (m)              314.25        314.04
  Q Bridge (m3/s)            923.00    Crit W.S. (m)              313.39        313.39
  Q Weir (m3/s)                        Max Chl Dpth (m)             4.69          4.62
  Weir Sta Lft (m)                     Vel Total (m/s)              3.60          3.89
  Weir Sta Rgt (m)                     Flow Area (m2)             256.46        237.52
  Weir Submerg                         Froude # Chl                 0.57          0.67
  Weir Max Depth (m)                   Specif Force (m3)          862.80        838.99
  Min El Weir Flow (m)       314.51    Hydr Depth (m)               3.67          3.39
  Min El Prs (m)             316.29    W.P. Total (m)              95.51         88.23
  Delta EG (m)                 0.54    Conv. Total (m3/s)        11920.9       11145.4
  Delta WS (m)                 0.78    Top Width (m)               70.36         74.60
  BR Open Area (m2)          332.49    Frctn Loss (m)               0.06          0.01
  BR Open Vel (m/s)            3.89    C & E Loss (m)               0.03          0.24
  BR Sluice Coef                       Shear Total (N/m2)         157.86        181.06
  BR Sel Method         Energy only    Power Total (N/m s)        568.14        703.57


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 37705

INPUT
Description: Cross section directly downstream of proposed bridge replacement.
             Updated from survey data colected by K. Smart Associates in August
             of 2020
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000     320    1115   315.5    1213     316    1276   314.5    1301  314.26
    1325  314.14    1345  314.06    1390  313.81    1410  313.45    1435  312.06
    1460   312.1    1500   312.5    1518  312.83    1528  311.62    1530  310.05
    1540  309.46    1550  309.42    1560  309.62    1570  310.03    1575  311.68
1587.801  312.13    1618   312.8    1638  315.15    1658  319.54    1688  322.77
    1721  325.36    1750  327.39    1804  329.67

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06    1528     .04    1575     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1528    1575              103      83     153             .3       .5
Ineffective Flow     num=       2
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   Sta L   Sta R    Elev  Permanent
    1000    1514   314.1       F
    1586    1804   315.1       F
Skew Angle = 20

CROSS SECTION OUTPUT  Profile #25 yr

  E.G. Elev (m)           313.32    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.28    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           313.03    Reach Len. (m)          103.00      83.00     153.00
  Crit W.S. (m)           311.70    Flow Area (m2)            9.01     151.10      12.73
  E.G. Slope (m/m)      0.001999    Area (m2)                76.13     151.10      31.72
  Q Total (m3/s)          379.00    Flow (m3/s)               4.99     363.56      10.45
  Top Width (m)           202.43    Top Width (m)           110.46      47.00      44.96
  Vel Total (m/s)           2.19    Avg. Vel. (m/s)           0.55       2.41       0.82
  Max Chl Dpth (m)          3.61    Hydr. Depth (m)           0.64       3.21       1.16
  Conv. Total (m3/s)      8477.7    Conv. (m3/s)             111.5     8132.3      233.8
  Length Wtd. (m)          86.57    Wetted Per. (m)          14.07      47.84      11.01
  Min Ch El (m)           309.42    Shear (N/m2)             12.55      61.91      22.67
  Alpha                     1.16    Stream Power (N/m s)      6.94     148.96      18.61
  Frctn Loss (m)            0.14    Cum Volume (1000 m3)   6759.58    4832.83    5318.15
  C & E Loss (m)            0.05    Cum SA (1000 m2)       5945.01    1286.61    4450.89


Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (m)           313.81    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.41    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           313.39    Reach Len. (m)          103.00      83.00     153.00
  Crit W.S. (m)           312.21    Flow Area (m2)           14.07     168.10      16.71
  E.G. Slope (m/m)      0.002560    Area (m2)               117.27     168.10      48.55
  Q Total (m3/s)          522.00    Flow (m3/s)              11.87     491.51      18.62
  Top Width (m)           212.01    Top Width (m)           116.97      47.00      48.04
  Vel Total (m/s)           2.62    Avg. Vel. (m/s)           0.84       2.92       1.11
  Max Chl Dpth (m)          3.97    Hydr. Depth (m)           1.01       3.58       1.52
  Conv. Total (m3/s)     10316.7    Conv. (m3/s)             234.6     9714.2      367.9
  Length Wtd. (m)          87.73    Wetted Per. (m)          14.07      47.84      11.01
  Min Ch El (m)           309.42    Shear (N/m2)             25.11      88.23      38.12
  Alpha                     1.18    Stream Power (N/m s)     21.17     257.96      42.46
  Frctn Loss (m)            0.17    Cum Volume (1000 m3)   8800.55    5279.59    6882.41
  C & E Loss (m)            0.10    Cum SA (1000 m2)       6339.44    1286.74    4979.92


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Reg

  E.G. Elev (m)           314.66    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.39    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           314.27    Reach Len. (m)          103.00      83.00     153.00
  Crit W.S. (m)           313.30    Flow Area (m2)          253.99     209.39      26.37
  E.G. Slope (m/m)      0.002278    Area (m2)               253.99     209.39      94.04
  Q Total (m3/s)          923.00    Flow (m3/s)             216.92     668.51      37.57
  Top Width (m)           330.67    Top Width (m)           228.15      47.00      55.52
  Vel Total (m/s)           1.88    Avg. Vel. (m/s)           0.85       3.19       1.42
  Max Chl Dpth (m)          4.85    Hydr. Depth (m)           1.11       4.46       2.40
  Conv. Total (m3/s)     19340.7    Conv. (m3/s)            4545.4    14008.1      787.2
  Length Wtd. (m)          91.34    Wetted Per. (m)         228.27      47.84      11.01
  Min Ch El (m)           309.42    Shear (N/m2)             24.85      97.77      53.52
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  Alpha                     2.15    Stream Power (N/m s)      21.22     312.13      76.23
  Frctn Loss (m)            0.18    Cum Volume (1000 m3)   15793.24    6668.30   12413.55
  C & E Loss (m)            0.06    Cum SA (1000 m2)        7335.36    1285.46    5924.31


Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water surface was used.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 37643

INPUT
Description: Cross section about 62m downstream of proposed bridge replacement.
             Revised with survey data collected by K. Smart Associates in
             August of 2020
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000   316.5  1053.7   315.5 1138.29   315.5 1179.38     315 1294.28   315.5
 1343.82   315.5 1360.06     315 1455.38     313    1525  311.89    1590  312.32
    1600  312.15    1603  310.19    1605  309.75    1625  309.16    1642  310.09
    1648  310.36    1650  310.78    1660  311.89 1704.35   324.5 1738.22     326

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06    1600     .04    1650     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1600    1650              465     465     255             .1       .3

CROSS SECTION OUTPUT  Profile #25 yr

  E.G. Elev (m)           313.12    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.18    Wt. n-Val.                0.060      0.040      0.060
  W.S. Elev (m)           312.94    Reach Len. (m)           465.00     465.00     255.00
  Crit W.S. (m)                     Flow Area (m2)            95.86     158.32      17.99
  E.G. Slope (m/m)      0.001423    Area (m2)                 95.86     158.32      17.99
  Q Total (m3/s)          379.00    Flow (m3/s)               46.64     318.94      13.43
  Top Width (m)           204.53    Top Width (m)            140.84      50.00      13.69
  Vel Total (m/s)           1.39    Avg. Vel. (m/s)            0.49       2.01       0.75
  Max Chl Dpth (m)          3.78    Hydr. Depth (m)            0.68       3.17       1.31
  Conv. Total (m3/s)     10046.1    Conv. (m3/s)             1236.2     8454.0      355.9
  Length Wtd. (m)         454.87    Wetted Per. (m)          140.85      50.72      13.90
  Min Ch El (m)           309.16    Shear (N/m2)               9.50      43.57      18.06
  Alpha                     1.79    Stream Power (N/m s)       4.62      87.77      13.48
  Frctn Loss (m)            0.64    Cum Volume (1000 m3)    6750.73    4819.99    5314.35
  C & E Loss (m)            0.01    Cum SA (1000 m2)        5932.07    1282.59    4446.40


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (m)           313.53    Element                 Left OB    Channel   Right OB
  Vel Head (m)              0.21    Wt. n-Val.                0.060      0.040      0.060
  W.S. Elev (m)           313.32    Reach Len. (m)           465.00     465.00     255.00
  Crit W.S. (m)                     Flow Area (m2)           153.60     177.46      23.49
  E.G. Slope (m/m)      0.001555    Area (m2)                153.60     177.46      23.49
  Q Total (m3/s)          522.00    Flow (m3/s)               98.23     403.23      20.54
  Top Width (m)           225.03    Top Width (m)            159.99      50.00      15.04
  Vel Total (m/s)           1.47    Avg. Vel. (m/s)            0.64       2.27       0.87
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  Max Chl Dpth (m)          4.16    Hydr. Depth (m)           0.96       3.55       1.56
  Conv. Total (m3/s)     13237.4    Conv. (m3/s)            2491.1    10225.5      520.9
  Length Wtd. (m)         454.28    Wetted Per. (m)         160.01      50.72      15.30
  Min Ch El (m)           309.16    Shear (N/m2)             14.64      53.36      23.41
  Alpha                     1.89    Stream Power (N/m s)      9.36     121.24      20.47
  Frctn Loss (m)            0.74    Cum Volume (1000 m3)   8786.60    5265.25    6876.90
  C & E Loss (m)            0.00    Cum SA (1000 m2)       6325.18    1282.71    4975.10


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #Reg

  E.G. Elev (m)           314.42    Element                Left OB    Channel   Right OB
  Vel Head (m)              0.27    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           314.15    Reach Len. (m)          465.00     465.00     255.00
  Crit W.S. (m)                     Flow Area (m2)          302.17     218.80      37.12
  E.G. Slope (m/m)      0.001739    Area (m2)               302.17     218.80      37.12
  Q Total (m3/s)          923.00    Flow (m3/s)             277.09     604.60      41.31
  Top Width (m)           267.34    Top Width (m)           199.40      50.00      17.95
  Vel Total (m/s)           1.65    Avg. Vel. (m/s)           0.92       2.76       1.11
  Max Chl Dpth (m)          4.99    Hydr. Depth (m)           1.52       4.38       2.07
  Conv. Total (m3/s)     22131.0    Conv. (m3/s)            6643.8    14496.5      990.6
  Length Wtd. (m)         453.29    Wetted Per. (m)         199.42      50.72      18.32
  Min Ch El (m)           309.16    Shear (N/m2)             25.85      73.59      34.56
  Alpha                     1.94    Stream Power (N/m s)     23.70     203.35      38.46
  Frctn Loss (m)            0.88    Cum Volume (1000 m3)  15764.60    6650.53   12403.52
  C & E Loss (m)            0.00    Cum SA (1000 m2)       7313.34    1281.43    5918.69


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 37174

INPUT
Description:
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000   316.5 1051.02   315.5 1153.17   315.3 1190.72  314.95 1295.94   314.5
 1358.89   314.1 1407.33     312 1441.13   311.5 1543.63     311 1571.18   310.5
 1573.52   309.9 1575.12   309.8 1577.29   308.7 1604.29   308.7 1607.02   309.8
 1610.96   309.9 1645.12     315 1718.29     320

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .06 1575.12     .04 1607.02     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       1575.12 1607.02              280     307     260             .1       .3

CROSS SECTION OUTPUT  Profile #25 yr

  E.G. Elev (m)           312.47    Element                Left OB    Channel   Right OB
  Vel Head (m)              0.16    Wt. n-Val.               0.060      0.040      0.060
  W.S. Elev (m)           312.32    Reach Len. (m)          280.00     307.00     260.00
  Crit W.S. (m)                     Flow Area (m2)          181.54     112.65      29.26
  E.G. Slope (m/m)      0.001384    Area (m2)               181.54     112.65      29.26
```

```
  Q Total (m3/s)          379.00    Flow (m3/s)            115.28     240.58      23.15
  Top Width (m)           227.09    Top Width (m)          175.07      31.90      20.12
  Vel Total (m/s)           1.17    Avg. Vel. (m/s)          0.63       2.14       0.79
  Max Chl Dpth (m)          3.62    Hydr. Depth (m)          1.04       3.53       1.45
  Conv. Total (m3/s)     10187.5    Conv. (m3/s)           3098.6     6466.6      622.3
  Length Wtd. (m)         293.00    Wetted Per. (m)        175.17      32.38      20.30
  Min Ch El (m)           308.70    Shear (N/m2)            14.07      47.22      19.56
  Alpha                     2.23    Stream Power (N/m s)     8.93     100.85      15.48
  Frctn Loss (m)            0.39    Cum Volume (1000 m3)  6686.23    4756.99    5308.32
  C & E Loss (m)            0.02    Cum SA (1000 m2)      5858.62    1263.55    4442.09


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #100 yr

  E.G. Elev (m)           312.79    Element                Left OB    Channel   Right OB
  Vel Head (m)              0.20    Wt. n-Val.              0.060      0.040      0.060
  W.S. Elev (m)           312.59    Reach Len. (m)         280.00     307.00     260.00
  Crit W.S. (m)                     Flow Area (m2)         229.63     121.26      34.93
  E.G. Slope (m/m)      0.001722    Area (m2)              229.63     121.26      34.93
  Q Total (m3/s)          522.00    Flow (m3/s)            185.85     303.39      32.76
  Top Width (m)           235.13    Top Width (m)          181.30      31.90      21.93
  Vel Total (m/s)           1.35    Avg. Vel. (m/s)          0.81       2.50       0.94
  Max Chl Dpth (m)          3.89    Hydr. Depth (m)          1.27       3.80       1.59
  Conv. Total (m3/s)     12579.2    Conv. (m3/s)           4478.6     7311.2      789.4
  Length Wtd. (m)         291.47    Wetted Per. (m)        181.40      32.38      22.13
  Min Ch El (m)           308.70    Shear (N/m2)            21.38      63.25      26.66
  Alpha                     2.15    Stream Power (N/m s)    17.30     158.24      25.00
  Frctn Loss (m)            0.50    Cum Volume (1000 m3)  8697.50    5195.79    6869.45
  C & E Loss (m)            0.02    Cum SA (1000 m2)      6245.83    1263.67    4970.39


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #Reg

  E.G. Elev (m)           313.54    Element                Left OB    Channel   Right OB
  Vel Head (m)              0.28    Wt. n-Val.              0.060      0.040      0.060
  W.S. Elev (m)           313.26    Reach Len. (m)         280.00     307.00     260.00
  Crit W.S. (m)                     Flow Area (m2)         356.96     142.74      51.22
  E.G. Slope (m/m)      0.002182    Area (m2)              356.96     142.74      51.22
  Q Total (m3/s)          923.00    Flow (m3/s)            413.16     448.25      61.59
  Top Width (m)           255.17    Top Width (m)          196.83      31.90      26.44
  Vel Total (m/s)           1.68    Avg. Vel. (m/s)          1.16       3.14       1.20
  Max Chl Dpth (m)          4.56    Hydr. Depth (m)          1.81       4.47       1.94
  Conv. Total (m3/s)     19757.3    Conv. (m3/s)           8843.8     9595.1     1318.4
  Length Wtd. (m)         288.12    Wetted Per. (m)        196.95      32.38      26.69
  Min Ch El (m)           308.70    Shear (N/m2)            38.79      94.36      41.07
  Alpha                     1.95    Stream Power (N/m s)    44.90     296.32      49.39
  Frctn Loss (m)            0.53    Cum Volume (1000 m3) 15611.35    6566.47   12392.25
  C & E Loss (m)            0.04    Cum SA (1000 m2)      7221.22    1262.39    5913.03


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.


Profile Output Table - Standard Table 1

  Reach         River Sta                  Profile      Q Total   Min Ch El   W.S. Elev   Crit W.S.   E.G. Elev   E.G. Slope   Vel Chnl   Flow Area   Top Width   Froude # Chl
```

PROPOSED CONDITIONS

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                                                          (m3/s)         (m)         (m)         (m)         (m)        (m/m)      (m/s)        (m2)         (m)


  Reach-1       37770                       25 yr         379.00      309.96      313.33                  313.49     0.001594       2.10      317.78      241.72           0.38
  Reach-1       37770                       100 yr        522.00      309.96      313.87                  314.00     0.001230       2.05      450.58      248.17           0.34
  Reach-1       37770                       Reg           923.00      309.96      315.14                  315.26     0.000849       2.08      774.32      267.87           0.30

  Reach-1       37715                       25 yr         379.00      309.56      313.11      311.77      313.38     0.001905       2.35      180.38      203.86           0.42
  Reach-1       37715                       100 yr        522.00      309.56      313.51      312.33      313.89     0.002352       2.82      209.04      210.80           0.47
  Reach-1       37715                       Reg           923.00      309.56      315.05      313.31      315.20     0.000845       2.14      697.26      264.24           0.30

  Reach-1       37712.5                                   Bridge

  Reach-1       37705                       25 yr         379.00      309.42      313.03      311.70      313.32     0.001999       2.41      172.84      202.43           0.43
  Reach-1       37705                       100 yr        522.00      309.42      313.39      312.21      313.81     0.002560       2.92      198.89      212.01           0.49
  Reach-1       37705                       Reg           923.00      309.42      314.27      313.30      314.66     0.002278       3.19      489.76      330.67           0.48

  Reach-1       37643                       25 yr         379.00      309.16      312.94                  313.12     0.001423       2.01      272.16      204.53           0.36
  Reach-1       37643                       100 yr        522.00      309.16      313.32                  313.53     0.001555       2.27      354.54      225.03           0.39
  Reach-1       37643                       Reg           923.00      309.16      314.15                  314.42     0.001739       2.76      558.09      267.34           0.42

Profile Output Table - Standard Table 2

  Reach         River Sta                   Profile    E.G. Elev   W.S. Elev   Vel Head   Frctn Loss   C & E Loss   Q Left   Q Channel   Q Right   Top Width
                                                             (m)         (m)        (m)          (m)          (m)   (m3/s)      (m3/s)    (m3/s)         (m)



  Reach-1       37770                       25 yr         313.49      313.33       0.15         0.10         0.01   108.14      247.88     22.98      241.72
  Reach-1       37770                       100 yr        314.00      313.87       0.13         0.09         0.02   195.59      284.64     41.77      248.17
  Reach-1       37770                       Reg           315.26      315.14       0.12         0.05         0.00   434.48      388.35    100.17      267.87

  Reach-1       37715                       25 yr         313.38      313.11       0.27         0.00         0.01    14.29      356.07      8.64      203.86
  Reach-1       37715                       100 yr        313.89      313.51       0.38         0.00         0.01    25.37      480.21     16.42      210.80
  Reach-1       37715                       Reg           315.20      315.05       0.15         0.00         0.19   369.78      520.15     33.07      264.24

  Reach-1       37712.5                                   Bridge

  Reach-1       37705                       25 yr         313.32      313.03       0.28         0.14         0.05     4.99      363.56     10.45      202.43
  Reach-1       37705                       100 yr        313.81      313.39       0.41         0.17         0.10    11.87      491.51     18.62      212.01
  Reach-1       37705                       Reg           314.66      314.27       0.39         0.18         0.06   216.92      668.51     37.57      330.67

  Reach-1       37643                       25 yr         313.12      312.94       0.18         0.64         0.01    46.64      318.94     13.43      204.53
  Reach-1       37643                       100 yr        313.53      313.32       0.21         0.74         0.00    98.23      403.23     20.54      225.03
  Reach-1       37643                       Reg           314.42      314.15       0.27         0.88         0.00   277.09      604.60     41.31      267.34



Profile Output Table - Bridge Only

  Reach         River Sta                   Profile   E.G. US.   Min El Prs   BR Open Area   Prs O WS   Q Total   Min El Weir Flow   Q Weir   Delta EG   BR Sluice Coef
                                                           (m)          (m)           (m2)        (m)    (m3/s)                (m)   (m3/s)        (m)


  Reach-1       37712.5                     25 yr       313.38       316.29         332.49               379.00             314.51                  0.06
  Reach-1       37712.5                     100 yr      313.89       316.29         332.49               522.00             314.51                  0.08
  Reach-1       37712.5                     Reg         315.20       316.29         332.49               923.00             314.51                  0.54

Profile Output Table - Six XS Bridge

  Reach         River Sta                       Profile   E.G. Elev   W.S. Elev  Crit W.S.   Frctn Loss   C & E Loss   Top Width   Q Left   Q Channel   Q Right   Vel Chnl
```

PROPOSED CONDITIONS

			(m)	(m)	(m)	(m)	(m)	(m)	(m3/s)	(m3/s)	(m3/s)	(m/s)
Reach-1	37770	25 yr	313.49	313.33		0.10	0.01	241.72	108.14	247.88	22.98	2.10
Reach-1	37770	100 yr	314.00	313.87		0.09	0.02	248.17	195.59	284.64	41.77	2.05
Reach-1	37770	Reg	315.26	315.14		0.05	0.00	267.87	434.48	388.35	100.17	2.08
Reach-1	37715	25 yr	313.38	313.11	311.77	0.00	0.01	203.86	14.29	356.07	8.64	2.35
Reach-1	37715	100 yr	313.89	313.51	312.33	0.00	0.01	210.80	25.37	480.21	16.42	2.82
Reach-1	37715	Reg	315.20	315.05	313.31	0.00	0.19	264.24	369.78	520.15	33.07	2.14
Reach-1	37712.5 BR U	25 yr	313.37	313.08	311.81	0.03	0.00	75.29	17.05	351.72	10.24	2.44
Reach-1	37712.5 BR U	100 yr	313.88	313.48	312.41	0.04	0.01	75.29	30.75	471.42	19.83	2.91
Reach-1	37712.5 BR U	Reg	315.01	314.25	313.39	0.06	0.03	70.36	67.42	803.43	52.15	4.09
Reach-1	37712.5 BR D	25 yr	313.33	313.03	311.76	0.01	0.01	74.60	6.12	360.06	12.81	2.49
Reach-1	37712.5 BR D	100 yr	313.83	313.40	312.30	0.01	0.01	74.60	14.75	484.17	23.09	3.00
Reach-1	37712.5 BR D	Reg	314.92	314.04	313.39	0.01	0.24	74.60	44.66	823.13	55.22	4.32
Reach-1	37705	25 yr	313.32	313.03	311.70	0.14	0.05	202.43	4.99	363.56	10.45	2.41
Reach-1	37705	100 yr	313.81	313.39	312.21	0.17	0.10	212.01	11.87	491.51	18.62	2.92
Reach-1	37705	Reg	314.66	314.27	313.30	0.18	0.06	330.67	216.92	668.51	37.57	3.19
Reach-1	37643	25 yr	313.12	312.94		0.64	0.01	204.53	46.64	318.94	13.43	2.01
Reach-1	37643	100 yr	313.53	313.32		0.74	0.00	225.03	98.23	403.23	20.54	2.27
Reach-1	37643	Reg	314.42	314.15		0.88	0.00	267.34	277.09	604.60	41.31	2.76

11.

