TATHAM ENGINEERING

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Hanover Community Trails Bridges

CLASS ENVIRONMENTAL ASSESSMENT SCHEDULE B

PROJECT FILE REPORT

Town of Hanover

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Issue	Date	Description
1	June 15, 2022	Class EA Project File Report

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STUDY OVERVIEW & OBJECTIVE

The Town of Hanover initiated a Municipal Class Environmental Assessment (Class EA) to confirm that replacement of Trail Bridges 1, 2 and 4 and rehabilitation of Trail Bridge 3 on the Town's South line section which forms part of the Community Trails system, located in Hanover, Ontario, is the most appropriate bridge management strategy for these deteriorated structures. Tatham Engineering Limited were retained to undertake the study on behalf of the Town, in accordance with the planning and design process for a Schedule B project as outlined in the *Municipal Engineers Association Municipal Class Environmental Assessment* document (2000, revised in 2007, 2011 and 2015).

In consideration of the existing conditions, the Problem/Opportunity Statement, which sets the framework for the remainder of the Study, is as follows:

"The Town of Hanover has initiated a Municipal Class Environmental Assessment to consider options and to identify a preferred solution to address the deficiencies associated with Bridges 1 to 4 on the Town's South line section as they relate to safety, structural condition, performance, asset management, hydraulic capacity, and design standards."

ALTERNATIVE SOLUTIONS

Three alternative solutions were explored with respect to the natural, social, physical and economic environments.

Alternative A is to Do Nothing, under which no repairs will be completed on the bridges, they will continue to deteriorate, and the load carrying capacity of the structures will continue to decrease until the bridges are eventually closed to pedestrian traffic. Bridges 2 and 4 are closed.

Alternative B is to Rehabilitate the bridges. Each site would have different methodologies or works needed to repair, replace or strengthen elements to enable full pedestrian traffic loading, plus the capacity to support maintenance vehicles.

Alternative C is to Replace the existing bridges.

ENVIRONMENTAL INVENTORIES

The purpose of the environment inventories is to provide the existing information from which the assessment of the alternative solutions can be based. A description of the Study area has been developed considering existing land uses and developments, the natural environment, physical environment, economic environment, cultural/heritage environment and climate change.

Aboud & Associates completed a natural heritage assessment and Scoped Environmental Impact Study. Habitat for aquatic species, bird nesting habitat and amphibians were identified within the study area. Mitigations measures will be required to protect the watercourse and environment downstream of the structures, and to protect the natural environment around the structures during any removal, rehabilitation, or reconstruction activities.

Golder Associates Limited (Golder) completed a Stage 1 & 2 Archaeological assessment, and no archaeological resources were identified.

Golder completed a Cultural Heritage Evaluation (CHER) of Bridge 1, and Amick Consultants Limited (Amick) completed a CHER of Bridges 2, 3 and 4. Bridges 2, 3 and 4 were identified as requiring an HIA, which was completed by Golder. Heritage attributes were identified for Bridges 3 and 4, and Golder provided recommendations for mitigation of the impact of work on the structures.

With respect to the economic environment, the associated costs incurred in implementing and maintaining the structure improvements were considered. The costs have been considered in relation to the extent of required upgrades or improvements to the existing bridges or construction of new bridges. In addition, impacts to abutting lands have also been considered as part of the economic environment.

PREFERRED SOLUTION

Based on the evaluation of the alternative solutions, which considered several technical and ancillary criteria, the following alternatives have been identified as the recommended solutions:

- Trail Bridge 1 – Replace the existing timber structure with a prefabricated steel truss and timber deck, install new concrete abutments supported by steel piles.
- Trail Bridge 2 – Replace the existing timber structure with a prefabricated steel truss and timber deck, install new concrete abutments supported by steel piles.
- Trail Bridge 3 – Rehabilitate by replacing the existing timber deck with a new timber deck, complete abutment and pier concrete repairs, and replace the timber retaining walls at each abutment. Maintain the steel through-plate girders.
- Trail Bridge 4 – Replace the structure that will include replacing the existing timber approach spans with prefabricated steel trusses and timber deck, replacing the foundations with new concrete abutments and piers supported by steel piles, and incorporating rehabilitation of the steel pony truss that includes replacing its existing timber deck.