GEOTECHNICAL INVESTIGATION

- Geotechnical Investigation – Bridge 34/B-T9 (Bridge Street) prepared by Peto MacCallum Ltd. (PML) dated June 14, 2021

Peto MacCallum Ltd.
CONSULTING ENGINEERS

GEOTECHNICAL INVESTIGATION AND LIMITED CHEMICAL TESTING PROGRAM
BRIDGE 34/B-T9 (BRIDGE STREET)
TOWNSHIP OF WILMOT, ONTARIO

for

THE CORPORATION OF TOWNSHIP OF WILMOT
c/o K. SMART ASSOCIATES LIMITED

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PML Ref.: 20LF007
Report: 1
June 14, 2021

Peto MacCallum Ltd.
CONSULTING ENGINEERS

June 14, 2021

PML Ref.: 20LF007
Report: 1

The Corporation of the Township of Wilmot
c/o Mr. Pedram Yazdan Panah, E.I.T.
K. Smart Associates Limited
85 McIntyre Drive
Kitchener, Ontario
N2R 1H6

Dear Mr. Panah

Geotechnical Investigation
Bridge 34/B-T9 (Bridge Street)
Township of Wilmot, Ontario

Peto MacCallum Ltd. (PML) is pleased to report the findings of our geotechnical investigation completed for the above noted project. Authorization to proceed with this assignment was provided by Mr. A. Garnham, P.Eng. of K. Smart Associates Limited in a letter dated August 31, 2020.

It is understood that the Township of Wilmot is planning to replace Bridge 34/B-T9 located on Bridge Street (crossing the Nith River), between Puddicombe Road and Tye Road in Township of Wilmot. It is understood that the existing bridge comprises a steel truss structure with a span about 45 m, and accommodates only one traffic lane. Details of the proposed structure have not been provided; however, it is envisaged that the new structure will retain the current span but the deck will be wider to accommodate two traffic lanes.

The purpose of the investigation was to determine the specific subsurface soil and ground water conditions at the site. Based on the findings, we have prepared this engineering report with geotechnical recommendations pertaining to design and construction of the new bridge.

A limited chemical testing program was also included with the geotechnical work to check the geoenvironmental quality of the site soil in order to provide comments regarding on-site or off-site re-use and/or disposal options for excess soil.

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The comments and recommendations provided in this report are based on the site conditions at the time of the investigation, and are applicable only to the proposed works as described in the report. Any changes in plans, will require review by PML to assess the applicability of the report, and may require modified recommendations, additional analysis and/or investigation.

Investigation Procedure

The field work for the geotechnical investigation was conducted between September 28 and October 28, 2020. The investigation program comprised the drilling of four boreholes near the existing bridge, at locations shown on the appended Borehole Location Plan, Drawing 1. Two deep boreholes, Boreholes 2 and 3 were located at the existing bridge abutments and were advanced to 19.2 and 21.4 m depth, respectively. Boreholes 1 and 4 were advanced to 6.7 m depth on the bridge approaches.

The borehole locations were determined and established in the field by PML. The borehole locations and geodetic elevations were surveyed with a Sokkia GCX3 Real Time Kinematic receiver connected to the Global Navigation Satellite System.

The boreholes were advanced using continuous flight solid and hollow stem augers, powered by a truck mounted CME-75 drill rig, equipped with automatic hammer, supplied and operated by a specialist drilling contractor. The work was carried out under full-time supervision of a PML engineering staff member who directed the drilling and sampling operations, documented the soil stratigraphy, monitored ground water conditions and processed the recovered samples.

Representative samples of the overburden were secured from the boreholes at regular intervals of depth. Standard penetration tests were carried out in conjunction with the sampling operations using a conventional split spoon sampler.

Ground water observations were carried out in the open boreholes during and after completion of drilling. Upon completion of the drilling, the boreholes were decommissioned in accordance with O.Reg. 903/90, as amended.

All of the recovered samples were returned to PML's laboratory for detailed visual examination, classification and routine moisture content determinations. The laboratory testing also included four particle size distribution analyses carried out on samples of the major soil types encountered.

As part of the geoenvironmental procedure protocol, all recovered soil samples were examined for visual and olfactory evidence of potential contamination.

Selected soil samples were submitted to SGS Canada Inc. (SGS) for laboratory chemical testing to assess the geoenvironmental properties of the soil. Details concerning the geoenvironmental chemical testing program, including procedures and results of chemical testing, are provided in the Geoenvironmental Considerations section of this report.

Summarized Subsurface Conditions

Reference is made to the appended Log of Borehole sheets for details of the field work including soil descriptions, inferred soil stratigraphy, Standard Penetration Test (SPT) N values, pocket penetrometer shear strengths, ground water observations and laboratory moisture content determinations.

Due to the soil sampling procedures and the limited size of samples, the depth/elevation demarcations on the borehole logs must be viewed as “transitional” zones, and cannot be construed as exact geologic boundaries between layers.

In general, the subsurface soil stratigraphy encountered comprised surficial road pavement structure, fill, and alluvium, underlain by a deposit of sand and gravel/gravelly sand/sand, which in turn was underlain by silty sand till / sandy silt till / silt till.

Pavement Structure

The surficial pavement structure encountered in Boreholes 1 to 4 was 0.88 to 1.2 m thick. The pavement components under the lanes comprised 60 to 70 mm of asphalt, over 230 to 250 mm of granular base, over 560 to 850 mm of granular subbase. The pavement structure materials were observed to be moist, as confirmed by moisture contents between 3 to 7%

Fill

Fill consisting of clayey silt, sandy silt, and sand and gravel was encountered beneath the pavement structures, and extended to depths of between 3.5 to 4.7 m below existing road grades. The cohesive clayey silt fill was drier than plastic limit (DTPL) to about plastic limit (APL) with moisture content results between 21 to 30%. The cohesionless sand and gravel / sandy silt / silt fill was typically moist to wet with moisture contents between 2 to 24%.

Alluvium

A clayey silt alluvium deposit was encountered below the fill in Boreholes 1 and 2, on the west side of the Nith River, and extended to 5.6 and 5.7 m depths, respectively. The alluvium was very soft to soft with SPT N values between 3 to 8 blows per 0.3 m penetration of the split spoon sampler. The alluvium was APL to wetter than plastic limit (WTPL) with moisture contents between 30 and 51%.

Sand and Gravel / Gravelly Sand / Sand

An extensive native deposit of sand and gravel / gravelly sand / sand was encountered in the boreholes, below the fill and alluvium. The sand and gravel / gravelly sand / sand extended to the 6.7 m termination depths in Boreholes 1 and 4, and to 9.4 and 8.0 m depth in Boreholes 2 and 3, respectively. The cohesionless sand and gravel / gravelly sand / sand deposits were found to be compact to dense based on typical SPT N values ranging from 25 to 40 blows per 0.3 m penetration of the split spoon sampler. The sand and gravel / gravelly sand / sand deposits were observed to be saturated with moisture content test results between 8 and 10 %. Reference is given to the appended Figures 1 and 2 for the results of particle size analyses conducted on samples of the gravelly sand and sand. It is noted that the samples submitted for particle size analysis would not include coarse gravel particles greater than 38 mm due to the limitations of the split spoon sampling equipment.

Silty Sand Till / Sandy Silt Till / Silt Till

Cohesionless silty sand till / sandy silt till / silt till deposits were encountered in Boreholes 3 and 4 below the sand and gravel / gravelly sand / sand and extended to the borehole termination depths of up to 21.4 m. Occasional cobbles and occasional boulders were observed in the till deposits. The cohesionless silty sand till / sandy silt till / silt till was found to have a very dense consistency based on typical measured SPT N values greater than 50 blows per 0.3 m penetration of the split spoon sampler. The till deposits were typically wet with moisture content test results between 8 to 30%. Reference is given to the appended Figures 3 and 4 for the results of particle size analyses conducted on samples of the till deposits. It is noted that the samples submitted for particle size analysis would not include coarse gravel particles greater than 38 mm due to the limitations of the split spoon sampling equipment.

Boreholes 2 and 3 were terminated due to auger refusal on probable boulders within the till, at 19.2 and 21.4 m depths, respectively.

Geological mapping published by the Ontario Ministry of Natural Recourses indicates that bedrock at the bridge site would typically be located at 50 m depth and comprise Limestone or Dolostone of the Salina Formation.

Ground Water Conditions

Ground water observations carried out during the course of the field work are summarized on the appended Log of Borehole sheets. During drilling, wet / saturated conditions were observed in the sand and gravel / gravelly sand / sand between 3.6 to 4.7 m depths (Elevation 309.6 to 310.8). Wet samplers were observed below 4.9 to 6.1 m depth in the boreholes. Upon completion of auguring free water was observed at 5.8 and 4.4 m depth in Boreholes 1 and 4, respectively. The wet / saturated conditions and free water reflect the ground water levels at the site, and the Nith River water level.

The ground water levels at the site are subject to seasonal fluctuations and precipitation patterns. It should be noted that the relatively impermeable nature of the silt till could contribute to the development of perched water conditions following short term seasonal participation events.

Discussion and Recommendations

It is understood that the Township of Wilmot is planning to replace Bridge 34/B-T9 which crosses the Nith River between Puddicombe Road and Tye Road. Details of the proposed structure, which will replace the existing 45 m span steel truss structure have yet to be established. However, it is envisaged that the new structure will retain the current span but the deck and approach grades will be wider to accommodate two traffic lanes. When final design details are available, the comments and recommendations provided in this report should be reviewed to ensure their applicability.

The general subsurface stratigraphy encountered comprises surficial pavement structure, fill, and alluvium, over compact to dense sand and gravel / gravelly sand / sand, underlain by till deposits

Pile Foundations

Cognizant of the general size of the proposed structure it is anticipated that an integral abutment foundation system comprised of driven piles could be employed to support the prosed new bridge.

A driven pile system consisting of steel H-piles is considered suitable to support the bridge foundation loads at both abutments. The piles should be driven to refusal in the very dense till deposits, which is anticipated below 16 m depth (below Elevation 299).

For pile driven to refusal in the till, the following factored geotechnical axial resistance at ULS for the following sections of steel piles is considered to be appropriate.

PILE SECTION	FACTORED GEOTECHNICAL AXIAL RESISTANCE PER PILE AT ULS (kN)	ALLOWABLE GEOTECHNICAL AXIAL RESISTANCE PER PILE AT SLS (kN)
HP 310 x 110	1400	900
HP 360 x 152	1900	1250

The geotechnical reaction at SLS allows for 25 mm compression of the founding medium.

The piles should be installed and monitored in accordance with the requirements of OPSS 903. This should involve confirmation of the founding elevation, alignment, plumbness, uniformity of set and quality of splices and should be done on a full-time basis by experienced geotechnical personnel.

The pile capacities should be verified in the field by Pile Driving Analyser (PDA) testing. Prior to driving of piles, a Wave Equation Analysis (WEAP) should be performed by PML in order to confirm that appropriate pile driving equipment has been selected for the project and the pile will not be overstressed during driving. A WEAP analysis estimates the bearing capacities and stresses during driving based on the pile driving equipment, pile and the soil.

Pile caps should be provided with at least 1.2 m of earth cover or equivalent thermal insulation as protection against frost action. A 25 mm thick layer of polystyrene insulation is thermally equivalent to 600 mm of soil cover.

It is anticipated that the part of the existing road embankment will be excavated during demolition of the existing bridge and that working platforms will be constructed to drive the piles. Any additional fill that may be required at these locations should comprise OPSS Granular A to allow installation of the piles without damage. Alternative granular material such as Granular B Type II could be employed provided the maximum particle size does not exceed 75 mm. The granular material must be placed in 300 mm thick lifts and compacted to at least 95% standard Proctor maximum dry density (SPMDD).

To accommodate movement of the integral abutment system, two concentric CSPs that extend at least 3 m below the bottom of the abutment should be placed around the pile to create an annular space. The inner CSP should be filled with sand meeting the gradation requirements of Granular B Type I. Alternatively, a single CSP or auger hole filled with loose uniform sand meeting the requirements shown below maybe used. The sand must be placed following pile installation.

SIEVE DESIGNATION		PERCENTAGE PASSING BY MASS
2 mm	#10	100
600 µm	#30	80 - 100
425 µm	#40	40 - 80
250 µm	#60	5 - 25
150 µm	#100	0 - 6

Resistance to lateral loads may be provided in part by mobilization of passive resistance along the pile below the annular space. The lateral resistances recommended for the two pile sections are:

	HP 310 x 110	HP 360 x 152
Factored Lateral Resistance at ULS	100 kN	130 kN
Lateral Resistance at SLS	30 kN	40 kN

If additional lateral resistance is required, batter piles driven to refusal should be employed.

The coefficient of horizontal subgrade reaction, k_s (MN/m^3), for Granular A or B backfill and native sand and gravel / gravelly sand / sand may be computed using the following equation to evaluate the point of counter flexure:

$k_s = n_h z/b$

where k_s = coefficient of horizontal subgrade reaction

n_h = coefficient related to soil density

= 10 MN/m^3 for Granular A and B backfill

= 4 MN/m^3 for native sand and gravel / clayey silt / silty sand / silt / sandy gravel

z = depth, (m)

b = pile width, (m)

Group action for lateral loading should be considered, as the lateral capacity of a pile group may be less than the sum of the lateral capacities of individual piles. For design a reduction of the coefficient of subgrade reaction may be required when the spacing between piles in the direction of loading is less than eight pile diameters. Group action can be evaluated by reducing the coefficient of horizontal subgrade reaction by a reduction factor, R, as follows:

PILE SPACING d = PILE DIAMATER OR WIDTH	HORIZONTAL SUBGRADE REACTION REDUCTION FACTOR, R
8d	1.00
6d	0.70
4d	0.40
3d	0.25

Pile spacing normal to the direction of loading has no influence provided it is greater than 2.5 times the pile diameter.

Shallow Foundations

In general, shallow foundations may be used to support retaining walls, wing walls and headwalls at the abutments. Based on the results of the investigation, these structures may be supported on conventional shallow foundations. Foundations should extend a minimum of 0.2 m into the competent native sand and gravel / gravelly sand / sand deposits as shown in the following table.

FOOTING FOUNDING DEPTHS

BOREHOLE	For 200 kPa at SLS and 300 kPa at ULS	
	MINIMUM DEPTH (m)	CORRESPONDING ELEVATION
1	5.8	310.6
2	5.9	309.4
3	4.9	310.3
4	4.7	309.8

Alternatively, footings may be placed at higher elevations and supported on engineered structural fill, placed in accordance with the recommendations provided below. Footings founded on approved structural fill may be designed for 150 kPa at the SLS and 225 kPa at the ULS. Prior to placement of engineered fill, all existing deleterious soils must be removed and the soils should be subexcavated to the level of competent native soils, as noted in the table above. For engineered fill supporting footing loads, the fill should comprise approved granular material compacted to a minimum 98% SPMDD.

It is recommended that the footings be constructed at least 1.2 m below the river bottom as all footings subject to frost action should be provided with the normal 1.2 m of earth cover. The depth of potential scour should also be considered.

It is essential that all foundation excavations be inspected by geotechnical personnel from PML to check the competency of the founding surfaces and ensure that the geotechnical requirements presented in this report are properly implemented. All backfill, frost protection and cover for concrete abutments should be placed in accordance with Ontario Provincial Standard Drawing (OPSD) 3101.150.

The saturated native sand and gravel / gravelly sand / sand soils at this site are prone to disturbance by the weather elements and construction traffic. Accordingly, a 50 mm skim slab of lean concrete should be provided over the base of the approved founding subgrade, prior to erection of formwork or placement of reinforcing steel.

Provided the footings are designed and constructed for the SLS resistance outlined above, total settlements should not exceed 25 mm with differential settlements of 75% of this value.

Design provisions for earthquake loading should also be applied. For the soil conditions at the site, a Class C site category may be assumed, in accordance with the 2012 Ontario Building Code.

Excavation and Groundwater Control

It is anticipated that excavations for the proposed bridge will extend approximately 6 m below the existing road grades. The excavations will be advanced through the existing pavement structure, fill, alluvium the underlying wet to saturated native sand and gravel / gravelly sand / sand subgrade. Provided adequate ground water control has been achieved, the excavation side slopes may be assumed to be within a Type 3 soil, for which side slopes can be no steeper than one horizontal to one vertical (1H:1V). It may be necessary to flatten the side slopes to 3H:1V if excessively loose/soft conditions or concentrated seepage zones are encountered. Workers should not enter an unprotected excavation if there is evidence of ongoing ground water seepage in the banks. All construction work should be carried out in accordance with the Occupational Health and Safety Act (OHSA).

Excavations for the foundations are anticipated to extend below the ground water level into wet to saturated sand and gravel / gravelly sand / sand deposits. Rigorous dewatering will be required to maintain a safe and sufficiently dry excavation and the use of keg wells or well point dewatering is envisaged, in conjunction with River diversion an/or cut offs. Regardless of the dewatering method chosen, the hydraulic head and ground water inflow must be properly controlled to ensure stable and safe excavation and to facilitate construction. The design of the dewatering system should be left to the contractor's discretion, and the system should meet a performance specification to maintain and control ground water at least 0.3 m below the excavation base level, in order to provide a stable excavation base throughout construction.

It is recommended that test pits be carried out during the tendering stage of the project in order that prospective contractors may familiarize themselves with soil and ground water conditions. Also, the dewatering requirements should also be established by the contractor in the context of a performance specification.

It should be noted that, under the Ontario Water Resources Act, the Water Taking and Transfer Regulation 387/04, a Permit to Take Water (PTTW) from the Ministry of Environment Conservation and Parks (MECP) is required if the dewatering discharge is greater than 50,000 L/day. In accordance with the above noted regulatory requirements and in compliance with the MECP's PTTW Manual (April 2005), and application should be filed to the MECP for the subject property construction dewatering PTTW, if the dewatering discharge is greater than 400,000 L/day, or about 4.6 L/S. If the dewatering discharge is between 50,000 L/day (or about 0.6 L/S) and 400,000 L/day (or about 4.6 L/S) dewatering activities need to be registered on the Environmental Activity and Sector Registry (EASR). Dewatering volumes are expected to exceed 50,000 L/day and may possibly exceed 400,000 L/day cognizant of the ground water conditions observed. Therefore, an EASR or PTTW and supporting hydrogeological assessment will likely be required. A detailed review of the final foundation levels will be required to determine the extent of the dewatering and the requirements for a hydrogeological investigation.

Backfilling

Backfill adjacent to the bridge should be placed in accordance with the Ontario Provincial Standard Specifications (OPSS) 401, and 501, and OPSD 3101.150. The backfill should be placed in 300 mm maximum lifts and compacted to at least 95% SPMDD, as verified by insitu density testing.

The backfill should comprise free draining granular material such as OPS Granular B Type I. The near surface fill soils found below the pavement in the boreholes are not suitable for reuse as backfill, and imported granular fill will be required. Materials containing peat and / or organic matter should not be used as backfill.

Backfill should be brought up simultaneously on each side of the structure and operation of heavy equipment within 0.5 times the height of the structure (each side) restricted to minimize the potential for movement and/or damage of the structure due to the lateral earth pressure induced by compaction.

The structure must be designed to support the stress imposed by roadway traffic and the overlying fill as well as to resist the unbalanced lateral earth pressure and compaction pressure imposed by the backfill adjacent to the walls.

The lateral earth and water pressure, P (kPa), may be computed using the equivalent fluid pressure method presented in Section 6.12 of the Canadian Highway Bridge Design Code (CHBDC), CAN/CSA-S6-14, December 2014, or employing the following equation.

$$P = K(\gamma h + q) + C_p$$

where P = total lateral pressure at depth h (m) below ground surface (kPa)
K = lateral earth pressure coefficient of compacted backfill (0.5)
h = depth below grade (m) at which lateral pressure is calculated
γ = unit weight of compacted sand and gravel backfill
q = vertical stress at depth h due to surcharge loads (kPa)
C_p = compaction pressure (refer to clause 6.12.3 of CHBDC)

For walls restrained at the top, the total lateral compaction pressure may be computed as 12 kPa added at the backfill surface, reducing linearly to 0 kPa at a depth of 1.7 m, plus a further lateral surcharge of 0.15 times the at-rest lateral pressure added over the full backfilled height of the wall. It should be understood that the above equation assumes that the backfill will be free draining, and hydrostatic pressures cannot develop.

The loading induced by seismic events should also be considered in design, and reference is made to clause 4.6.4 of CHDBC.

Appropriate factors of safety must be used in design.

The following design parameters may be assumed for granular backfill materials compacted to 95% SPMDD:

PARAMETER	OPS GRANULAR A	OPS GRANULAR B TYPE I
Angle of Internal Friction, Ø (degrees)	35	32
Unit Weight, γ (kN/m3)	23	21
Coefficient of Active Earth Pressure (K_a)	0.27	0.31
Coefficient of Earth Pressure At Rest (K_o)	0.43	0.47
Coefficient of Passive Earth Pressure (K_p)	3.70	3.23
Angle of friction between soil and wall, d (degrees)	23.5	21.5

Upon completion of backfilling, the embankment slope should be graded and dressed with an appropriate cover to prevent erosion. Minimal erosion is anticipated in earth slopes that are properly constructed at 2H:1V or flatter. Effort should be made to use 3H:1V earth slopes where possible. As a minimum, the new slopes should be seeded and mulched (as per OPSS 804) as soon after grading as possible to prevent erosion.

Pavement Reinstatement

Based on the proposed pavement usage, frost susceptibility, and strength of the expected subgrade soils, the following pavement component thicknesses are considered suitable for roadway reinstatement.

PAVEMENT COMPONENT	THICKNESS
Asphalt	100 mm
Granular A Base	150 mm
Granular B Subbase	400 mm

The pavement design considers that construction will be carried out during the drier time of the year and that the subgrade is stable, as determined by proofrolling and inspection by PML personnel. If the subgrade is wet and unstable, subexcavation and placement of additional granular subbase material will be required.

The pavement materials should conform to current OPS and municipal specifications. The Granular A base and Granular B subbase courses should be placed in thin lifts and compacted to a minimum of 100% SPMDD, and asphalt should be placed to a minimum of 92% of the material's maximum relative density (MRD) and reference is made to OPS Specification 310.

It should be noted that the subgrade will lose its strength if allowed to become wet due to surface water or during freezing and thawing periods. Therefore, drainage of the granular courses and subgrade becomes very essential. Drainage should be provided by extending the granular courses out to the face of the embankment slopes.

It is recommended that at the transition zones, the subgrade level of the new pavement sections and existing pavement section should match, if possible, to avoid any problems associated with differential frost heaving of the subgrade. Alternatively, frost tapering of the subgrade at 10 horizontal to 1 vertical would be recommended.

During construction, testing should be conducted to confirm the gradation and compatibility characteristics of the granular base and subbase materials.

Proofrolling procedures and the placement and compaction of all the fill and granular materials for the pavement construction and backfilling at the site should be inspected on a continuous basis by PML technicians.

Geoenvironmental Considerations

PML understands that excess soil may be generated during construction, the volume of which is unknown at this time. A limited chemical testing program was carried out to check the geoenvironmental quality of the soil at selected sampling locations in order to provide comments regarding on-site or off-site re-use and/or disposal options of excess soil.

The geoenvironmental sampling and testing was conducted as a limited chemical testing program. A Phase One Environmental Site Assessment (ESA) was not within the scope of work for this assignment. Accordingly, soil and ground water impairment that has not been identified by the limited chemical testing program may exist elsewhere at the site. The limited chemical testing program does not constitute an Environmental Site Assessment as defined under the Environmental Protection Act and O.Reg. 153/04, as amended.

Chemical Testing Protocol

Representative samples collected during the geotechnical investigation were returned to our laboratory for detailed visual examination. Soil samples were submitted for chemical analysis to SGS, a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory in Lakefield, Ontario. The chemical analyses conducted by SGS were in accordance with the O.Reg. 153/04, as amended Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act dated March 9, 2004, amended as of July 1, 2011.

As part of the geoenvironmental procedural protocol, all recovered soil samples were examined for visual and olfactory evidence of potential contamination.

The rational for sample selection was based on materials exhibiting visual or olfactory evidence of contamination, SVC screening, site coverage, and materials most likely to be excavated during construction.

Four samples were submitted for analysis for metals and inorganics (M&I), petroleum hydrocarbon (PHC) fractions F1 to F4 and volatile organic compounds (VOCs) in. The M&I analyses includes testing for electrical conductivity (EC) and sodium adsorption ratio (SAR). A list of all samples submitted for analysis is presented in the table below.

SAMPLES SUBMITTED FOR CHEMICAL TESTING

LOCATION	SAMPLE ID	APPROXIMATE DEPTH (m)	DESCRIPTION	CHEMICAL ANALYSIS
Borehole 1	BH1 SS2	0.8 to1.4	Fill	PHC, VOC and M&I
Borehole 3	BH3 SS6	4.7 to 5.2	Sand and Gravel	PHC, VOC and M&I
Borehole 4	BH4 SS4	2.3 to 2.9	Fill	PHC, VOC and M&I
Borehole 4	BH4 SS6	4.6 to 5.2	Sand and Gravel	PHC, VOC and M&I

Site Condition Standards

The MECP has developed a set of Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (April 15, 2011) and O.Reg. 153/04, as amended. The standards consist of nine tables (Table 1 through Table 9) that provide criteria for maximum concentrations of various contaminants. In general, the applicable Table and corresponding Site Condition Standards (SCSs) depend on the site location, land use, soil texture, bedrock depth, soil pH and potable or non-potable ground water setting at the site.

As a transportation corridor, a community property use designation applies to the site (Bridge Street) under O.Reg. 153/04, as amended. Based on review of the above factors, PML selected the Generic Criteria of the O.Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act dated April 15, 2011. In particular, the Table 8 (T8) Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for Residential / Parkland / Institutional / Industrial / Commercial / Community (RPI/ICC) Property Use within 30 m of a Water Body in a Potable Ground Water Condition would likely apply to the site; however, a full evaluation of applicable SCSs in accordance with Sections 41 and 43.1 of O.Reg. 153/04, as amended, was not within the scope of this assignment and further environmental work would be required to confirm this.

For off-site re-use of soil with minimal environmental restrictions, the O.Reg. 153/04, as amended, Full Depth Background Table 1 (T1) SCSs for RPI/ICC property uses were utilized, which is the most stringent Standard listed under the Regulation apart from agricultural use.

For the option of reusing the excess soil at a property with a potable or non potable ground water condition, the O.Reg. 153/04, as amended, Full Depth Generic Table 2 and Table 3 SCSs were utilized for RPI/ICC land use.

It is noted that a comparison to the O.Reg. 153/04, as amended, Tables 4 and 5 SCSs for stratified site conditions and Tables 6 and 7 SCSs for shallow bedrock conditions were not conducted as part of this assignment. If the potential receiving site for excess soil falls within one of these categories, additional evaluation by PML will be required to confirm conformance.

Analytical Findings and Conclusions

Laboratory Certificates of Analysis compared to the Table 1 RPI/ICC SCSs are included in Appendix A. The results of the analyses were also compared to Table 2 ICC and Table 8 RPI/ICC SCSs in the following paragraphs. The measured values and corresponding Standards (labelled as G/S for Guideline/Standard) are shown on the certificates of analysis. In the event of an exceedance of the SCSs, the level is shown as **highlighted**, if applicable.

On-Site Re-use

The measured concentrations of the tested parameters complied with T8 RPI/ICC SCSs with the following exceptions:

LOCATION	SAMPLE	PARAMETERS
Borehole 1	BH1 SS2	EC
Borehole 4	BH4 SS4	EC & SAR
Borehole 4	BH4 SS6	EC

Under O.Reg. 153/04, as amended, where a SCS is exceeded solely because a substance has been applied to surfaces for the safety of vehicular or pedestrian traffic under conditions of snow or ice or both, the applicable site condition standard is deemed not to be exceeded. In this regard, soil exhibiting EC and SAR exceedances, only, would not be considered "contaminated" if re-used on site as part of the road reconstruction or off-site at another site where paved surfaces are to be constructed and continued de-icing salt application can be expected to occur for traffic safety. Reference is made to O.Reg. 153/04 (as amended), s. 49.1 and O.Reg. 339 s. 2 for a full outline of the regulations regarding soils impacted by de-icing salt.

Off Site Re-use

A comparison of the results was carried out against the Table 1 RPI/ICC, Table 8 RPI/ICC and Table 2 and 3 ICC SCSs. The following table outlines a summary of the suitability for re-use of excess soil material based on the limited chemical testing.

SAMPLE ID	TABLE 1 RPI/ICC	TABLE 8 RPI/ICC	TABLE 2 ICC & TABLE 3 ICC	LICENSED LANDFILL
BH1 SS2	No[1]	No[1]	Yes	TCLP testing required
BH3 SS6	Yes	Yes	Yes	
BH4 SS4	No[1]	No[1]	Yes	
BH4 SS6	No[1]	No[1]	Yes	

Notes:

[1] Due to elevated metals and inorganics parameters, specifically EC and SAR

Cognizant of the elevated levels of EC and SAR parameters in the tested samples, off-site re-use and/or disposal will be subject to restrictions. In general, excess soil would not be considered suitable for off-site re-use as Table 1 RPI/ICC soil due to the above noted exceedances; however, samples with EC exceedances only (BH2 SS4 and BH2 SS5) may be considered suitable for reuse at Table 2 ICC and Table 3 ICC sites subject to the following conditions.

If the soil is to be removed from the site for off site re-use, the following conditions must be met:

- The extent of the contaminated soil identified above is delineated;

- The work must be completed in accordance with local by-laws governing soil movement and/or placement at other sites;

- All analytical results and environmental assessment reports must be fully disclosed to the receiving site owners/authorities and they have agreed to receive the material;

- The applicable SCSs for the receiving site have been determined, as confirmed by the environmental consultant and the SCSs are consistent with the chemical quality of the soil originating at the source site;

- The excess soil cannot be taken to a property for which a Record of Site Condition (RSC) is being filed as outlined in O.Reg. 153/04, as amended, unless the chemical testing program is completed in accordance with the regulation;

- Transportation and placement of the surplus soil is monitored by the environmental consultant to check the material is appropriately placed at the pre-approved site;

- The receiving site must be arranged and/or approved well in advance of excavation in order to avoid delays during construction. As well, it is noted the chemical testing requirements for various receiving sites is site-specific and additional testing may be required, beyond that provided in this limited sampling and testing report.

- The excavation work should be conducted in accordance with a written Soil Management Plan prepared by a qualified professional to ensure that all surplus excavated material is tested and managed appropriately, and that imported fill material is of suitable quality and meets the SCSs applicable to the site. Re-use of excess excavated soil on site is also subject to acceptance for re-use by the geotechnical consultant at the time of construction based on geotechnical considerations.

Additional sampling and chemical testing should be carried out during construction to verify the chemical quality of the excess soil to assess the appropriate management/disposal options for the soil leaving the site.

It should be noted that the MECP has introduced new On-Site and Excess Soil Management Regulations (O.Reg. 406/19) which include certain exemptions for projects which are underway prior to January 1, 2022. Compliance with the regulations will require additional environmental review and management of excess soils, including additional soil sampling and analytical testing requirements.

It should be noted there is no legal imperative to remove or treat the soil that exceeds the applicable Site Condition Standard, provided it is demonstrated that there is no off-site impact or adverse effect. However, if contaminated soil is left on site, the landowner assumes liability associated with the contamination. The liability concerns could include potential scrutiny from the MECP, neighbouring property owners and the public; potential for decreased value of the land and issues during potential divesting of the property due to environmental liability concerns on the part of future owners or their financiers / insurers.

Geotechnical Review and Construction Inspection and Testing

It is recommended that the design drawings be submitted to PML for general geotechnical review for compatibility with site conditions and recommendations of this report.

Foundation construction and earthworks operations should be carried out under the supervision of PML to approve subgrade preparation, backfill materials, placement and compaction procedures, and verify the specified degree of compaction is achieved uniformly throughout fill materials.

The comments and recommendations provided in the report are based on the information revealed in the boreholes. Conditions away from and between boreholes may vary, particularly where service trenches exist. Geotechnical review during construction should be on going to confirm the subsurface conditions are substantially similar to those encountered in the boreholes, which may otherwise require modification to the original recommendations.

This report is subject to the Statement of Limitations that is included in Appendix B, which must be read in conjunction with the report.

Closure

We trust the information presented in this report is sufficient for your present purposes. If you have any questions, please do not hesitate to contact our office.

Sincerely

Peto MacCallum Ltd.

LICENSED PROFESSIONAL ENGINEER
W. A. P. LOGHRIN
100143946
June 14, 2021
PROVINCE OF ONTARIO

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RB/WL/SJ:cs

Enclosure(s):
Figures 1 to 4 - Particle Size Distribution Charts
List of Abbreviations
Log of Boreholes 1 to 4
Drawing 1 – Borehole Location Plan
Appendix A – SGS – Certificate of Analysis
Appendix B – Statement of Limitations

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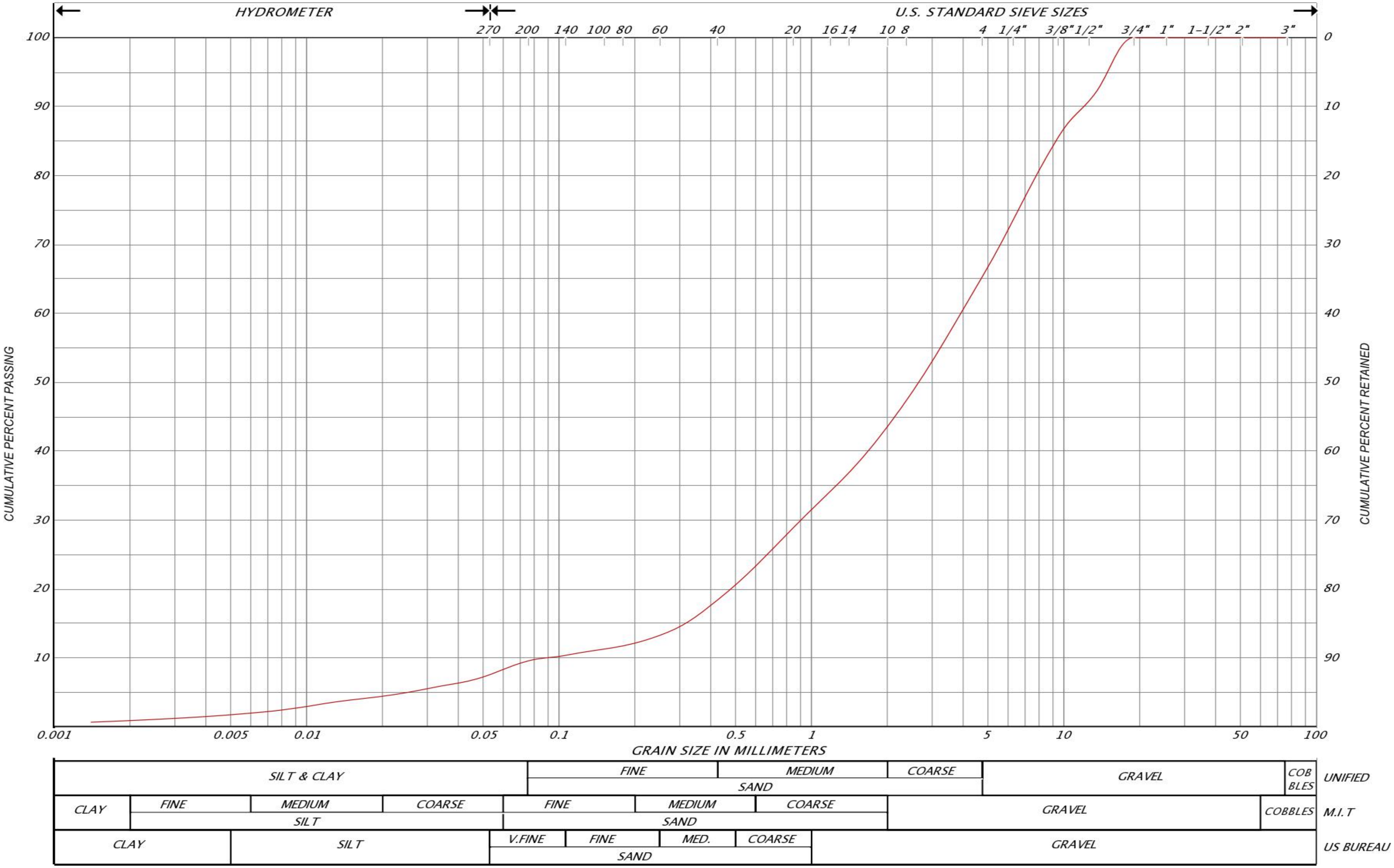
PROJECT NO.20LF007
FIGURE NO. 1

PARTICLE SIZE DISTRIBUTION CHART



REMARKS: Borehole 3, Sample SS7, Depth 6.1 to 6.7 m

SAND AND GRAVEL

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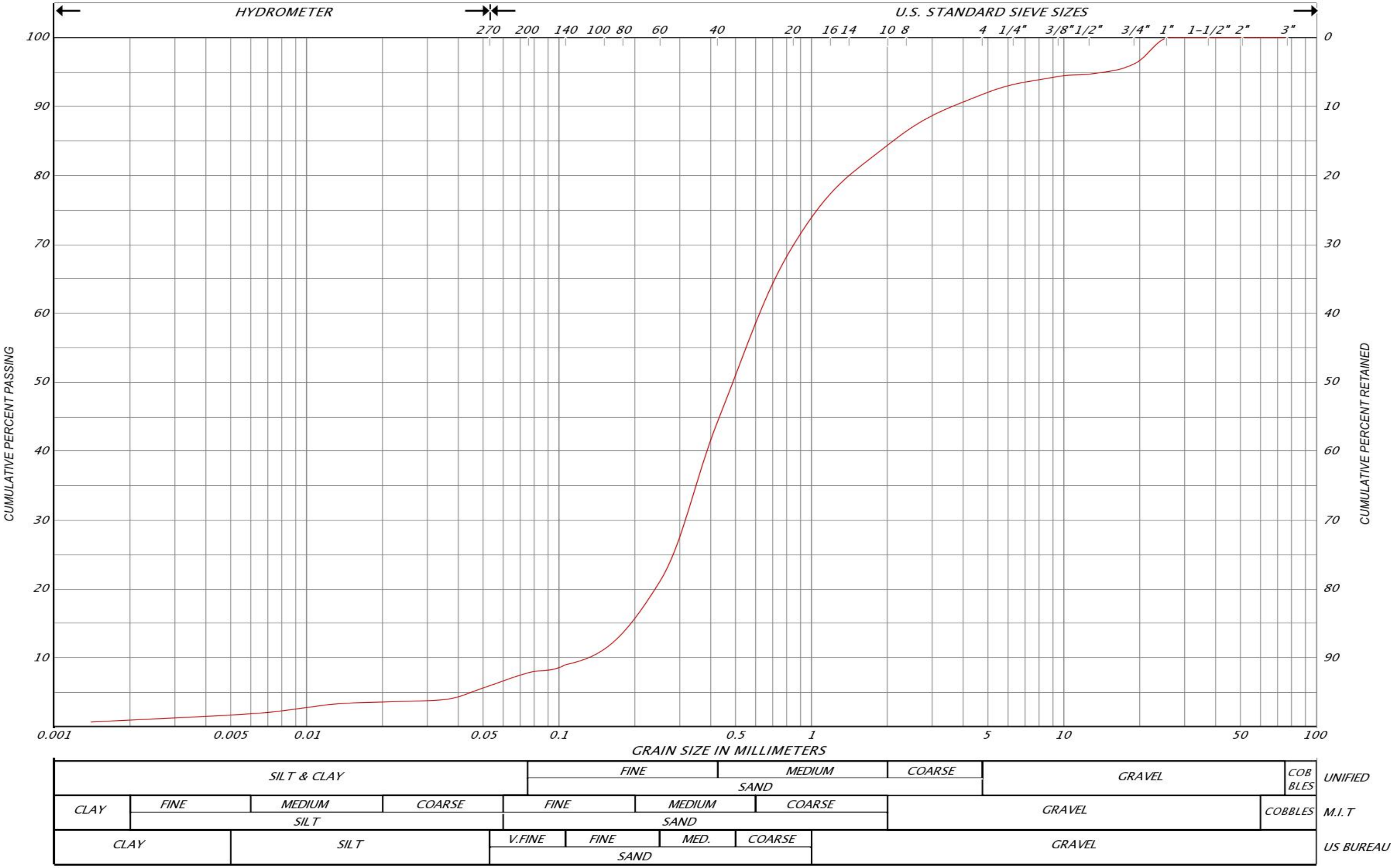
PARTICLE SIZE DISTRIBUTION CHART

PROJECT NO.20LF007
FIGURE NO. 2



REMARKS: Borehole 2, Sample SS8, Depth 7.6 to 8.1 m

GRAVELLY SAND

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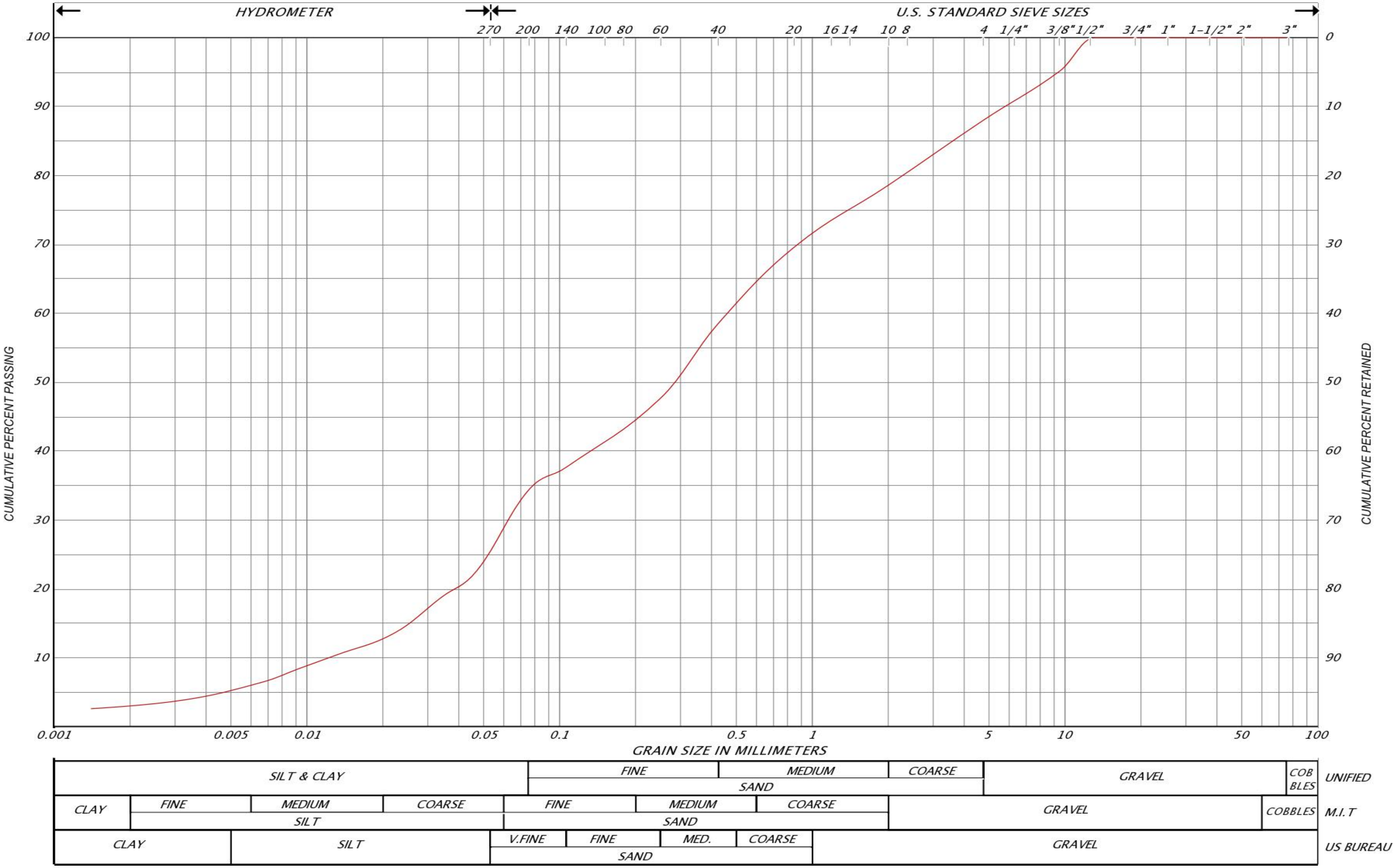
PARTICLE SIZE DISTRIBUTION CHART

PROJECT NO.20LF007
FIGURE NO. 3



REMARKS: Borehole 2, Sample SS10, Depth 10.7 to 10.8 m

SILTY SAND TILL

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PARTICLE SIZE DISTRIBUTION CHART

PROJECT NO.20LF007
FIGURE NO. 4

REMARKS: Borehole 3, Sample SS9, Depth 9.1 to 9.4 m,

SILT TILL

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. - Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	TW	Thinwall Open
WS	Washed Sample	TP	Thinwall Piston
SB	Scraper Bucket Sample	OS	Oesterberg Sample
AS	Auger Sample	FS	Foil Sample
CS	Chunk Sample	RC	Rock Core
ST	Slotted Tube Sample	USS	Undisturbed Shear Strength
PH	Sample Advanced Hydraulically	RSS	Remoulded Shear Strength
PM	Sample Advanced Manually		

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

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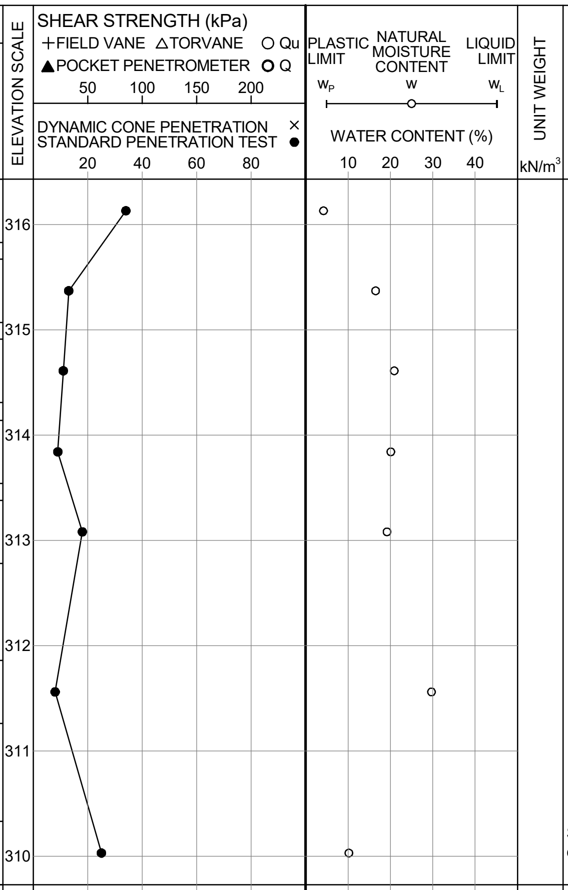
LOG OF BOREHOLE NO. 1

PROJECT Geotechnical Invesrigation - Bridge 34/B-T9 (Bridge Street Bridge)
PML REF.
LOCATION Wilmot, Ontario
BORING DATE October 26, 2020
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN R. Bhavsar