The proposed staging includes replacing Trail Bridge 1 and 2 in 2023 and replacing Trail Bridge 4 and rehabilitating Trail Bridge 3 in 2024.

NEXT STEPS

Following the completion of the Class EA Schedule B process, which allows for one further point of public consultation and review and provided there are no requests for a Section 16 Order, the Town may proceed to implementation.

1 Introduction & Background

The Town of Hanover (Town) is considering replacement of Bridges 1, 2 and 4 and rehabilitation of Bridge 3 on the Town's south line trail section which forms part of the Community Trails system located within the Town of Hanover. This section of trail extends north starting from Concession 2 - South Line/Cemetery Road and ending at Grey County Road 10 - 7th Avenue.

A key map of the site location is depicted in Figure 1.

Tatham Engineering Limited was retained by the Town to undertake a Municipal Class Environmental Assessment (Class EA) Study, in accordance with the appropriate guidelines[1]. The objective of the Class EA Study is to confirm the need for improvements and consider the most appropriate manner in which they can be implemented.

1.1 CLASS ENVIRONMENTAL ASSESSMENT PROCESS

The Class EA process is defined in the *Municipal Class Environmental Assessment* document. Applying to all municipal road improvement projects, a number of Study categories or schedules have been established recognizing the range of environmental impacts. These are briefly described below and illustrated in Figure 2.

1.1.1 Class EA Schedules

Schedule A

Schedule A projects generally include normal or emergency operational and maintenance activities. As the environmental effects of these activities are usually minimal, these projects are pre-approved and may proceed directly to implementation without the need to complete the design and planning process. No reports or Study documents need to be prepared.

Schedule A+

Schedule A+, includes projects that are typically limited in size and scope, and thus have minimal associated environmental impacts. While these projects are also pre-approved, they require notification to the public from the Municipality prior to implementation. No reports or Study documents need to be prepared outside of the notification.

1 *Municipal Class Environmental Assessment*. Municipal Engineers Association, October 2000 as amended in 2007, 2011, & 2015.

Schedule B

Schedule B projects generally include improvements and expansions to existing facilities. As there is the potential for some adverse environmental impacts, the municipality is required to conduct a screening process whereby members of the public and review agencies are informed of the project and given the opportunity to provide comment. Documentation of the planning and design process is required under a Schedule B Study. As these studies are generally straightforward and do not require detailed technical investigations to arrive at the preferred solution, a formal report is not required. Rather, a Project File is prepared to demonstrate that the appropriate steps have been followed. The Project File is to be made available for review by the public and review agencies.

Schedule C

Schedule C projects generally include the construction of new facilities and major expansions to existing facilities. As they have the potential for environmental impacts, they must proceed under the full planning and documentation procedures specified by the Municipal Class EA document. Schedule C projects require an Environmental Study Report (ESR) to be prepared and appropriately filed for review by the public and review agencies.

1.1.2 Class EA Terminology

Prior to determining the appropriate Class EA schedule, an understanding of the defining terminology is provided below:

Hydraulic Capacity

The volume of water that can be conveyed under or through a water crossing structure.

Road Capacity

The number of travelled lanes and does not differentiate between various lane widths to accommodate differing traffic volumes, speeds, movements.

Same Purpose, Use, Capacity & Location

The replacement or upgrading of a structure or facility or its performance, where the objective and application remain unchanged, and the volume, size and capability do not exceed the minimum municipal standard, or the existing rated capacity, and there is no substantial change of location. Works carried out within an existing road allowance such that no land acquisition is required are considered to be in the same location. Conversely, it is thus inferred that should improvements extend beyond the existing road allowance and additional property is required; the location is considered to have changed.

Watercourse

Flowing water, though not necessarily continuous, within a defined channel and with a bed and banks which usually discharges into some other watercourse or body of water.