SOIL PROFILE		SAMPLES			GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	
	SURFACE ELEVATION 316.43				
	PAVEMENT STRUCTURE: 70 mm asphalt, over 250 mm granular base, moist, over 560 mm granular subbase, moist	1	SS	34	
0.88 315.55	FILL: Dark brown clayey silt, some gravel, trace sand, DTPL to APL	2	SS	13	
		3	SS	11	
		4	SS	9	
		5	SS	18	
4.1 312.3	occasional rootlets	6	SS	8	
5.6 310.8	SAND AND GRAVEL: Compact brown sand and gravel, some silt, trace clay, saturated	7	SS	25	Sampler wet from 6.1 m to completion
6.7 309.7	BOREHOLE TERMINATED AT 6.7 m				Upon completion of auguring Cave at 5.9 m Free water at 5.8 m



GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

NOTES

LOG OF BOREHOLE NO. 2

1 of 2

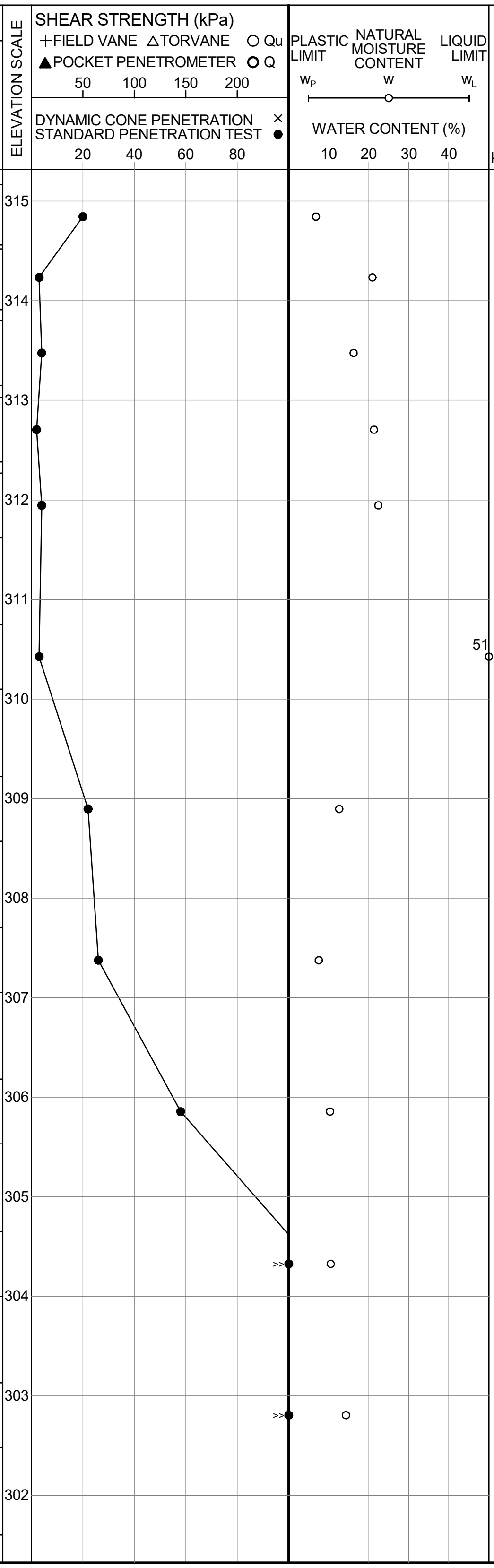
PROJECT Geotechnical Invesrigation - Bridge 34/B-T9 (Bridge Street Bridge)
PML REF.
LOCATION Wilmot, Ontario
BORING DATE September 28, 2020
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN D. Patterson

SOIL PROFILE

DEPTH / ELEV (metres)	DESCRIPTION
	SURFACE ELEVATION 315.32
0.0	PAVEMENT STRUCTURE: 70 mm asphalt, over 1020 mm granular
1.1 314.2	FILL: Brown sandy silt, some gravel, occasional cobbles, moist
2.2 313.1	becoming brown silt, trace to some sand, trace to some gravel, occasional cobbles, moist
3.5 311.8	CLAYEY SILT: Soft dark brown clayey silt, trace sand, occasional cobbles, trace organics, APL to WTPL
5.7 309.6	SAND: Compact brown sand, some gravel, occasional cobbles, saturated
9.4 305.9	SILTY SAND: Very dense grey silty sand, trace gravel, occasional cobbles, wet to saturated
	CONTINUED

SAMPLES

NUMBER	TYPE	"N" VALUES
1	GS	20
2	SS	3
3	SS	4
4	SS	2
5	SS	4
6	SS	3
7	SS	22
8	SS	26
9	SS	58
10	SS	50/100mm
11	SS	85/280mm



GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

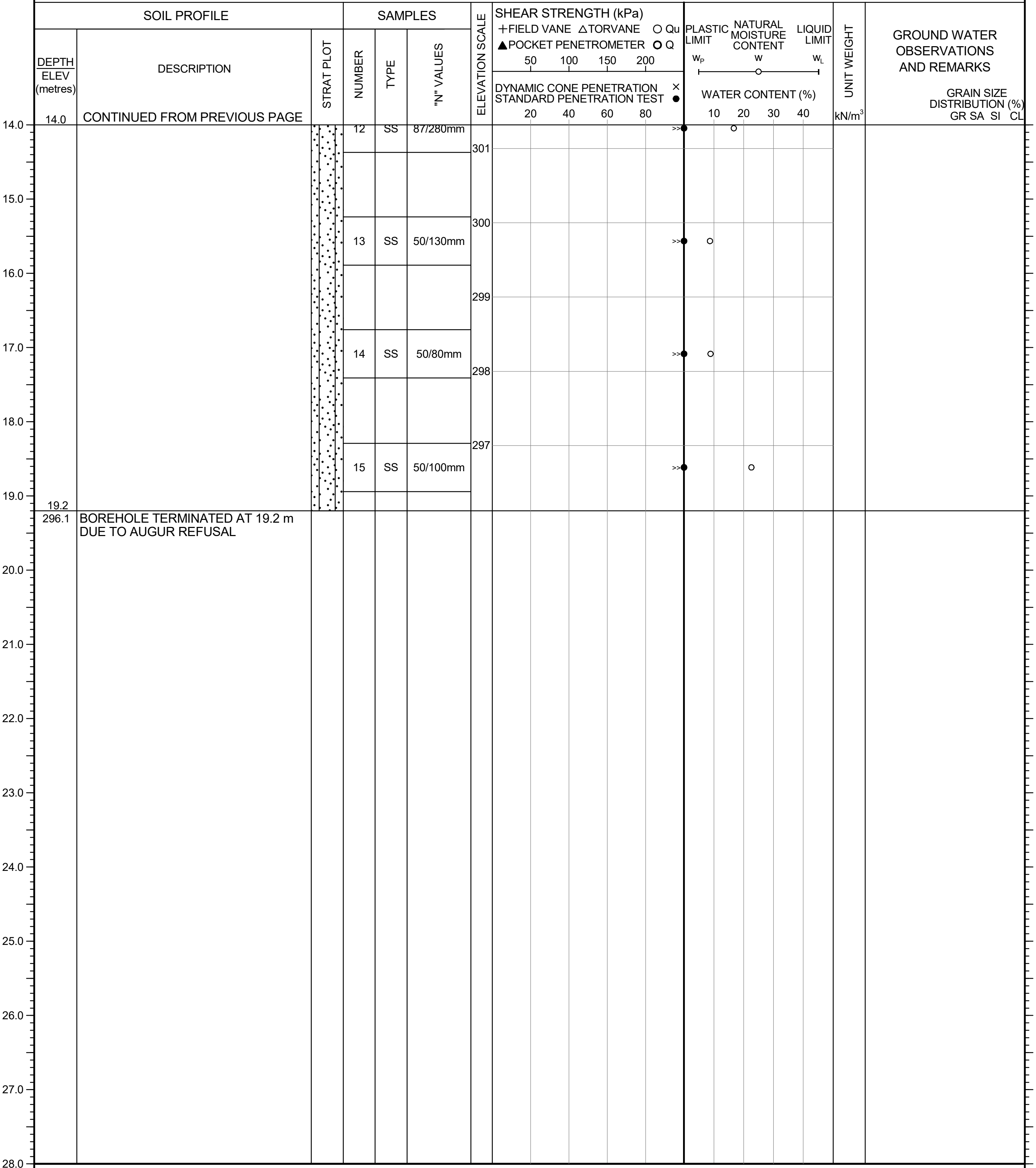
Sampler wet from 6.1 m to completion

NOTES

LOG OF BOREHOLE NO. 2

2 of 2

PROJECT Geotechnical Invesrigation - Bridge 34/B-T9 (Bridge Street Bridge)
PML REF.
LOCATION Wilmot, Ontario
BORING DATE September 28, 2020
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN D. Patterson



DEPTH ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
14.0	CONTINUED FROM PREVIOUS PAGE					
		12	SS	87/280mm		
		13	SS	50/130mm		
		14	SS	50/80mm		
		15	SS	50/100mm		
19.2 296.1	BOREHOLE TERMINATED AT 19.2 m DUE TO AUGUR REFUSAL					

NOTES

LOG OF BOREHOLE NO. 3

1 of 2

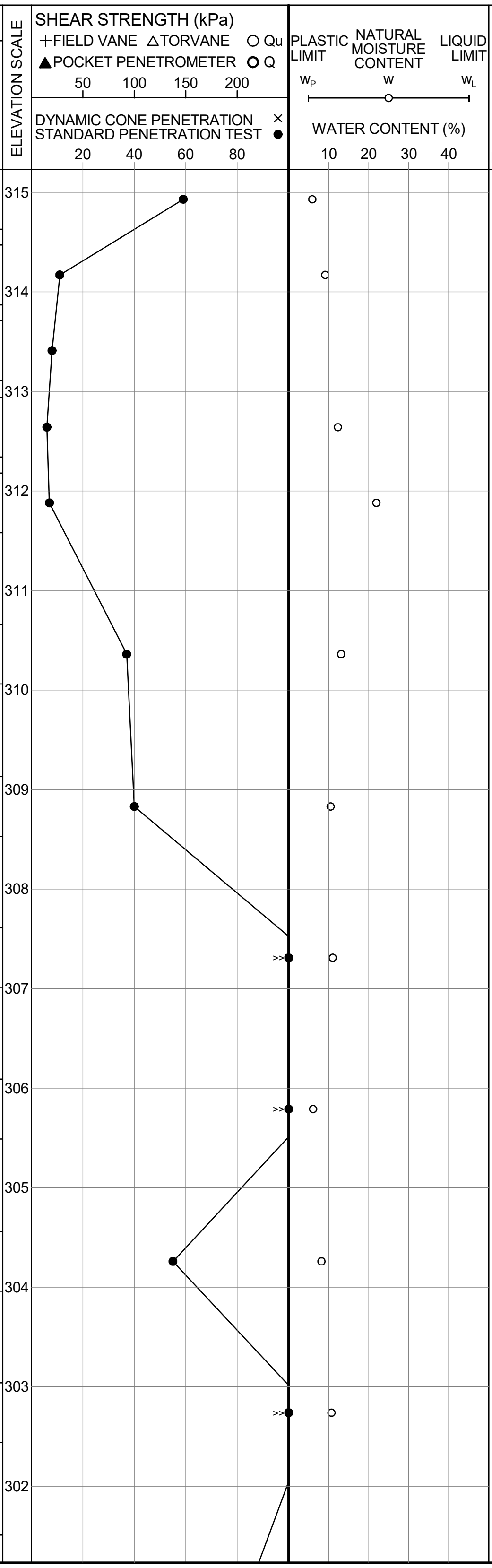
PROJECT Geotechnical Invesrigation - Bridge 34/B-T9 (Bridge Street Bridge)
PML REF.
LOCATION Wilmot, Ontario
BORING DATE October 28, 2020
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN R. Bhavsar

SOIL PROFILE

DEPTH / ELEV (metres)	DESCRIPTION
	SURFACE ELEVATION 315.23
	PAVEMENT STRUCTURE: 70 mm asphalt, over 230 mm granular base, moist, over 620 mm granular subbase, moist
0.88	FILL: Dark brown sandy silt, some gravel, trace clay, moist
4.7 310.5	SAND AND GRAVEL: Dense brown sand and gravel, some silt, trace clay, saturated
8.0 307.2	SILTY SAND: Very dense grey silty sand till, some gravel, trace clay, moist to wet
11.7 303.5	SAND AND GRAVEL: Very dense grey sand and gravel, trace silt, saturated
	CONTINUED

SAMPLES

NUMBER	TYPE	"N" VALUES
1	GS	59
2	SS	11
3	SS	8
4	SS	6
5	SS	7
6	SS	37
7	SS	40
8	SS	86/280mm
9	SS	81/280mm
10	SS	55
11	SS	50/150mm



UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Sampler wet from 4.8 m to completion

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

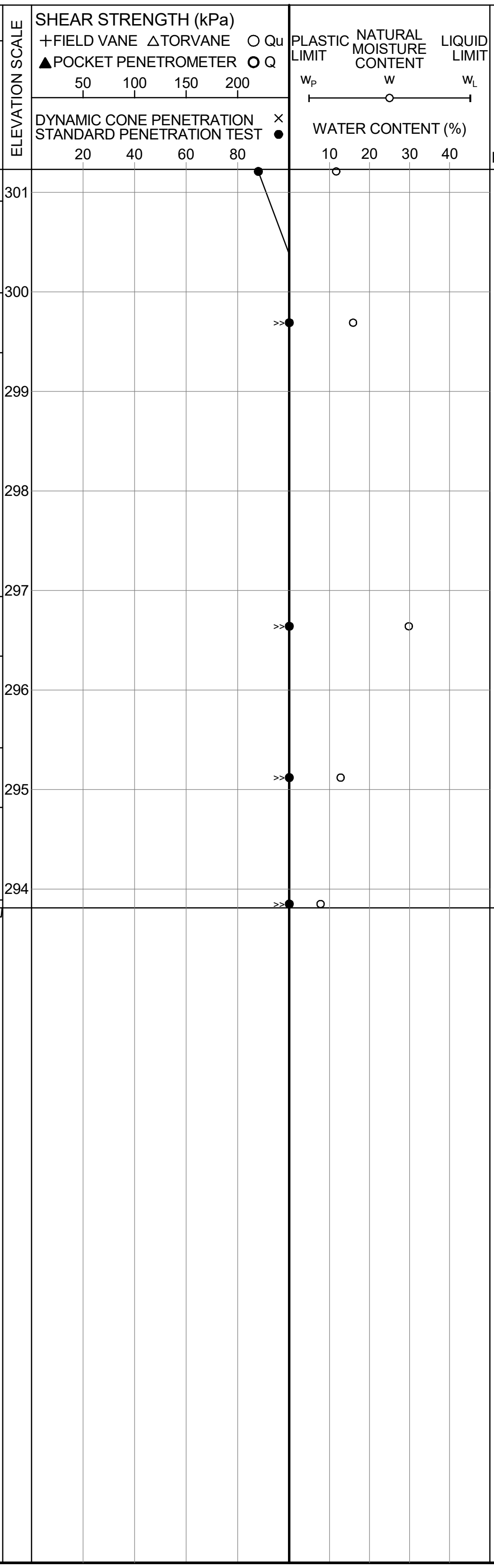
LOG OF BOREHOLE NO. 3

2 of 2

PROJECT Geotechnical Invesrigation - Bridge 34/B-T9 (Bridge Street Bridge)
PML REF.
LOCATION Wilmot, Ontario
BORING DATE October 28, 2020
ENGINEER W. Loghrin
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN R. Bhavsar

DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS
14.0	CONTINUED FROM PREVIOUS PAGE	12	SS	88		
14.8 300.4	SILT TILL: Very dense grey silt till, some gravel, some sand, trace clay, wet	13	SS	50/100mm		
		14	SS	50/80mm		
		15	SS	50/50mm		
21.4 293.8	BOREHOLE TERMINATED AT 21.4 m	16	SS	50/80mm		

GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL



NOTES

LOG OF BOREHOLE NO. 4

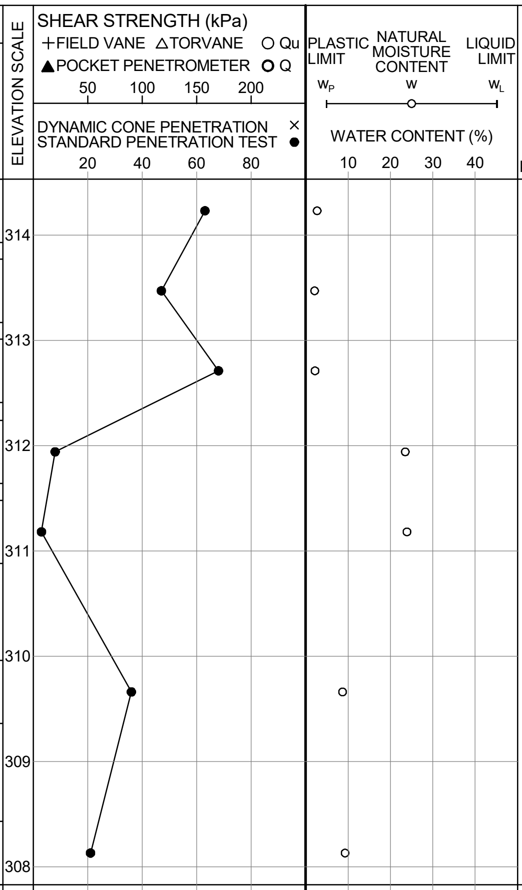
PROJECT Geotechnical Invesrigation - Bridge 34/B-T9 (Bridge Street Bridge) **PML REF.**

LOCATION Wilmot, Ontario **BORING DATE** October 26, 2020 **ENGINEER** W. Loghrin

BORING METHOD Continuous Flight Solid Stem Augers **TECHNICIAN** R. Bhavsar

SURFACE ELEVATION 314.53

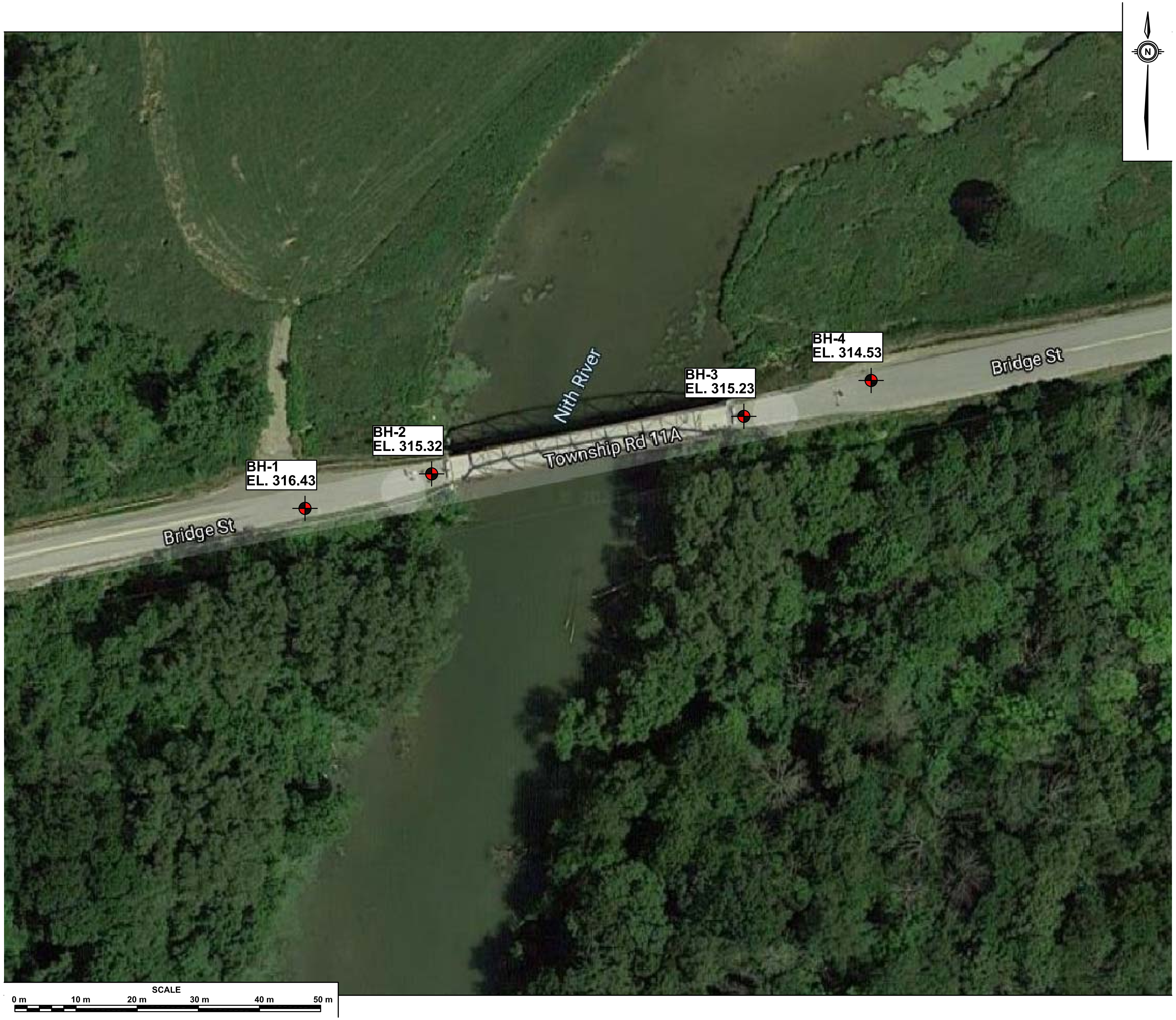
DEPTH / ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.0	PAVEMENT STRUCTURE: 60 mm asphalt, over 250 mm granular base, moist, over 850 mm granular subbase, moist	1	SS	63	
		2	SS	47	
1.2 313.3	FILL: Brown sand and gravel fill, trace silt, moist	3	SS	68	
2.2 312.3	becoming dark brown clayey silt, some gravel, trace sand, DTPL to APL	4	SS	8	
		5	SS	3	
4.1 310.4	SAND AND GRAVEL: Compact to dense brown sand and gravel, some silt, trace clay, saturated	6	SS	36	Sampler wet from 4.9 m to completion
		7	SS	21	
6.7 307.8	BOREHOLE TERMINATED AT 6.7 m				Upon completion of auguring Cave at 4.6 m Free water at 4.4 m



UNIT WEIGHT kN/m³

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

NOTES



KEY PLAN

LEGEND:

⊕ APPROXIMATE BOREHOLE LOCATION

REFERENCE:

BOREHOLE LOCATION PLAN REPRODUCED FROM AN AERIAL PHOTO.

NOTES:

THE INFERRED STRATIGRAPHY REFERRED TO IN THE REPORT IS BASED ON THE DATA FROM THESE BOREHOLES SUPPLEMENTED BY GEOLOGICAL EVIDENCE. THE ACTUAL STRATIGRAPHY BETWEEN THE BOREHOLES MAY VARY.

THE BOREHOLE LOCATIONS AND GEODETIC ELEVATIONS WERE SURVEYED WITH A SOKKIA GCX3 REAL TIME KINEMATIC RECEIVER CONNECTED TO THE GLOBAL NAVIGATION SATELLITE SYSTEM.

TOWNSHIP OF WILMOT

GEOTECHNICAL INVESTIGATION BRIDGE 34/B-T9

BRIDGE STREET

NEW HAMBURG, ONTARIO

BOREHOLE LOCATION PLAN

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DWG. NO.
DRAWN	R. BHAVSAR	JUNE 2021	AS SHOWN	20LF007	1
CHECKED	W. LOGHRIN				
APPROVED	S. JEFFREY				

APPENDIX A

SGS, Certificates of Analysis

O.Reg. 153/04, As Amended, Table 1, Table 2, Table 3 and Table 8 Standards (Soil)

(Residential / Parkland / Institutional / Industrial / Commercial / Community Property Use)

FINAL REPORT

CA14936-OCT20 R

20LF007, Bridge St, New Hamburg

Prepared for

Peto MacCallum Ltd

FINAL REPORT

First Page

CLIENT DETAILS

Client	Peto MacCallum Ltd
Address	16 Franklin St S Kitchener, ON N2C 1R4, Canada
Contact	Rahil Bhavsar
Telephone	519-893-7500
Facsimile	519-893-0654
Email	rbhavsar@petomaccallum.com;sjeffrey@petomaccallum.com
Project	20LF007, Bridge St, New Hamburg
Order Number	
Samples	soil (4)

LABORATORY DETAILS

Project Specialist	Brad Moore Hon. B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2143
Facsimile	705-652-6365
Email	brad.moore@sgs.com
SGS Reference	CA14936-OCT20
Received	10/30/2020
Approved	11/05/2020
Report Number	CA14936-OCT20 R
Date Reported	11/05/2020

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.
nC6 and nC10 response factors within 30% of response factor for toluene: YES
nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES
C50 response factors within 70% of nC10 + nC16 + nC34 average: YES
Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: 4 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:012784

F4 (C34-C50) Duplicate: RPD for this parameter is outside control limits. The average of the two duplicates is less than five times the RL, therefore a greater uncertainty is expected.

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

FINAL REPORT

Client: Peto MacCallum Ltd
Project: 20LF007, Bridge St, New Hamburg
Project Manager: Rahil Bhavsar
Samplers: Rahil Bhavsar

PACKAGE: **REG153 - BTEX** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	BH1 SS2	BH3 SS6	BH4 SS4	BH4 SS6
			Sample Matrix	soil	soil	soil	soil
			Sample Date	26/10/2020	27/10/2020	26/10/2020	26/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
BTEX							
Benzene	µg/g	0.02	0.02	< 0.02	< 0.02	< 0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	µg/g	0.05	0.2	< 0.05	< 0.05	< 0.05	< 0.05
Xylene (total)	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
m/p-xylene	µg/g	0.05		< 0.05	< 0.05	< 0.05	< 0.05
o-xylene	µg/g	0.05		< 0.05	< 0.05	< 0.05	< 0.05

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	BH1 SS2	BH3 SS6	BH4 SS4	BH4 SS6
			Sample Matrix	soil	soil	soil	soil
			Sample Date	26/10/2020	27/10/2020	26/10/2020	26/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
Hydrides							
Antimony	µg/g	0.8	1.3	< 0.8	< 0.8	< 0.8	< 0.8
Arsenic	µg/g	0.5	18	2.9	2.6	2.3	3.1
Selenium	µg/g	0.7	1.5	< 0.7	< 0.7	< 0.7	< 0.7

Client: Peto MacCallum Ltd

Project: 20LF007, Bridge St, New Hamburg

Project Manager: Rahil Bhavsar

Samplers: Rahil Bhavsar

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	BH1 SS2	BH3 SS6	BH4 SS4	BH4 SS6
			Sample Matrix	soil	soil	soil	soil
			Sample Date	26/10/2020	27/10/2020	26/10/2020	26/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics							
Moisture Content	%	-		17.4	9.8	14.2	14.6
Barium	µg/g	0.1	220	71	20	53	36
Beryllium	µg/g	0.02	2.5	0.51	0.15	0.36	0.25
Boron	µg/g	1	36	5	5	5	5
Cadmium	µg/g	0.02	1.2	0.11	0.05	0.17	0.12
Chromium	µg/g	0.5	70	18	11	14	12
Cobalt	µg/g	0.01	21	7.8	2.5	5.9	4.3
Copper	µg/g	0.1	92	17	6.2	12	12
Lead	µg/g	0.1	120	10	4.1	7.9	7.2
Molybdenum	µg/g	0.1	2	0.3	1.0	0.3	0.6
Nickel	µg/g	0.5	82	17	5.4	12	8.8
Silver	µg/g	0.05	0.5	< 0.05	< 0.05	< 0.05	< 0.05
Thallium	µg/g	0.02	1	0.13	0.03	0.08	0.06
Uranium	µg/g	0.002	2.5	0.53	0.64	0.48	0.49
Vanadium	µg/g	3	86	25	13	19	15
Zinc	µg/g	0.7	290	50	20	45	40
Water Soluble Boron	µg/g	0.5		< 0.5	< 0.5	< 0.5	< 0.5

FINAL REPORT

Client: Peto MacCallum Ltd
Project: 20LF007, Bridge St, New Hamburg
Project Manager: Rahil Bhavsar
Samplers: Rahil Bhavsar

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	BH1 SS2	BH3 SS6	BH4 SS4	BH4 SS6
			Sample Matrix	soil	soil	soil	soil
			Sample Date	26/10/2020	27/10/2020	26/10/2020	26/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
Other (ORP)							
Mercury	ug/g	0.05	0.27	< 0.05	< 0.05	< 0.05	< 0.05
Sodium Adsorption Ratio	No unit	0.2	2.4	**3.6**	0.4	**5.8**	**3.1**
SAR Calcium	mg/L	0.09		49.6	130	48.3	50.3
SAR Magnesium	mg/L	0.02		6.4	38.6	9.5	10.0
SAR Sodium	mg/L	0.15		97.6	21.8	168	88.5
Conductivity	mS/cm	0.002	0.57	**0.81**	0.34	**1.1**	**0.75**
pH	pH Units	0.05		7.71	8.02	7.93	7.89
Chromium VI	µg/g	0.2	0.66	< 0.2	< 0.2	< 0.2	< 0.2
Free Cyanide	µg/g	0.05	0.051	< 0.05	< 0.05	< 0.05	< 0.05

PACKAGE: **REG153 - PHCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	BH1 SS2	BH3 SS6	BH4 SS4	BH4 SS6
			Sample Matrix	soil	soil	soil	soil
			Sample Date	26/10/2020	27/10/2020	26/10/2020	26/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
PHCs							
F1 (C6-C10)	µg/g	10	25	< 10	< 10	< 10	< 10
F1-BTEX (C6-C10)	µg/g	10		< 10	< 10	< 10	< 10
F2 (C10-C16)	µg/g	10	10	< 10	< 10	< 10	< 10
F3 (C16-C34)	µg/g	50	240	< 50	< 50	< 50	< 50
F4 (C34-C50)	µg/g	50	120	< 50	< 50	< 50	< 50
Chromatogram returned to baseline at nC50	Yes / No	-		YES	YES	YES	YES

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	BH1 SS2	BH3 SS6	BH4 SS4	BH4 SS6
			Sample Matrix	soil	soil	soil	soil
			Sample Date	26/10/2020	27/10/2020	26/10/2020	26/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
THMs (VOC)							
Bromodichloromethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Bromoform	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibromochloromethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	BH1 SS2	BH3 SS6	BH4 SS4	BH4 SS6
			Sample Matrix	soil	soil	soil	soil
			Sample Date	26/10/2020	27/10/2020	26/10/2020	26/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
VOC Surrogates							
Surr 1,2-Dichloroethane-d4	Surr Rec %	-		101	99	101	101
Surr 4-Bromofluorobenzene	Surr Rec %	-		89	96	89	88
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-		96	94	96	95

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	BH1 SS2	BH3 SS6	BH4 SS4	BH4 SS6
			Sample Matrix	soil	soil	soil	soil
			Sample Date	26/10/2020	27/10/2020	26/10/2020	26/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
VOCs							
Acetone	µg/g	0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bromomethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chlorobenzene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chloroform	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dichlorodifluoromethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1-Dichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,2-Dichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	BH1 SS2	BH3 SS6	BH4 SS4	BH4 SS6
			Sample Matrix	soil	soil	soil	soil
			Sample Date	26/10/2020	27/10/2020	26/10/2020	26/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
VOCs (continued)							
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03		< 0.03	< 0.03	< 0.03	< 0.03
trans-1,3-dichloropropene	µg/g	0.03		< 0.03	< 0.03	< 0.03	< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
n-Hexane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Methyl ethyl ketone	µg/g	0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5
Methyl isobutyl ketone	µg/g	0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Methylene Chloride	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Styrene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Tetrachloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Trichlorofluoromethane	µg/g	0.05	0.25	< 0.05	< 0.05	< 0.05	< 0.05
Vinyl Chloride	µg/g	0.02	0.02	< 0.02	< 0.02	< 0.02	< 0.02

EXCEEDANCE SUMMARY

Parameter	**Method**	**Units**	**Result**	REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED **L1**

BH1 SS2

Conductivity	EPA 6010/SM 2510	mS/cm	0.81	**0.57**
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	3.6	**2.4**

BH4 SS4

Conductivity	EPA 6010/SM 2510	mS/cm	1.1	**0.57**
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	5.8	**2.4**

BH4 SS6

Conductivity	EPA 6010/SM 2510	mS/cm	0.75	**0.57**
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	3.1	**2.4**

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0060-NOV20	mS/cm	0.002	<0.002	3	10	100	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5004-NOV20	µg/g	0.05	<0.05	ND	20	99	80	120	83	75	125

Hexavalent Chromium by SFA

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-[ENV]SKA-LAK-AN-012

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	SKA5001-NOV20	ug/g	0.2	<0.2	ND	20	93	80	120	92	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 I Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0010-NOV20	ug/g	0.05	<0.05	ND	20	104	80	120	89	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 I Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0012-NOV20	mg/L	0.09	<0.09	7	20	92	80	120	101	70	130
SAR Magnesium	ESG0012-NOV20	mg/L	0.02	<0.02	19	20	94	80	120	102	70	130
SAR Sodium	ESG0012-NOV20	mg/L	0.15	<0.15	4	20	93	80	120	98	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0010-NOV20	ug/g	0.05	<0.05	ND	20	106	70	130	91	70	130
Arsenic	EMS0010-NOV20	µg/g	0.5	<0.5	0	20	102	70	130	98	70	130
Barium	EMS0010-NOV20	ug/g	0.1	<0.1	1	20	106	70	130	91	70	130
Beryllium	EMS0010-NOV20	µg/g	0.02	<0.02	2	20	102	70	130	107	70	130
Boron	EMS0010-NOV20	µg/g	1	<1	3	20	99	70	130	100	70	130
Cadmium	EMS0010-NOV20	µg/g	0.02	<0.02	6	20	101	70	130	92	70	130
Cobalt	EMS0010-NOV20	µg/g	0.01	<0.01	1	20	104	70	130	100	70	130
Chromium	EMS0010-NOV20	µg/g	0.5	<0.5	2	20	108	70	130	104	70	130
Copper	EMS0010-NOV20	µg/g	0.1	<0.1	3	20	106	70	130	95	70	130
Molybdenum	EMS0010-NOV20	µg/g	0.1	<0.1	7	20	95	70	130	93	70	130
Nickel	EMS0010-NOV20	ug/g	0.5	<0.5	1	20	102	70	130	97	70	130
Lead	EMS0010-NOV20	µg/g	0.1	<0.1	3	20	108	70	130	96	70	130
Antimony	EMS0010-NOV20	µg/g	0.8	<0.8	ND	20	93	70	130	92	70	130
Selenium	EMS0010-NOV20	µg/g	0.7	<0.7	ND	20	101	70	130	94	70	130
Thallium	EMS0010-NOV20	µg/g	0.02	<0.02	8	20	108	70	130	101	70	130
Uranium	EMS0010-NOV20	µg/g	0.002	<0.002	4	20	100	70	130	102	70	130
Vanadium	EMS0010-NOV20	µg/g	3	<3	2	20	105	70	130	99	70	130
Zinc	EMS0010-NOV20	µg/g	0.7	<0.7	1	20	106	70	130	93	70	130

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0012-NOV20	µg/g	10	<10	ND	30	102	80	120	106	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0015-NOV20	µg/g	10	<10	ND	30	114	80	120	118	60	140
F3 (C16-C34)	GCM0015-NOV20	µg/g	50	<50	ND	30	114	80	120	118	60	140
F4 (C34-C50)	GCM0015-NOV20	µg/g	50	<50	51	30	114	80	120	118	60	140

FINAL REPORT

QC SUMMARY

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0011-NOV20	pH Units	0.05		0	20	100	80	120			

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	96	60	130	100	50	140
1,1,1-Trichloroethane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	96	60	130	98	50	140
1,1,2,2-Tetrachloroethane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	94	60	130	86	50	140
1,1,2-Trichloroethane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	96	60	130	100	50	140
1,1-Dichloroethane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	95	60	130	100	50	140
1,1-Dichloroethylene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	91	60	130	103	50	140
1,2-Dichlorobenzene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	95	60	130	100	50	140
1,2-Dichloroethane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	95	60	130	99	50	140
1,2-Dichloropropane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	95	60	130	98	50	140
1,3-Dichlorobenzene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	96	60	130	99	50	140
1,4-Dichlorobenzene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	95	60	130	99	50	140
Acetone	GCM0011-NOV20	µg/g	0.5	< 0.5	ND	50	75	50	140	92	50	140
Benzene	GCM0011-NOV20	µg/g	0.02	< 0.02	ND	50	95	60	130	100	50	140
Bromodichloromethane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	95	60	130	98	50	140
Bromoform	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	94	60	130	99	50	140
Bromomethane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	89	50	140	67	50	140
Carbon tetrachloride	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	96	60	130	98	50	140
Chlorobenzene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	95	60	130	98	50	140
Chloroform	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	95	60	130	98	50	140
cis-1,2-Dichloroethylene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	96	60	130	97	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0011-NOV20	µg/g	0.03	< 0.03	ND	50	95	60	130	87	50	140
Dibromochloromethane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	94	60	130	97	50	140
Dichlorodifluoromethane	GCM0011-NOV20	µg/g	0.05	< 0.05	1	50	87	50	140	75	50	140
Ethylbenzene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	97	60	130	100	50	140
Ethylenedibromide	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	96	60	130	99	50	140
n-Hexane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	108	60	130	77	50	140
m/p-xylene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	97	60	130	99	50	140
Methyl ethyl ketone	GCM0011-NOV20	µg/g	0.5	< 0.5	ND	50	88	50	140	96	50	140
Methyl isobutyl ketone	GCM0011-NOV20	µg/g	0.5	< 0.5	ND	50	92	50	140	102	50	140
Methyl-t-butyl Ether	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	94	60	130	102	50	140
Methylene Chloride	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	94	60	130	102	50	140
o-xylene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	98	60	130	102	50	140
Styrene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	97	60	130	100	50	140
Tetrachloroethylene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	96	60	130	94	50	140
Toluene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	96	60	130	98	50	140
trans-1,2-Dichloroethylene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	95	60	130	101	50	140
trans-1,3-dichloropropene	GCM0011-NOV20	µg/g	0.03	< 0.03	ND	50	98	60	130	90	50	140
Trichloroethylene	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	94	60	130	107	50	140
Trichlorofluoromethane	GCM0011-NOV20	µg/g	0.05	< 0.05	ND	50	104	50	140	98	50	140
Vinyl Chloride	GCM0011-NOV20	µg/g	0.02	< 0.02	ND	50	90	50	140	89	50	140

QC SUMMARY

Water Soluble Boron

Method: O.Reg. 153/04 | Internal ref.: ME-CA-[ENV] SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0003-NOV20	µg/g	0.5	<0.5	ND	20	94	80	120	98	70	130

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

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-- End of Analytical Report --

SGS Environment, Health & Safety

- Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

Request for Laboratory Services and CHAIN OF CUSTODY

No: 012784

Page ______ of ______

Laboratory Information Section - Lab use only

Received By: Majeed Almandalawi
Received Date: 10 / 30 / 2020 (mm/dd/yy)
Received Time: 14 : 00 (hr : min)

Received By (signature): Majeed Almandalawi
Custody Seal Present: Yes ☑ No ☐
Custody Seal Intact: Yes ☑ No ☐

Cooling Agent Present: Yes ☑ No ☐ Type: Icepack
Temperature Upon Receipt (°C) 3°C 4°C 4°C

LAB LIMS #: CA14936-OCT20

REPORT INFORMATION

Company: Peto Maccallum LTD
Contact: Rahil Bhavsar
Address: 16 Franklin St S
Kitchener, ON, N2C 1R4
Phone: 905-719-0102
Fax:
Email: rbhavsar@petomaccallum.com

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email:

Quotation #:
P.O. #:
Project #: 20LF007
Site Location/ID: Bridge St, New Hamburg

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

Regulation 153/04:
☑ Table 1
☐ Table 2
☐ Table 3
☐ Table ______
☐ Res/Park
☐ Ind/Com
☐ Agri/Other

Soil Texture:
☐ Coarse
☐ Medium
☐ Fine

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO
☐ CCME
☐ MISA
☐ MMER
☐ Other: ______

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality: ______

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

							M & I			SVOC		PCB	PHC		VOC		Pest	Other (please specify)							TCLP	
	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics incl CrVI, CN, Hg pH,(B(HWS),EC,SAR-soil) (Cl, Na-water)	Full Metals Suite ICP metals plus B(HWS-soil only) Hg, CrVI	ICP Metals only Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni, Se,Ag,Tl,U,V,Zn	PAHs only	SVOCs all incl PAHs, ABNs, CPs	PCBs Total ☐ Aroclor ☐	F1-F4 + BTEX	F1-F4 only no BTEX	VOCs all incl BTEX	BTEX only	Pesticides Organochlorine or specify other						Sewer Use: Specify pkg:	Water Characterization Pkg General ☐ Extended ☐	Specify TCLP tests ☐M&I ☐VOC ☐PCB ☐B(a)P ☐ABN ☐Ignit.	COMMENTS:
1	BH 1 SS2	Oct 26	12:30	4	S		✓							✓	✓											
2	BH3 SS6	Oct 27	2:15	4	S		✓							✓	✓											
3	BH4 SS 4	Oct 26	2:30	4	S		✓							✓	✓											
4	BH4 SS 6	Oct 26	2:50	4	S		✓							✓	✓											
5																										
6																										
7																										
8																										
9																										
10																										
11																										
12																										

Observations/Comments/Special Instructions

Sampled By (NAME): Rahil Bhavsar **Signature:** RmBhavsar **Date:** 10 / 29 / 20 (mm/dd/yy)

Relinquished by (NAME): Rahil Bhavsar **Signature:** RmBhavsar **Date:** 10 / 29 / 20 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.2
Date of Issue: 09 Sept, 2019

Note: Submission of samples to SGS is acknowledgement that you have been provided direction on sample collection/handling and transportation of samples. {2} Submission of samples to SGS is considered authorization for completion of work. Signatures may appear on this form or be retained on file in the contract, or in an alternative format (e.g. shipping documents). {3} Results may be sent by email to an unlimited number of addresses for no additional cost. Fax is available upon request. This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. (Printed copies are available upon request.) Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

APPENDIX B

STATEMENT OF LIMITATIONS

STATEMENT OF LIMITATIONS

This report is prepared for and made available for the sole use of the client named. Peto MacCallum Ltd. (PML) hereby disclaims any liability or responsibility to any person or entity, other than those for whom this report is specifically issued, for any loss, damage, expenses, or penalties that may arise or result from the use of any information or recommendations contained in this report. The contents of this report may not be used or relied upon by any other person without the express written consent and authorization of PML.

This report shall not be relied upon for any purpose other than as agreed with the client named without the written consent of PML. It shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. A portion of this report may not be used as a separate entity: that is to say the report is to be read in its entirety at all times.

The report is based solely on the scope of services which are specifically referred to in this report. No physical or intrusive testing has been performed, except as specifically referenced in this report. This report is not a certification of compliance with past or present regulations, codes, guidelines and policies.

The scope of services carried out by PML is based on details of the proposed development and land use to address certain issues, purposes and objectives with respect to the specific site as identified by the client. Services not expressly set forth in writing are expressly excluded from the services provided by PML. In other words, PML has not performed any observations, investigations, study analysis, engineering evaluation or testing that is not specifically listed in the scope of services in this report. PML assumes no responsibility or duty to the client for any such services and shall not be liable for failing to discover any condition, whose discovery would require the performance of services not specifically referred to in this report.

The findings an comments made by PML in this report are based on the conditions observed at the time of PML’s site reconnaissance. No assurances can be made and no assurances are given with respect to any potential changes in site conditions following the time of completion of PML’s field work. Furthermore, regulations, codes and guidelines may change at any time subsequent to the date of this report and these changes may effect the validity of the findings and recommendations given in this report.

The results and conclusions with respect to site conditions are therefore in no way intended to be taken as a guarantee or representation, expressed or implied, that the site is free from any contaminants from past or current land use activities or that the conditions in all areas of the site and beneath or within structures are the same as those areas specifically sampled.

Any investigation, examination, measurements or sampling explorations at a particular location may not be representative of conditions between sampled locations. Soil, ground water, surface water, or building material conditions between and beyond the sampled locations may differ from those encountered at the sampling locations and conditions may become apparent during construction which could not be detected or anticipated at the time of the intrusive sampling investigation.

Budget estimates contained in this report are to be viewed as an engineering estimate of probable costs and provided solely for the purposes of assisting the client in its budgeting process. It is understood and agreed that PML will not in any way be held liable as a result of any budget figures provided by it.

The Client expressly waives its right to withhold PML's fees, either in whole or in part, or to make any claim or commence any action or bring any other proceedings, whether in contract, tort, or otherwise against PML in anyway connected with advice or information given by PML relating to the cost estimate or Environmental Remediation/Cleanup and Restoration or Soil and Ground Water Management Plan Cost Estimate.

12.

SITE PHOTOS

- Site Photos taken during the Spring and Fall of 2021 by K. Smart Associates Limited

1. Far East Approach (looking west)

2. East Approach (looking west)

3. North Elevation (looking south)

4. Looking Upstream (looking north)

5. Looking Downstream (looking south)

6. Deck Surface

7. Typical Railing

8. Typical Perforated Stringer

9. Typical Repaired Floor Beam

10. Typical Repaired Truss Chord

11. Typical Soffit

12. Field Entrance 1 - West of Bridge (looking north)

13. Field Entrance 2 - Future Driveway – East of Bridge

14. Entrance 3 - Residence East of Bridge (looking south)

15. Field Entrance 4 - East of Bridge (looking north)

13.

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATING MEASURES ASSOCIATED WITH IMPLEMENTATION OF THE PREFERRED ALTERNATIVE

13.1 Construction Process - In-Water Aspect

13.2 Construction Process - Terrestrial Aspect

13.1 CONSTRUCTION PROCESS - IN-WATER ASPECT

Removal and Demolition of Existing Structure Including its Substructure and Foundations

The proposed design calls for the demolition of the existing truss structure and removal of the existing substructure and foundations.

The construction of the new structure should start around July 1, 2022 and all in-water work should be completed prior to November 15, 2022.

The steps involved in accomplishing this task are as follows:

- A barn swallow habitat will be established outside the construction zone;
- Bird netting will be installed on the existing structure prior to nesting season and remain in place until demolition commencement;
- Silt fence will be installed at the perimeter of the construction zone to prevent turtles and other small animals from entering the construction zone;
- Removal of concrete deck, steel stringers and railing system
- Lifting the steel truss in one piece off the substructure
- Installing sheet pile cofferdams around the new piers to isolate them from the river.
- Dewatering the area inside the cofferdams
- Demolition of the concrete of the existing structure
- Demolition of the foundation (if any)

Removal of the concrete deck, steel stringer, and railing system will produce dust and debris. Temporary floating platforms covered with tarps will be placed underneath the structure to catch this debris from entering the river. These platforms will be installed prior to starting any bridge demolition. After the deck is completely removed, the platforms will be cleaned to remove the debris.