1.1.3 Selected Schedule

As per the Class EA guidelines and in consideration of the improvement works, the following apply to bridge projects:

- Schedule A for the reconstruction or alteration of a structure or the grading adjacent to it when the structure is over 40 years old, which after appropriate evaluation is found not to have cultural heritage value;
- Schedule A+ for the reconstruction of a water crossing for the same purpose, use, capacity (refers to either hydraulic capacity or road capacity) and at the same location;
- Schedule A+ for installation of guide rails;
- Schedule B for the reconstruction or alteration of a structure or the grading adjacent to it when the structure is over 40 years old, which after appropriate evaluation is found to have cultural heritage value and provided the cost is less than $2.6M;
- Schedule B for the reconstruction of a water crossing where the reconstructed facility will not be for the same purpose, use, capacity (refers to either hydraulic capacity or road capacity) or at the same location and provided the cost is less than $2.6M;
- Schedule B for the construction of a new water crossing provided the cost is less than $2.6M;
- Schedule B for the reconstruction or alteration of a structure or the grading adjacent to it when the structure is over 40 years old, which after appropriate evaluation is found to have cultural heritage value; and
- Schedule C for the above noted Schedule B projects which exceed $2.6M.

In consideration of the above Class EA guidelines, heritage value, potential alternative solutions, and the associated costs (the reconstruction and rehabilitation of the existing four bridges can be implemented for less than $2.6M), and to ensure appropriate public consultation throughout the Study, the Schedule B Class EA process has been adopted. As illustrated in Figure 2, a Schedule B requires completion of Phases 1 and 2 of the Municipal Class EA planning and design process.

1.2 OBJECTIVES OF THE PROJECT FILE REPORT

The overall objective of this report is to document the planning process undertaken during the Class EA process related to the development and evaluation of alternative solutions and designs. Specifically, the objectives of this report are as follows:

- to prepare a detailed description of the problem;
- to establish alternatives to address the problem;
- to prepare a detailed inventory of the affected/applicable environments (physical, natural, social, economic, cultural, etc.);
- to screen the impact of the alternatives on the environment; and
- to outline the remaining steps involved in the planning and design for improvements to the Hanover Community Trail Bridges to complete the Municipal Class Environmental Assessment process.

1.3 FORMAT OF THE PROJECT FILE REPORT

The Project File Report has been prepared in accordance with the chronological order of the Class EA process and is structured as follows:

- Chapter 2 presents the need and justification of the study and the preparation of a problem statement to guide the Municipal Class EA process;
- Chapter 3 addresses the first point of public consultation - Notice of Study Commencement;
- Chapter 4 details the alternative solutions developed to address the problem statement;
- Chapter 5 identifies the affected environments and provides an inventory of such to be considered in the subsequent evaluation;
- Chapter 6 details the evaluation of the alternative solutions in context of the manner to which they satisfy the problem statement and potential impacts to the environments;
- Chapter 7 identifies the preferred solution; and
- Chapter 8 outlines the remaining tasks in the Municipal Class EA process.

2 Need & Justification

The purpose of this Class EA Study is to identify improvement alternatives to address the structure deficiencies and confirm that the most appropriate strategy is replacement of Bridges 1, 2 and 4 and rehabilitation of Bridge 3 on the Town's South line section. In doing so, it is first necessary to establish/understand the existing conditions from which the needs are determined. Once these existing conditions and needs are identified, the overall problem statement can be defined. These tasks have been completed in accordance with Phase 1 of the Class EA process, which culminates with the creation of the problem statement.

The main areas of concern are:

- identifying, evaluating and selecting long-term cost-effective strategies to address the deteriorated condition of the existing bridges;
- providing the necessary improvements to the trail approaches to suit the bridges;
- minimizing and/or avoiding impacts to adjacent lands;
- environmental protection and mitigation measures given the proximity of construction activities to the watercourse; and
- acquisition of necessary approvals, in a timely manner.