The steel truss structure will be lifted off its supports and onto the adjacent roadway approach in one single operation by a large crane. This crane would be positioned on the existing roadway in order to complete the lift. Once lifted off its supports and onto the roadway, the truss will then be torch cut into small pieces. Should a need be found, salvaged elements/members of the bridge could be retained for future conservation work. The remaining pieces will be distributed to a recycling facility. Again, temporary floating platforms underneath will prevent debris from entering the watercourse. If a suitable purpose and location is found, the existing bridge could be moved in its entirety to a new location.

Steel sheet piling will then be installed to form a cofferdam around the existing abutments and foundations (if any) in the water. These cofferdams would be strategically placed to allow for the construction of the new pier and abutment footings without having to remove and re-install them. Prior to driving the sheets, a floating silt curtain will be installed to contain any disturbance and prevent its spread throughout the remainder of the water. Once the cofferdam is complete, the area inside will be dewatered. Conventional submersible pumps will be used. All trapped aquatic life will be gathered (with nets) and relocated alive to the adjacent river as required. This work will be completed by a qualified technician under a ‘License to Collect Fish’ obtained from the Ministry of Northern Development, Mines, Natural Resources and Forestry.

The concrete abutments and foundations will be demolished using a hydraulic breaker. As this work will be contained within the cofferdams, all debris will be contained inside. After demolition, the debris will be removed via hydraulic excavator and used as roadway fill. Reinforcing steel (if any) will be recycled.

The sheet pile cofferdams will remain intact until the foundation, piers and abutments of the new structure are constructed and backfilled.

Construction of New Footings, Piers and Abutments
The new bridge footings, piers and abutments would be constructed within the cofferdams set in place to remove the existing structure foundations.

Some excavation will be required to provide sufficient frost and scour cover and to provide room for rock protection. The rock protection would be placed to prevent erosion/scouring of the streambed in front of the abutments and around the piers. This work is all contained within the cofferdams.

The foundation of the new bridge will be driven steel piles and will be designed for loads of the bridge as well as vehicular loads. Vehicular loads will be current loads as per the Canadian Highway Bridge Design Code. Again, all this work is contained within the cofferdams.

Cast-in-place concrete will be used to construct the pier footings, pier shafts, abutment footings and abutment walls. Formwork comprised of wood and/or steel will be erected to contain the wet concrete. Steel reinforcing bars will be tied within the formwork to reinforce the concrete. After the concrete has cured, all formwork will be removed and disposed of outside the limits of the project. This work is isolated from the water by the cofferdams.

Backfilling of the piers and abutments will then take place. Backfill materials will be Granular “B” obtained from a licensed pit and trucked to the site. Rock protection will be placed in front of the abutments and around the piers as dictated by the design. This work is again all contained within the cofferdams.

Once backfilling is complete, dewatering apparatus will be removed, allowing in the area within the cofferdams to be flooded. After flooding, the cofferdams will be completely removed. Once complete, the floating silt curtain will be removed.

Construction of Superstructure
Placement of the prestressed concrete box girders, concrete deck and railings will occur above the river.

The girders will be placed with a crane from the roadway approaches. Before lifting the girders into place, a worker will brush the girders with a broom to remove any mud or loose particles. This procedure will eliminate any debris from entering the river. The very nature of this type of structure (side-by-side concrete box girders) negates the need to construct falsework between the girders to support the deck. This falsework can not only generate dust and debris during its installation, but also during its removal. Falsework is required along the sides, but this can be installed and removed from the top.

Once the girders are erected and side falsework installed, the bridge deck can be formed and poured. The girders themselves as well as the side falsework will prevent debris and wet concrete from entering the river. All gaps between adjacent girders and formwork will be sealed to prevent concrete spillage into the watercourse below. After the deck is cured, the side falsework will be removed. Again, this will occur from the bridge deck. To prevent dust and debris from entering the river, a floating barge covered with tarps will be employed.

The railings would then be installed. The proposed railing system would be manufactured off site and delivered via truck. The railing would be installed from the bridge deck with no disturbance to the river below.

Water Quality and Quantity

There are no anticipated impacts to water quality or quantity in the river. The various mitigation measures outlined for the construction components are deemed sufficient to address the potential for aquatic impacts including sedimentation, fuel spillage and other deleterious substances. Proper spill response planning combined with appropriate fuel and chemical best management practices will ensure that precautions are exercised to prevent any spills from entering the river.

Fuel and Chemical Storage

Proper prevention and spill response procedures are to be put in place to deal with the potential for spills to occur during refuelling and maintenance of equipment. Refuelling, fuel storage and maintenance of equipment is not to occur in or adjacent to watercourses. Any fuel or chemical storage area will not be allowed within 30 metres of the river. In addition, the Contractor will:

- Conduct proper spill response training for all personnel associated with chemical and fuel handling and storage;
- Be responsible for ensuring that all material required for the containment and cleanup of a spill is present, on site, in close proximity to fuelling and maintenance areas; and
- Immediately report any fuel or chemical spills to the Ontario Spills Action Centre (1-800-268-6060).

Discharge of Excavation Water

All water which is pumped from the cofferdam during the construction will be piped to a dewatering trap. The dewatering trap will prevent sediment from entering the watercourse. The dewatering trap will be designed by the Contractor and would be located well away from the river and the edge of the excavations.

Aquatic Species-at-Risk

The following describes Species at Risk that have been identified as possibly being present at the project location.

Greater Redhorse, Black Redhorse, and Silver Shiner;
Rainbow Mussel and Wavy-rayed Lampmussel:
The project will use timing windows and exclusion strategies to avoid interactions and mitigate habitat disturbance for these species. Furthermore, the work area along the shoreline near the construction area will be screened for mussels, using standard methods, prior to the commencement of construction. In-water work will take place during the low water period of Summer-Autumn.

Snapping Turtle:
To mitigate against impacts to Snapping Turtle, silt fence will be installed around the project site. Properly installed silt fence (i.e. embedded into the ground) will prevent Snapping Turtles from entering the construction site altogether.

Further details will be determined during the detailed design stage.

13.2 CONSTRUCTION PROCESS – TERRESTRIAL ASPECT

Roadway Approach Construction

In order to match the new bridge, the existing roadway approaches will need to be elevated. This work will be contained within the existing 20m right-of-way owned by the Township. This reconstruction will require the removal of ground vegetation on the sideslopes of the roadway.

The grade change is necessary to achieve a safe, effective approach to the bridge. Not addressing the vertical alignment of the roadway and structure is not an option because the Township is required to adhere to current design criterion for roadways set in place by Regulatory Agencies.

Minimizing the removal of vegetation is a project goal and will be achieved by:

- Minimizing the extent of the work during the design phase of the project
- Identifying the extent of clearing required prior to the commencement of work and demarking the area,
- Restoring disturbed areas as the work progresses.
- Avoiding equipment & material use or storage within restored areas.

The implementation of these measures will minimize the amount of vegetation clearing and maximize the amount of existing vegetation to be retained.

As the roadway construction will create the potential for materials to migrate towards the river, sufficient erosion and sediment control measures must be incorporated into the work. As such, conventional silt fence is proposed. The details of this fence will be depicted on the final engineering drawings. In addition to this silt fencing, erosion control blankets may be placed on disturbed areas adjacent to the river after seeding.

Adjacent Landowners

There are 7 adjacent landowners in the vicinity of this project.

No substantial impacts are expected to 5 of these landowners.

One landowner will be getting a new entrance as they currently do not have an entrance from Bridge Street.

One landowner will be directly affected by the work as the entrance to this property will require complete reconstruction and relocation to meet the new roadway. The existing field entrance will remain in place until the new entrance is completed.

Communication with all landowners will be essential to ensure project goals are achieved.

Disruption of Traffic

Detour signs will be provided to guide traffic around the closed road. Overall, no major disruption to traffic is expected as Bridge Street adjacent to the bridge is closed frequently. Local residents, as well as Emergency Services, have already become accustomed to the bridge being closed.

Noise Impacts

Noise is anticipated to arise from removal of the existing structure, dewatering pumps, generators used to supply power to the site, installation of steel piles to support the new bridge structure, and general construction equipment and vehicles (e.g. hydraulic excavators, material handlers, concrete pump trucks, and trucks used to haul material and supplies to the site). The noise is expected to extend throughout the length of the project. No construction is anticipated to occur after dark (unless there are extenuating circumstances), therefore impacts will be limited to the daylight hours. Steps will be taken during the construction to minimize the level of noise, such as requesting that stationary noise generating equipment (e.g. generators) be enclosed and that construction equipment (e.g. hydraulic excavators, trucks, etc.) be fitted with mufflers and maintained in good working order.

Impacts to wildlife are anticipated to be minimal for the same reasons given in the previous paragraph.

Dust Impacts

Normal construction activities have the potential to generate dust which has the potential to impact nearby vegetation, aquatic habitats and residents. Dust can arise from a range of activities, including vehicular traffic, excavations and removal of the existing structure foundations. Appropriate dust control measures will be implemented to control dust (e.g. use of dust-suppressing materials, enclosures, etc.). As a result of the implementation of dust control measures, significant dust impacts are not anticipated.

Terrestrial Rehabilitation

All scarred and bare soils including roadway sideslopes and backslopes will be rehabilitated by placing topsoil, hydroseed, and the placement of erosion control blanket (if necessary).

Terrestrial Species-at-Risk

Barn Swallows have been identified as being present underneath the existing structure.

To mitigate against loss of habitat, a temporary nesting structure will be constructed adjacent to the bridge. The new bridge fascia’s will provide excellent nesting opportunities after construction is complete.

Cultural Heritage Resources

<u>Built Heritage Resources and Cultural Heritage Landscapes</u>:
Should a need be found, salvaged elements/members of the existing bridge could be retained for future conservation work and a recording and documentation of the existing structure undertaken. Photographs and descriptions gathered during the course of the CHER/HIA and previous documentation by the Region of Waterloo and historicbridges.org could be utilized for that purpose. As well, the existing structure could be commemorated with a plaque mounted on the replacement bridge.

<u>Archaeological Resources</u>:
If archaeological resources are impacted by EA project work, notify MHSTCI at archaeology@ontario.ca. All activities impacting archaeological resources must cease immediately and a licensed archaeologist is required to carry out an archaeological assessment in accordance with the Ontario Heritage Act and the Standards and Guidelines for Consultant Archaeologists.

If human remains are encountered, all activities must cease immediately, and the local police and coroner must be contacted. In situations where human remains are associated with archaeological resources, MHSTCI should also be notified (at archaeology@ontario.ca) to ensure that the site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act.

14.

DRAWINGS OF PROPOSED STRUCTURE

- Drawings 1-5 inclusive showing the proposed structure prepared by K. Smart Associates Limited dated October 2021.

BRIDGE 34/B-T9 REPLACEMENT

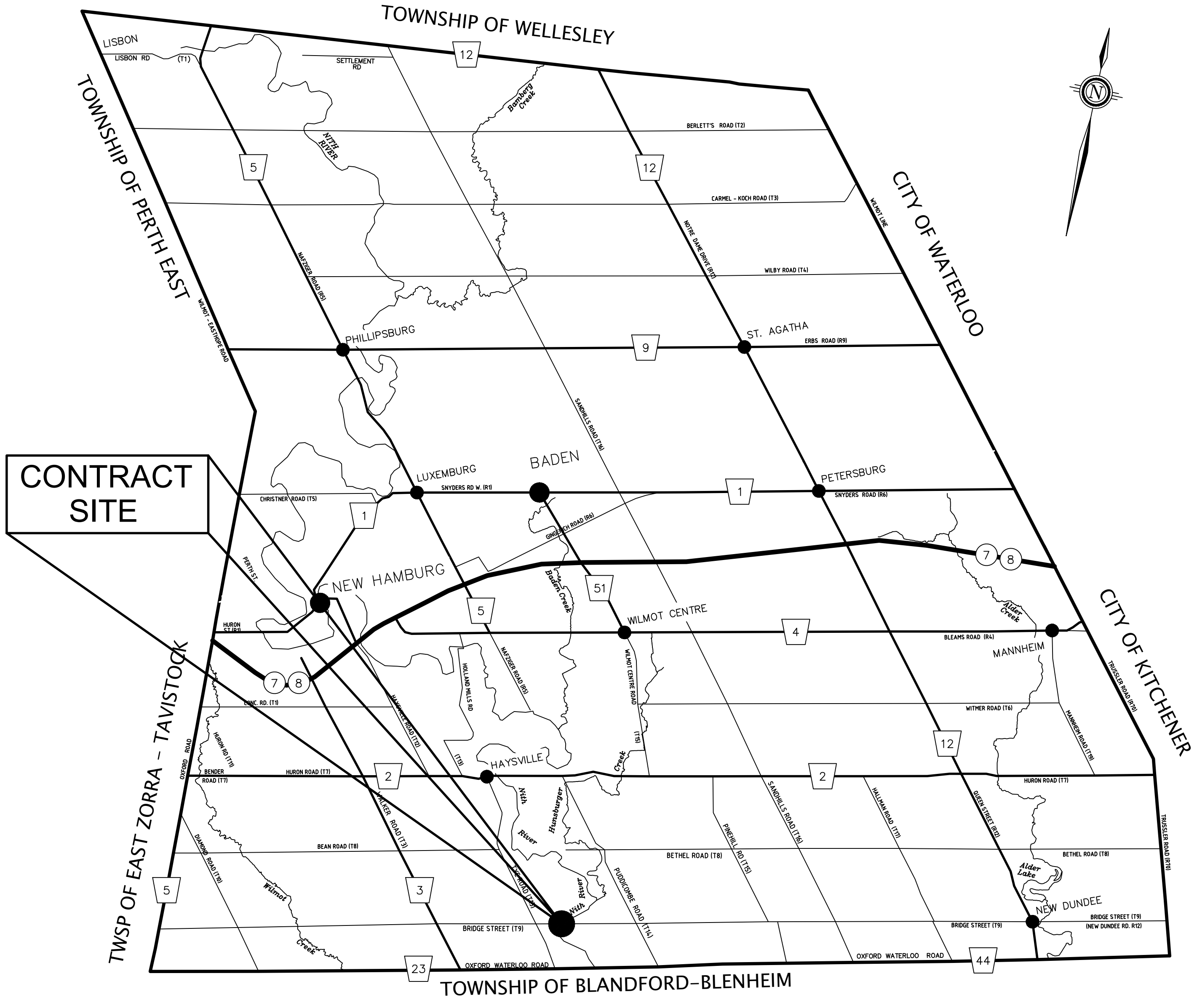
(BRIDGE STREET BRIDGE)

TOWNSHIP OF WILMOT
REGION OF WATERLOO

BUILDING A SURE FOUNDATION

LIST OF DRAWINGS

1. PLAN
2. PROFILE – STA 0+175 TO STA 0+525
3. PLAN AND PROFILE – STA 0+525 TO STA 0+690
4. GENERAL ARRANGEMENT
5. EROSION & SEDIMENT CONTROL



KEY PLAN
N.T.S.

CONTRACT DRAWINGS

TENDER No. 2022–XX

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

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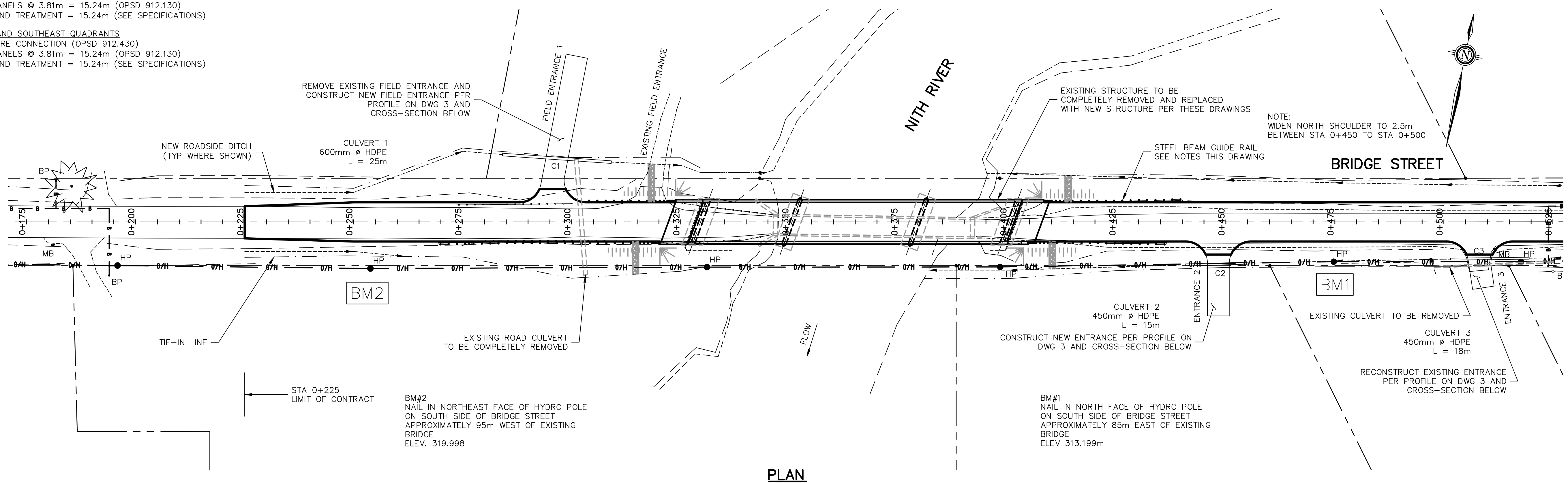
STEEL BEAM GUIDE RAIL WITH CHANNEL

NORTHWEST QUADRANT
1 – STRUCTURE CONNECTION (OPSD 912.430)
9 – SBGR PANELS @ 3.81m = 34.29m (OPSD 912.130)
1 – LEAVING END TREATMENT = 3.81m (OPSD 912.235)

NORTHEAST QUADRANT
1 – STRUCTURE CONNECTION (OPSD 912.430)
4 – SBGR PANELS @ 3.81m = 15.24m (OPSD 912.130)
1 – SBEAT END TREATMENT = 15.24m (SEE SPECIFICATIONS)

SOUTHWEST AND SOUTHEAST QUADRANTS
1 – STRUCTURE CONNECTION (OPSD 912.430)
4 – SBGR PANELS @ 3.81m = 15.24m (OPSD 912.130)
1 – SBEAT END TREATMENT = 15.24m (SEE SPECIFICATIONS)



REMOVE EXISTING FIELD ENTRANCE AND CONSTRUCT NEW FIELD ENTRANCE PER PROFILE ON DWG 3 AND CROSS–SECTION BELOW

NEW ROADSIDE DITCH (TYP WHERE SHOWN)

CULVERT 1
600mm ø HDPE
L = 25m

EXISTING STRUCTURE TO BE COMPLETELY REMOVED AND REPLACED WITH NEW STRUCTURE PER THESE DRAWINGS

NOTE:
WIDEN NORTH SHOULDER TO 2.5m BETWEEN STA 0+450 TO STA 0+500

STEEL BEAM GUIDE RAIL
SEE NOTES THIS DRAWING

TIE–IN LINE

EXISTING ROAD CULVERT TO BE COMPLETELY REMOVED

CULVERT 2
450mm ø HDPE
L = 15m

CONSTRUCT NEW ENTRANCE PER PROFILE ON DWG 3 AND CROSS–SECTION BELOW

EXISTING CULVERT TO BE REMOVED

CULVERT 3
450mm ø HDPE
L = 18m

RECONSTRUCT EXISTING ENTRANCE PER PROFILE ON DWG 3 AND CROSS–SECTION BELOW

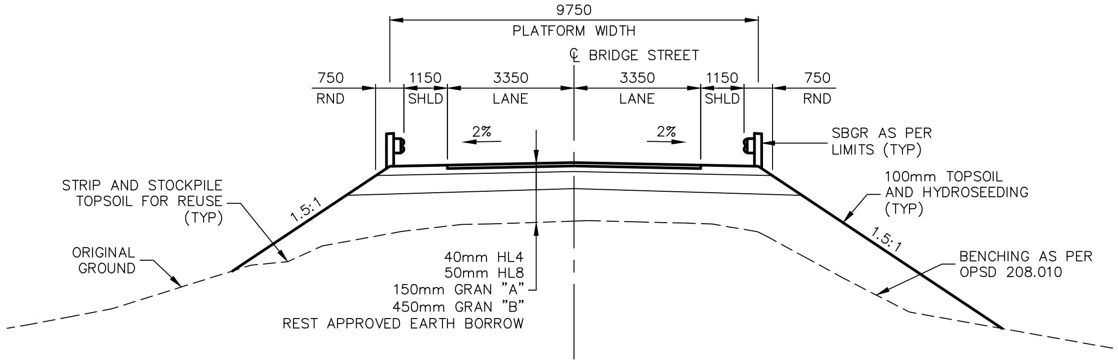
STA 0+225
LIMIT OF CONTRACT

BM#2
NAIL IN NORTHEAST FACE OF HYDRO POLE
ON SOUTH SIDE OF BRIDGE STREET
APPROXIMATELY 95m WEST OF EXISTING
BRIDGE
ELEV. 319.998

BM#1
NAIL IN NORTH FACE OF HYDRO POLE
ON SOUTH SIDE OF BRIDGE STREET
APPROXIMATELY 85m EAST OF EXISTING
BRIDGE
ELEV 313.199m

PLAN
SCALE 1:500

LOCATION	DIM "A"	DIM "B"
FIELD ENTRANCE 1	2.5m	5.0m
ENTRANCE 2	1.75m	3.5m
ENTRANCE 3	2.5m	5.0m
FIELD ENTRANCE 4	2.5m	5.0m



SBGR AS PER LIMITS (TYP)

STRIP AND STOCKPILE TOPSOIL FOR REUSE (TYP)

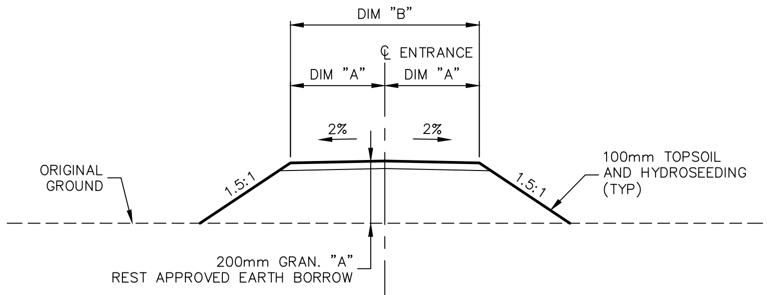
100mm TOPSOIL AND HYDROSEEDING (TYP)

ORIGINAL GROUND

BENCHING AS PER OPSD 208.010

40mm HL4
50mm HL8
150mm GRAN "A"
450mm GRAN "B"
REST APPROVED EARTH BORROW

TYPICAL ROAD CROSS–SECTION
SCALE 1:100



ORIGINAL GROUND

100mm TOPSOIL AND HYDROSEEDING (TYP)

200mm GRAN. "A"
REST APPROVED EARTH BORROW

TYPICAL ENTRANCE CROSS–SECTION
SCALE 1:100

No.	REVISION	DATE
1.	ISSUED FOR PIC	OCT 1/21
2.	ISSUED FOR PROJECT FILE	NOV 18/21

DESIGNED BY: A.G.
CHECKED BY: P.M.
DRAWN BY: J.A.
CHECKED BY: A.G.
FIELD BOOK:

SCALE
1:500
U.N.O
5.0m 0 10m
(ON 24 x 36 PAPER)

BRIDGE 34/B–T9 REPLACEMENT

TOWNSHIP OF WILMOT
REGION OF WATERLOO

PLAN

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER
SUDBURY

JOB NUMBER
20–145
DATE
OCTOBER 2021
DRAWING NUMBER
1

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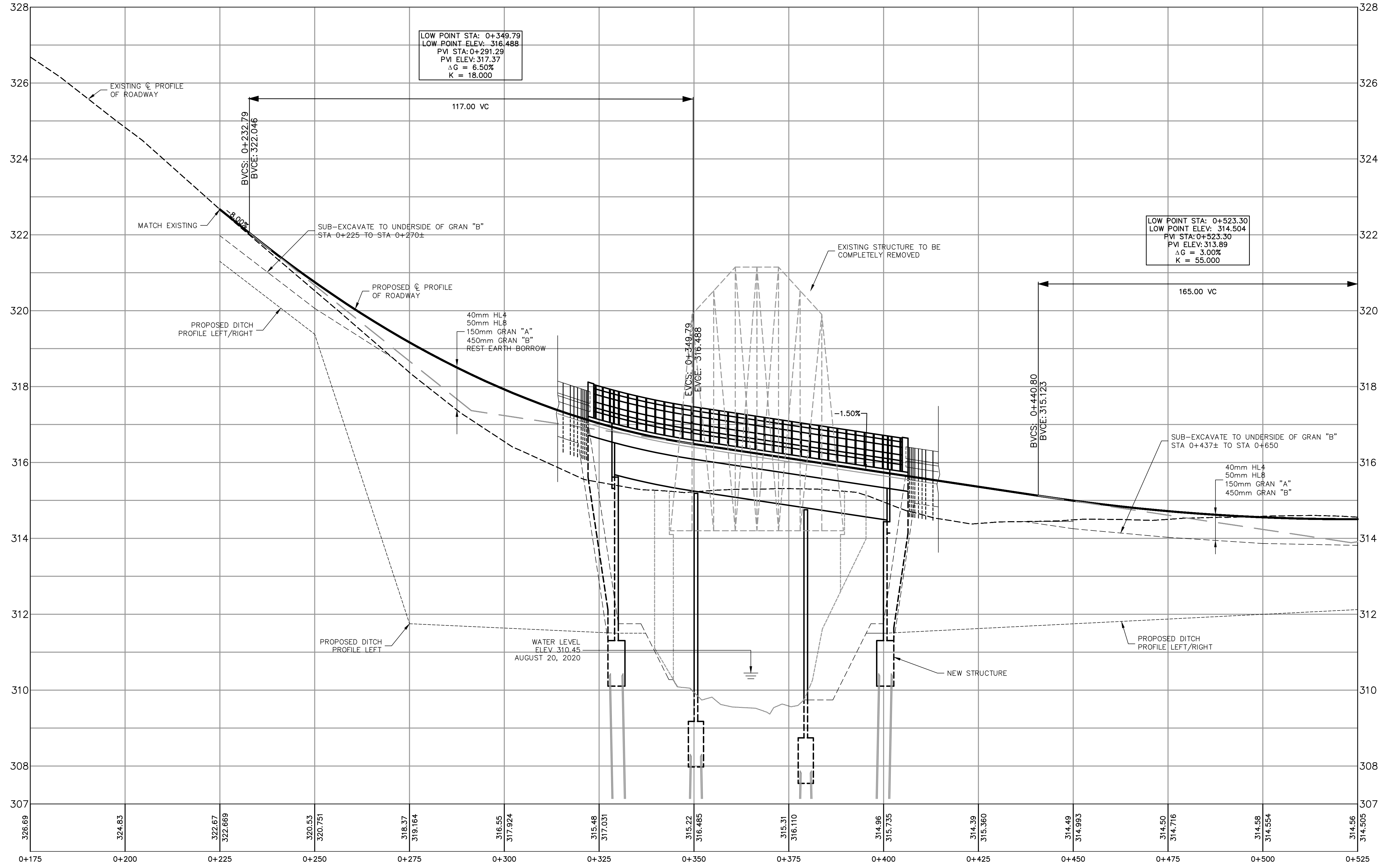

No.	REVISION	DATE
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2.	ISSUED FOR PROJECT FILE	NOV 18/21

DESIGNED BY: A.G.
CHECKED BY: P.M.
DRAWN BY: J.A.
CHECKED BY: A.G.
FIELD BOOK:

SCALE
HORIZ. 1:500
VERT. 1:50
5.0m 0 10m
(ON 24 x 36 PAPER)

BRIDGE 34/B-T9 REPLACEMENT

TOWNSHIP OF WILMOT
REGION OF WAATERLOO

PROFILE - STA 0+175 TO STA 0+525

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

JOB NUMBER
20-145
DATE
OCTOBER 2021
DRAWING NUMBER
2

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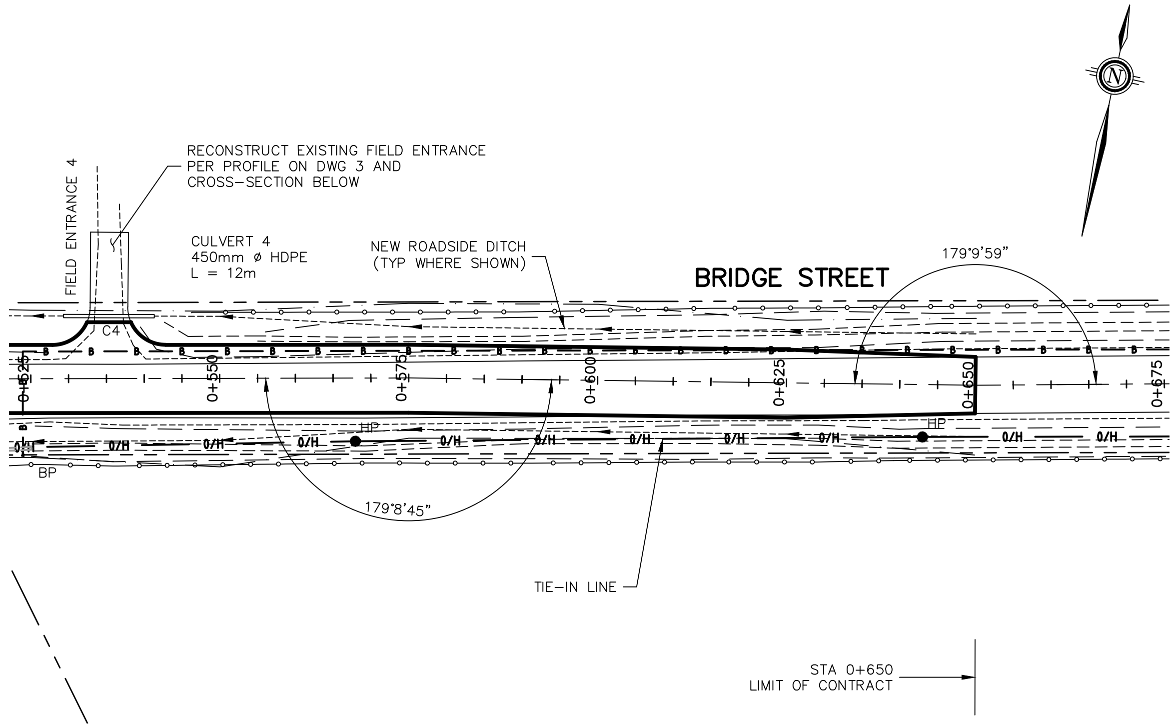
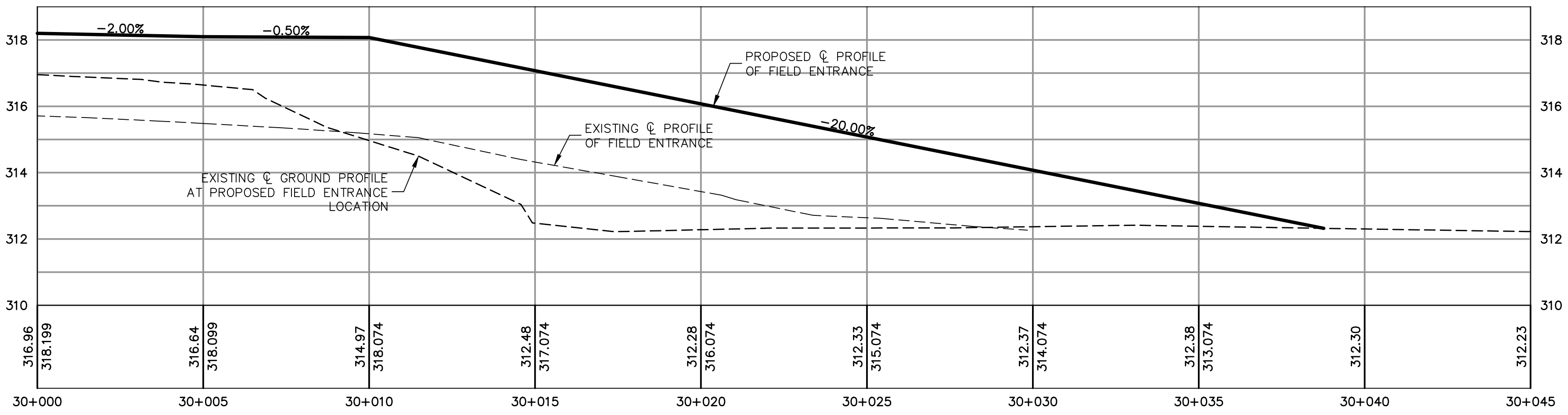
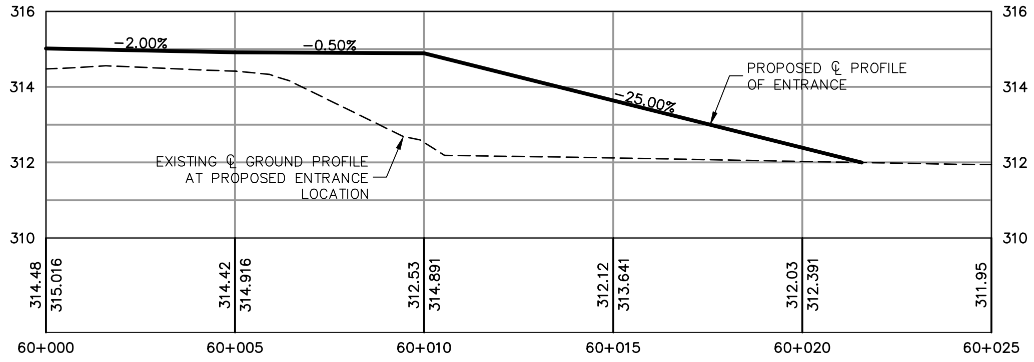




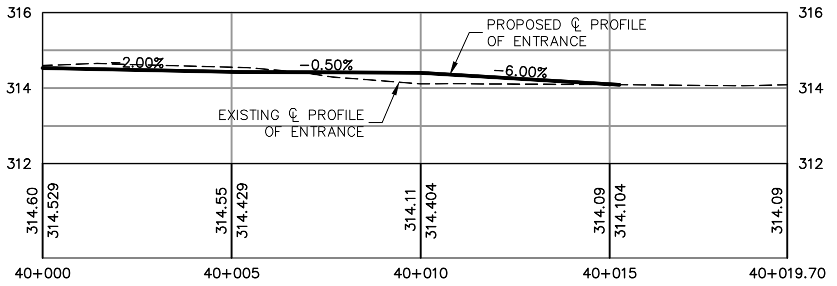
FIELD ENTRANCE 1 PROFILE

SCALE 1:100



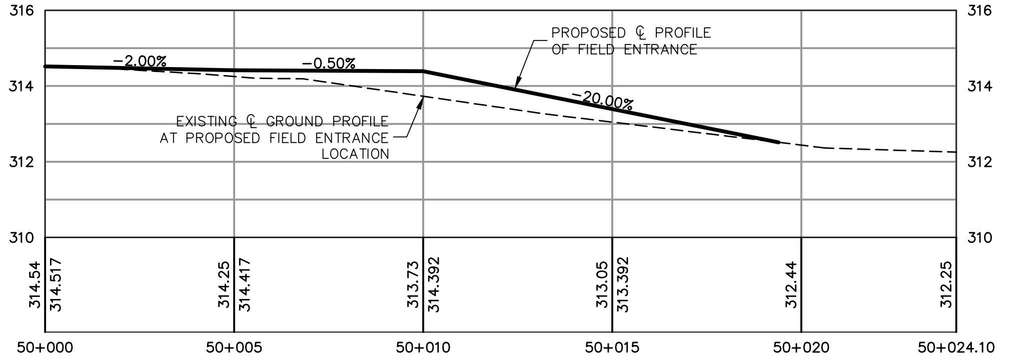
ENTRANCE 2 PROFILE

SCALE 1:100



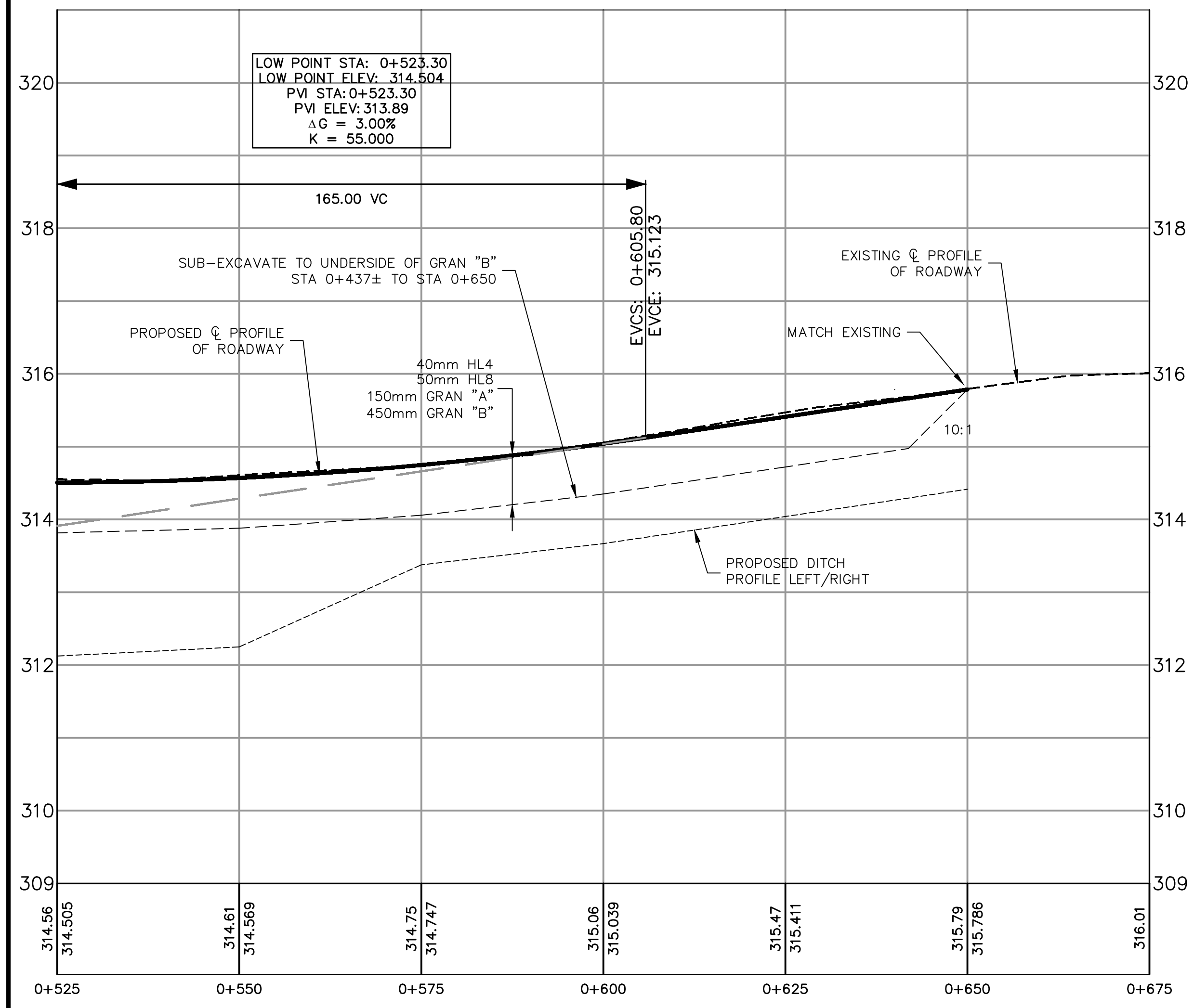
ENTRANCE 3 PROFILE

SCALE 1:100



FIELD ENTRANCE 4 PROFILE

SCALE 1:100



No.	REVISION	DATE
1.	ISSUED FOR PIC	OCT 1/21
2.	ISSUED FOR PROJECT FILE	NOV 18/21

DESIGNED BY: A.G.
CHECKED BY: P.M.
DRAWN BY: J.A.
CHECKED BY: A.G.
FIELD BOOK:

SCALE
HORIZ. 1:500
VERT. 1:50
5.0m 0 10m
(ON 24 x 36 PAPER)

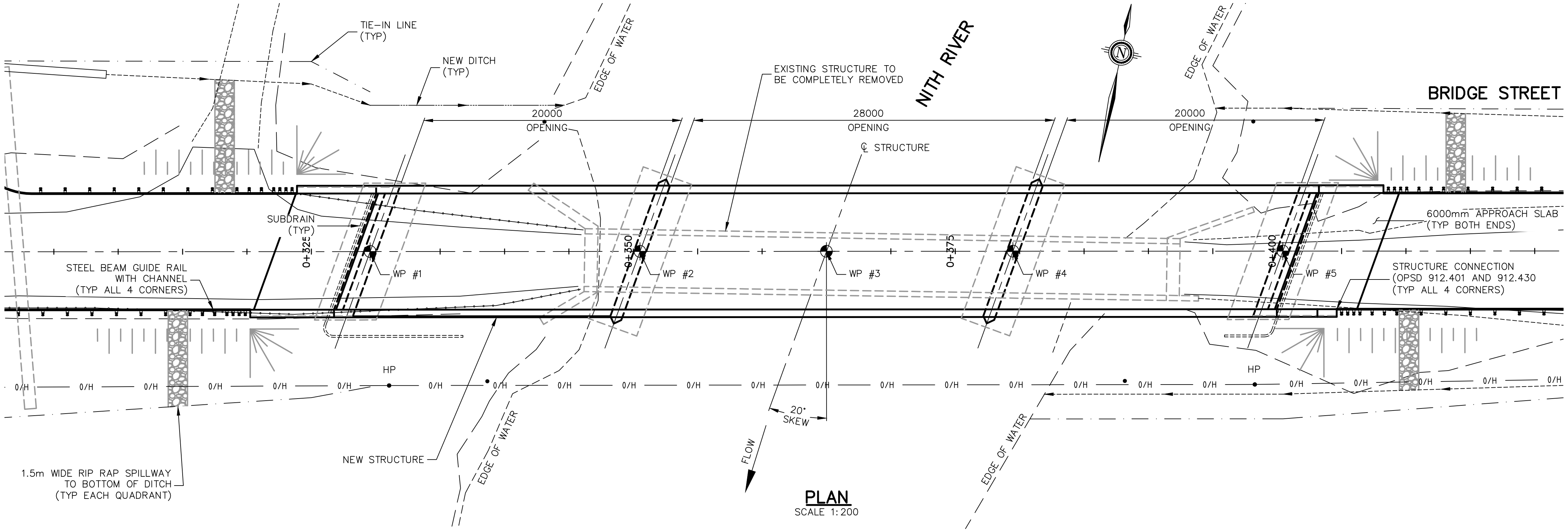
BRIDGE 34/B-T9 REPLACEMENT

TOWNSHIP OF WILMOT
REGION OF WATERLOO

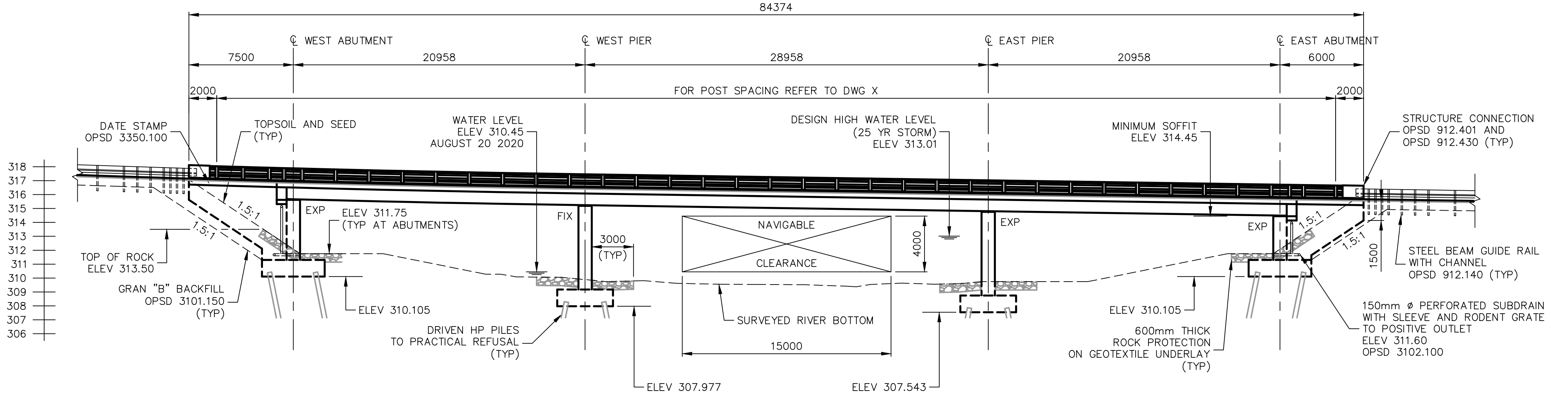
PLAN AND PROFILE - STA 0+525 TO STA 0+690

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER
SUDBURY

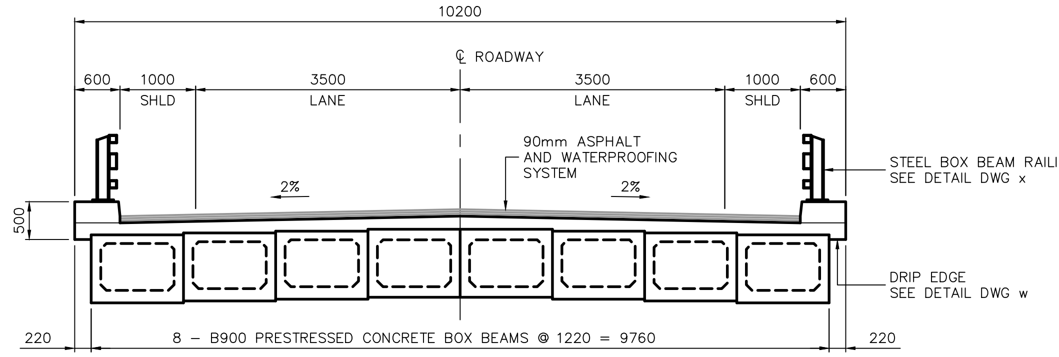
JOB NUMBER
20-145
DATE
OCTOBER 2021
DRAWING NUMBER
3



PLAN
SCALE 1:200



ELEVATION
SCALE 1:200



DECK CROSS SECTION
SCALE 1:50

	WP #1	WP #2	WP #3	WP #4	WP #5
STATION	0+329.563	0+350.521	0+365.000	0+379.479	0+400.437
ELEVATION	316.905	316.477	316.260	316.043	315.728

NOTE: WORKING POINT ELEVATIONS GIVEN TO TOP OF ASPHALT

GENERAL NOTES

1. STRUCTURE DESIGNED FOR CL-625 (ONT) LOADING PLUS 90mm ASPHALT AND WATERPROOFING SYSTEM IN ACCORDANCE WITH THE CANADIAN HIGHWAY BRIDGE DESIGN CODE 2019.
2. WORK ON THE STRUCTURE MUST NOT BE COMMENCED UNTIL MONUMENTS TO FIX CONTROL POINTS HAVE BEEN ERECTED AND CHECKED BY THE CONTRACT ADMINISTRATOR
3. STRUCTURE TO BE BUILT IN ACCORDANCE WITH THE MOST CURRENT OPS SPECIFICATIONS AND DRAWINGS AS WELL AS THE CONTRACT ADMINISTRATORS SPECIFICATIONS.
4. THE COMPLETE SOIL INVESTIGATION REPORT BY PETO MACCALLUM LTD. FORM PART OF THE CONTRACT DOCUMENTS. THE ENGINEER DOES NOT GUARANTEE THE ACCURACY OF THIS REPORT. THE CONTRACTOR SHALL REVIEW THE REPORT AND DETERMINE HIS OWN METHOD TO CONTROL GROUND WATER DURING THE CONSTRUCTION.
5. THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS ON THE JOB AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR BEFORE PROCEEDING WITH THE WORK
6. CLASS OF CONCRETE:

CAST-IN-PLACE CONCRETE	35 MPA C-1 MIX
PRESTRESSED CONCRETE	REFER TO RELEVANT DRAWINGS

ALL CONCRETE SHALL INCLUDE AN APPROVED AIR ENTRAINING ADMIXTURE

7. CLEAR COVER TO REINFORCING STEEL

FOOTINGS	100 ± 25mm
REMAINDER (UNLESS NOTED OTHERWISE)	70 ± 20mm

8. REINFORCING STEEL SHALL BE GRADE 400. BARS MARKED WITH A POSTFIX "S" DENOTE STAINLESS STEEL BARS. UNLESS OTHERWISE SHOWN, TENSION LENGTH LAPS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS "B". BAR HOOKS SHALL BE MINIMUM LENGTH AND STIRRUPS SHALL HAVE MINIMUM HOOKS, UNLESS INDICATED OTHERWISE.
9. STAINLESS STEEL BARS SHALL BE TYPE 316 LN OR DUPLEX 2205 WITH A MINIMUM YIELD STRENGTH OF 500 MPA.
10. MINIMUM LAP OF REINFORCING STEEL SHALL BE IN ACCORDANCE WITH THE CHBDC (2019)
11. ALL CONCRETE SHALL BE PLACED IN THE DRY.
12. NO CONCRETE SHALL BE PLACED BEFORE MATERIALS, FORMWORK AND REINFORCING STEEL HAVE BEEN CHECKED BY THE CONTRACT ADMINISTRATOR
13. ALL EXPOSED EDGES TO BE CHAMFERED 19mm UNLESS OTHERWISE NOTED. ALL ACUTE ANGLES SHALL BE FILLETED AS NOTED.
14. CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR.
15. BEARING SEATS SHALL BE FINISHED DEAD LEVEL TO THE SPECIFIED ELEVATIONS TO A TOLERANCE OF ±3mm.
16. THE BRIDGE DECK SHALL BE FINISHED USING AN APPROVED FINISHING MACHINE IN ACCORDANCE WITH OPS.MUNI 904.
17. ANY EXCAVATED OR IMPORTED MATERIAL SHALL BE STOCKPILED WELL AWAY FROM THE EDGE OF THE EXCAVATION AND AT APPROVED LOCATIONS.
18. NO BACKFILL SHALL BE PLACED UNLESS APPROVED BEFOREHAND BY THE CONTRACT ADMINISTRATOR. NATIVE MATERIAL SHALL NOT BE REMOVED FROM THE CONSTRUCTION SITE WITHOUT WRITTEN APPROVAL FROM THE CONTRACT ADMINISTRATOR.
19. ROCK PROTECTION SHALL BE 300mm NOMINAL SIZE WITH 50% LARGER THAN 300mm AND 50% SMALLER THAN 300mm. ROCK PROTECTION SHALL BE PLACED ON GEOTEXTILE UNDERLAY.

SUGGESTED SEQUENCE OF CONSTRUCTION

YEAR 1

1. DEMOLISH EXISTING BRIDGE
2. CONSTRUCT PIERS TO BEARING SEAT ELEVATIONS
3. CONSTRUCT ABUTMENTS AND WINGWALLS TO BEARING SEAT ELEVATIONS
4. PLACE BACKFILL AND ROCK PROTECTION AS REQUIRED
5. PLACE GIRDERS

YEAR 2

1. CONSTRUCT BRIDGE DECK AND WINGWALL TOPS
2. PLACE REMAINING BACKFILL
3. CONSTRUCT APPROACH SLABS, CURBS AND END POSTS
4. ERECT BRIDGE RAILING
5. COMPLETE ROAD RECONSTRUCTION INCLUDING GUIDE RAIL
6. WATERPROOF BRIDGE DECK AND PAVE ROADWAY APPROACHES
7. COMPLETE ANY REMAINING RESTORATION WORK

No.	REVISION	DATE
1.	ISSUED FOR PIC	OCT 1/21
2.	ISSUED FOR PROJECT FILE	NOV 18/21

DESIGNED BY: A.G.
CHECKED BY: P.M.
DRAWN BY: J.A.
CHECKED BY: A.G.
FIELD BOOK:

SCALE
1:200
U.N.O
2.0m 0 4m
(ON 24 x 36 PAPER)

BRIDGE 34/B-T9 REPLACEMENT

TOWNSHIP OF WILMOT
REGION OF WATERLOO

GENERAL ARRANGEMENT

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER SUDBURY

JOB NUMBER
20-145
DATE
OCTOBER 2021
DRAWING NUMBER
4

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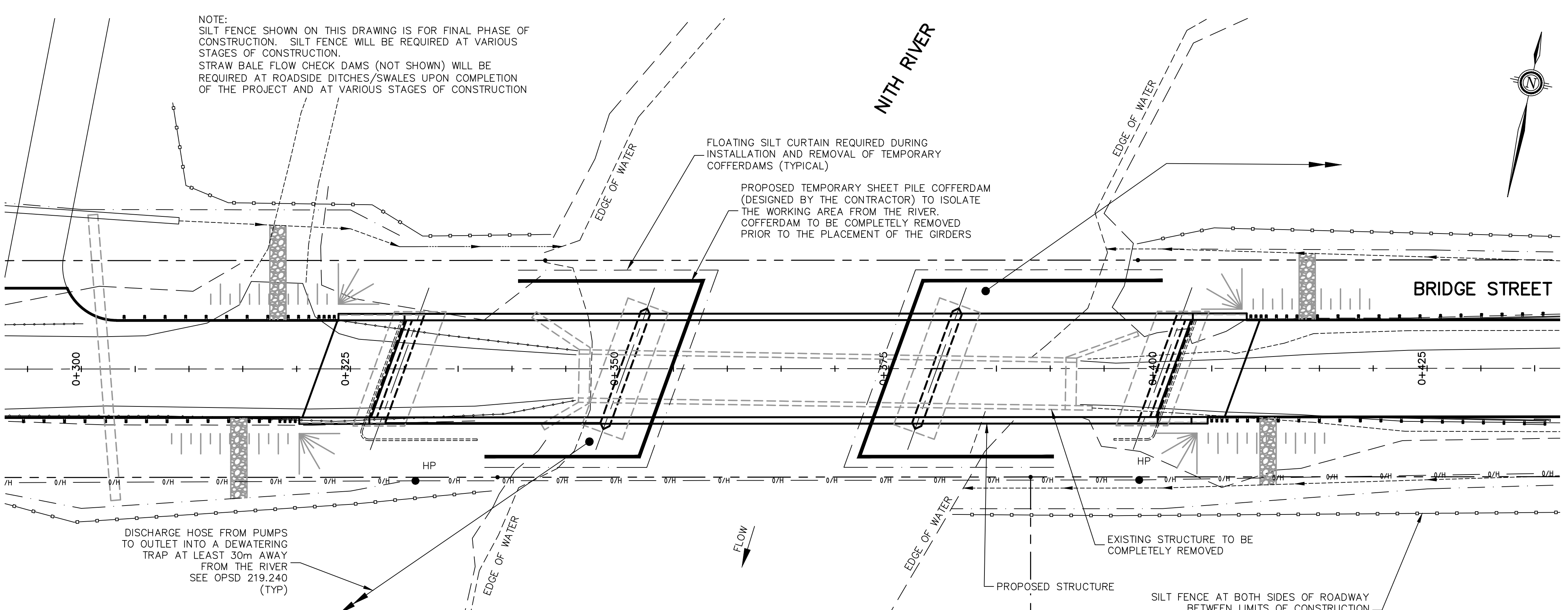


NOTE:
SILT FENCE SHOWN ON THIS DRAWING IS FOR FINAL PHASE OF CONSTRUCTION. SILT FENCE WILL BE REQUIRED AT VARIOUS STAGES OF CONSTRUCTION.
STRAW BALE FLOW CHECK DAMS (NOT SHOWN) WILL BE REQUIRED AT ROADSIDE DITCHES/SWALES UPON COMPLETION OF THE PROJECT AND AT VARIOUS STAGES OF CONSTRUCTION

FLOATING SILT CURTAIN REQUIRED DURING INSTALLATION AND REMOVAL OF TEMPORARY COFFERDAMS (TYPICAL)

PROPOSED TEMPORARY SHEET PILE COFFERDAM (DESIGNED BY THE CONTRACTOR) TO ISOLATE THE WORKING AREA FROM THE RIVER. COFFERDAM TO BE COMPLETELY REMOVED PRIOR TO THE PLACEMENT OF THE GIRDERS

DISCHARGE HOSE FROM PUMPS TO OUTLET INTO A DEWATERING TRAP AT LEAST 30m AWAY FROM THE RIVER SEE OPSD 219.240 (TYP)

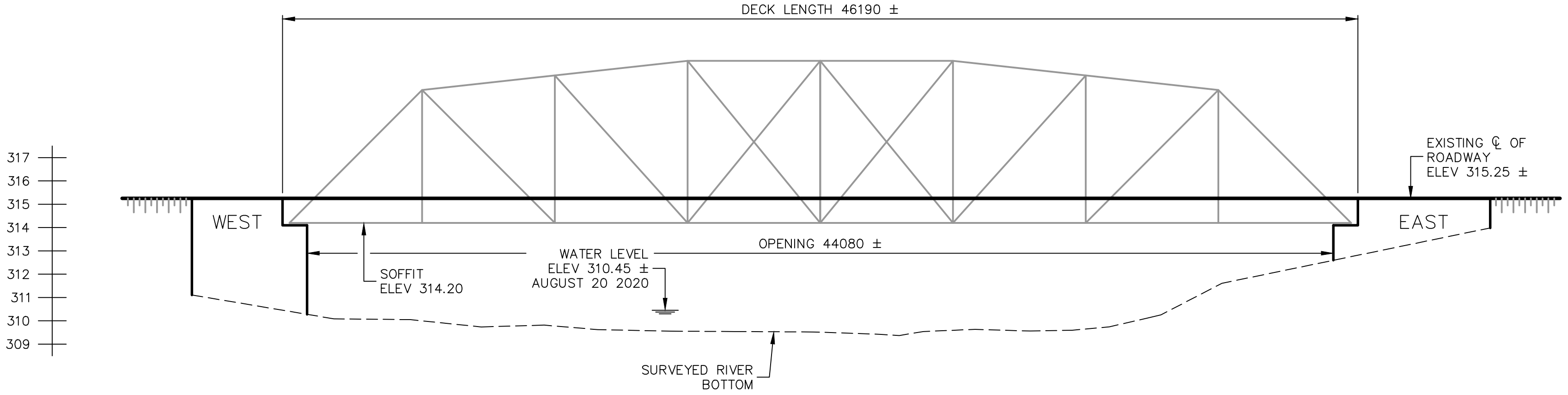
EXISTING STRUCTURE TO BE COMPLETELY REMOVED

PROPOSED STRUCTURE

SILT FENCE AT BOTH SIDES OF ROADWAY BETWEEN LIMITS OF CONSTRUCTION (TYP)

PLAN

SCALE 1:250



EXISTING STRUCTURE

SCALE 1:150

NAVIGATION

1. SIGNS TO BE PLACED 50m UPSTREAM AND DOWNSTREAM WARNING BOATERS OF THE CONSTRUCTION WORK AHEAD..
2. SILT CURTAINS OR DEWATERING BERMS, INSTALLED DURING NAVIGATION SEASON, ARE TO BE MARKED WITH YELLOW BUOYS AND/OR YELLOW LIGHTS.
3. NO PERSON SHALL PERMIT ANY TOOLS, EQUIPMENT, VEHICLES, TEMPORARY STRUCTURES OR PARTS THEREOF USED OR MAINTAINED FOR THE PURPOSE OF BUILDING OR PLACING A WORK IN A NAVIGABLE WATER TO REMAIN IN SUCH WATER AFTER THE COMPLETION OF THE PROJECT.
4. WHERE A WORK OR PORTION OF A WORK THAT IS BEING CONSTRUCTED OR MAINTAINED IN A NAVIGABLE WATER CAUSES DEBRIS OR OTHER MATERIAL TO ACCUMULATE ON THE BED OR SURFACE OF THE WATER, THE OWNER OF THAT WORK OR PORTION OF THAT WORK SHALL CAUSE THE DEBRIS OR OTHER MATERIAL TO BE REMOVED TO THE SATISFACTION OF THE MINISTER OF TRANSPORT, INFRASTRUCTURE AND COMMUNITIES.

DEWATERING SEQUENCE

1. ATTEND A PRE–CONSTRUCTION MEETING WITH THE OWNER AND CONTRACT ADMINISTRATORPRIOR TO COMMENCEMENT OF CONSTRUCTION.
2. INSTALL SILT FENCE, STRAW BALE CHECK DAMS AND ANY OTHER EROSION CONTROL MEASURES WHICH MAY BE REQUIRED.
3. CONSTRUCT DEMOLITION PLATFORM UNDERNEATH EXISTING BRIDGE AND REMOVE EXISTING SUPERSTRUCTURE.
4. CLEAN DEBRIS, DUST AND SLURRY FROM DEMOLITION PLATFORM AND REMOVE PLATFORM.
5. PLACE SILT FENCE AND/OR FLOATING SILT CURTAINS OUTSIDE OF PLANNED COFFERDAM LOCATIONS.
6. INSTALL TEMPORARY COFFERDAMS OR OTHER CONTAINMENT SYSTEM AS REQUIRED.
7. COMPLETE DEMOLITION OF THE EXISTING BRIDGE.
8. EXCAVATE AS REQUIRED IN ORDER TO CONSTRUCT NEW STRUCTURE.
9. DRIVE PILES, CONSTRUCT FOOTINGS AND CONSTRUCT PIERS AND ABUTMENTS TO BEARING SEAT ELEVATIONS.
10. PLACE BACKFILL AND ROCK PROTECTION AS REQUIRED TO FACILITATE REMOVAL OF COFFERDAMS. PLACE ROCK PROTECTION.
11. REMOVE COFFERDAMS.
12. REMOVE FLOATING SILT CURTAINS.
13. COMPLETE REMAINING CONSTRUCTION OF THE BRIDGE.
14. COMPLETE ROADWORK.
15. INSTALL PERMANENT SILT FENCE AND STRAW BALE CHECK DAMS.

EROSION CONTROL – BRIDGE RECONSTRUCTION

1. ALL WORK SHALL BE DONE IN THE DRY.
2. IN–WATER WORK SHALL ONLY TAKE PLACE BETWEEN JULY 15 AND MARCH 14. NO IN–WATER WORK MAY OCCUR OUTSIDE OF THESE DATES FOR ANY REASON.
3. DEWATERING OF THE SITE SHALL BE ACHIEVED BY THE INSTALLATION OF COFFERDAMS TO ISOLATE THE WORKING AREA, AND THE PLACEMENT OF CONVENTIONAL SUMP PUMPS WHERE REQUIRED. THE CONTRACTOR'S SPECIFIC METHOD SHALL BE APPROVED BEFOREHAND BY THE CONTRACT ADMINISTRATOR. ALTERNATIVE METHODS OF DEWATERING SUCH AS SHEET PILE COFFERDAMS AROUND THE PIERS, BYPASS CHANNEL, OR AQUA DAMS MAY BE POSSIBLE PENDING THE WRITTEN APPROVAL OF THE CONTRACT ADMINISTRATOR.
4. DISCHARGE FROM PUMPING OPERATIONS SHALL FIRST OUTLET INTO A SILTING POND OR SEDIMENT TRAP BEFORE THE WATER IS ALLOWED TO RE–ENTER THE STREAM OR ANOTHER WATERCOURSE.
5. COFFERDAMS SHALL BE DESIGNED BY THE CONTRACTOR AND SUBMITTED TO THE CONTRACT ADMINISTRATOR FOR REVIEW PRIOR TO CONSTRUCTION.
6. ALL DISTURBED AREAS INCLUDING BANKS ABOVE WATER LEVEL SHALL BE REGRADED, TOPSOILED AND SEEDED TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AS SOON AS POSSIBLE.
7. ALL EROSION CONTROL MEASURES (SILT FENCE, ROCK DAMS, SILTATION POND/DEWATERING TRAP, ETC.) SHALL BE CHECKED DAILY DURING ON–SITE WORK AND BE MAINTAINED IN GOOD STATE SO THAT THEY ARE FUNCTIONING PROPERLY. SILT FENCE AND STRAW BALE CHECK DAMS TO BE LEFT IN PLACE FOR 12 MONTHS OR UNTIL SUCH TIME AS THE SITE STABILIZES (THESE ARE LOCATED ABOVE HIGH WATER LEVEL).
8. NO MACHINERY SHALL CROSS THE RIVER AT ANY TIME. ANY MACHINERY THAT IS REQUIRED ON THE OTHER SIDE OF THE RIVER WHILE THE BRIDGE IS DISMANTLED OR UNDER CONSTRUCTION SHALL BE HAULED BY FLOAT OR DRIVEN AROUND ON THE ROADS. MACHINERY, VEHICLES, EQUIPMENT PUMPS, ETC., WILL NOT BE REFUELED WITHIN 30 METRES OF THE WATERCOURSE. MACHINERY SHALL NOT BE CLEANED WITHIN 30 METRES OF THE RIVER.
9. ALL WASTE MATERIAL FROM CONSTRUCTION SHALL BE STORED AWAY AND ABOVE THE HIGH WATERMARK AND AT NO TIME SHALL SUCH MATERIAL ENTER IN THE WATER.
10. FOR TYPICAL CHECK DAMS REFER TO OPSD 219.210
11. FOR SILT FENCE REFER TO OPSD 219.130 HEAVY DUTY.

ADDITIONAL ENVIRONMENTAL MEASURES TO BE ADHERED TO:

1. SEDIMENT AND EROSION CONTROL MEASURES SHOULD BE IMPLEMENTED PRIOR TO WORK, AND MAINTAINED DURING THE WORK PHASE, TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATER OR THE MOVEMENT OF RE–SUSPENDED SEDIMENT.
2. A FLOATING TURBIDITY CURTAIN OR SILT FENCE SHOULD BE PLACED IMMEDIATELY AROUND THE WORK SITE PRIOR TO THE INSTALLATION OF COFFERDAMS.
3. ALL DISTURBED WORK AREAS SHOULD BE STABILIZED AND RE–VEGETATED AS REQUIRED UPON THE COMPLETION OF WORK AND RESTORED TO A PRE–DISTURBED STATE OR BETTER.
4. SEDIMENT AND EROSION CONTROL MEASURES SHOULD BE LEFT IN PLACE UNTIL ALL DISTURBED AREAS HAVE BEEN STABILIZED.
5. EXISTING STREAM FLOWS SHOULD BE MAINTAINED DOWNSTREAM OF THE DE–WATERED WORK AREA WITHOUT INTERRUPTION, DURING ALL STAGES OF WORK. THERE SHOULD BE NO INCREASE IN WATER LEVELS UPSTREAM OF THE DE–WATERED WORK AREA.
6. FISH SHOULD BE REMOVED FROM THE WORK AREA PRIOR TO DE–WATERING AND RELEASED ALIVE IMMEDIATELY DOWNSTREAM.
7. SILT OR DEBRIS THAT HAS ACCUMULATED AROUND THE TEMPORARY COFFERDAMS SHOULD BE REMOVED PRIOR TO THE WITHDRAWAL.
8. NATURAL STRUCTURES SUCH AS LOGJAMS AND IN–STREAM WOODY COVER SHOULD NOT BE REMOVED UNLESS THEY REPRESENT A BARRIER TO FLOWS OR FISH MOVEMENT.
9. OPERATE HEAVY MACHINERY ON LAND AND IN A MANNER THAT MINIMIZES DISTURBANCE TO THE BANKS OR BED OF THE STREAM.
10. ENSURE THAT MACHINERY ARRIVES ON SITE IN A CLEAN, WASHED CONDITION AND IS MAINTAINED FREE OF FLUID LEAKS.
11. WASH, REFUEL AND SERVICE MACHINERY AND STORE FUEL AND OTHER MATERIALS FOR THE MACHINERY AWAY FROM THE WATER TO PREVENT ANY DELETERIOUS SUBSTANCE FROM ENTERING THE WATER OR SPREADING ONTO THE ICE SURFACE.
12. KEEP AN EMERGENCY SPILL KIT ON SITE IN CASE OF FLUID LEAKS OR SPILLS FROM MACHINERY.
13. STABILIZE ANY WASTE MATERIALS REMOVED FROM THE WORK SITE TO PREVENT IT FROM ENTERING THE RIVER. THIS COULD INCLUDE COVERING STOCKPILES WITH BIODEGRADABLE MATS OR TARPS, OR PLANTING STOCKPILES WITH GRASS OR SHRUBS.
14. ALL UNSTABLE BANKS OF THE WATERCOURSE SHOULD BE STABILIZED AND SIDE RUN–OFF DITCHES SHOULD BE CONSTRUCTED TO DIVERT ROAD RUN–OFF THROUGH THE GREENBELT BEFORE ENTERING THE STREAM.
15. VEGETATE AND STABILIZE ANY DISTURBED AREAS BY SEEDING AND PLANTING TREES, SHRUBS, OR GRASSES PER SPECIFICATIONS.
16. STREAM CROSSINGS SHOULD ALLOW FOR UNIMPEDED UPSTREAM AND DOWNSTREAM MOVEMENT OF FISH.
17. CONCRETE LEACHATE IS ALKALINE AND HIGHLY TOXIC TO FISH AND AQUATIC LIFE AND MEASURES MUST BE TAKEN TO PREVENT ANY INCIDENCE OF CONCRETE OR CONCRETE LEACHATE FROM ENTERING THE RIVER. ALL CAST–IN–PLACE CONCRETE, GROUT, MORTARS, ETC. SHOULD BE TOTALLY ISOLATED FROM PRECIPITATION AND THE WATERS OF THE WATERCOURSE FOR A MINIMUM 48 HOUR PERIOD OR UNTIL SIGNIFICANTLY CURED TO ALLOW THE pH TO REACH NEUTRAL LEVELS. CONTAINMENT FACILITIES SHOULD BE PROVIDED AT THE SITE FOR THE WASH–DOWN FROM CONCRETE DELIVERY TRUCKS, CONCRETE PUMPING EQUIPMENT, AND OTHER TOOLS AND EQUIPMENT AS REQUIRED.

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TOWNSHIP OF WILMOT
REGION OF WATERLOO

EROSION AND SEDIMENT CONTROL

K. SMART ASSOCIATES LIMITED
CONSULTING ENGINEERS AND PLANNERS
KITCHENER
SUDBURY

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