2.1 EXISTING CONDITIONS

The four bridge structures are on a former railway right-of way. Therefore, the horizontal alignment is relatively straight with large radius curves, and the vertical alignment is relatively flat. This section of trail includes the Town's South line section which forms part of the Community Trails system and extends north starting from Concession 2 - South Line/Cemetery Road and ending at Grey County Road 10 - 7th Avenue. The bridges are identified as Trail Bridge #1 at the south end and increasing to Trail Bridge #4 at the north end. From south to north the trail generally parallels the South Saugeen River along the west side, crosses the river, then generally parallels South Saugeen River along the east side. The South Saugeen River confluences with the Saugeen River towards the north end of this section of trail.

The gravel and earth surfaced trail averages 3.0 m in width and is generally raised from the adjacent terrain. The trail is not posted for speed restrictions. Being railway bridges they were not designed to the Canadian Highway Bridge Design Code (CHBDC) or predecessor vehicular bridge codes, but rather to railway design standards at time of construction. Date of construction of the four bridges is unknown. However, the Canadian Pacific Railway (CPR) appears to have constructed this Walkerton branch line around 1906.

Appendix A contains a copy of the 2018 Ontario Structure Inspection Manual (OSIM) Form reports with associated photos for each site, by others. This appendix also contains site photos from Tatham's August 2022 site assessment. Appendix B contains Existing Site Plans.

2.1.1 Trail Bridge #1

Trail: This site is the first crossing north of Concession 2 - South Line/Cemetery Road. The trail is on a straight tangent with a flat vertical profile. There is mature tree and vegetation growth along either side of the trail. There are no approach barriers.

Load Capacity: This site is open to users.

Bridge Condition: This is a 17.8 m four span timber trestle bridge. The gravel covered timber plywood with geotextile fabric deck is supported by transverse timber cross ties and 8 longitudinal timber stringers spanning abutment to pier and pier to pier. The pier and abutment trestles consist of timber caps bearing on 5 timber piles. All heavy timber is creosote treated. The clearance between the deck railing system is approximately 3.0 m.

The bridge is in generally fair to good condition, with isolated areas of poor. The ballast walls are deteriorating with various degrees of rot, the north pier cap beam is rotting and deforming, and several pier bracing members have various degrees of rot.

Hydrology: The bridge spans over a South Saugeen River oxbow, with the main river to the east. There was no evidence of water or flowing water at the time of inspection. During high flows within the South Saugeen River the oxbow channel would carry water, or during high rainfall or other events.

Utilities: There are no utilities on or immediately adjacent to the bridge.

2.1.2 Trail Bridge #2

Trail: This site is the second crossing north of Concession 2 - South Line/Cemetery Road. The trail is on a straight tangent with a flat vertical profile. There is mature tree and vegetation growth along either side of the trail. There are no approach barriers.

Load Capacity: This site is closed to users and has timber barricades and signage indicating "Bridge Closed to Vehicle and Pedestrian Traffic".

Bridge Condition: This is an 18.5 m four span timber trestle bridge. The gravel covered timber plywood with geotextile fabric deck is supported by transverse timber cross ties and 8 longitudinal timber stringers spanning abutment to pier and pier to pier. The pier and abutment trestles consist of timber caps bearing on 5 timber piles. All heavy timber is creosote treated. The clearance between the deck railing system is approximately 3.2 m.

The bridge is in generally poor to fair condition. The ballast walls are deteriorating with significant rot and section loss, the north abutment cap beam is rotting and deforming, the north abutment piles have extensive rot and deformations, the south abutment piles have isolated rot, the north pier cap is rotting and deforming, and the pier piles are generally exhibiting rot and isolated section loss.

Hydrology: The bridge spans over a South Saugeen River oxbow, the same oxbow that Trail Bridge #1 spans, with the main river to the east. There was no evidence of water or flowing water at the time of inspection. During high flows within the South Saugeen River the oxbow channel would carry water, or during high rainfall or other events.

Utilities: There are no utilities on or immediately adjacent to the bridge.

2.1.3 Trail Bridge #3

Trail: This site is the third crossing north of Concession 2 - South Line/Cemetery Road. The trail is on a large radius horizontal curve with a flat vertical profile. It spans the South Saugeen River. There is mature tree and vegetation growth along either side of the trail. There are no approach barriers.

Load Capacity: This site is open to users.

Bridge Condition: This is a 35.6 m two-span steel through plate girder bridge, with deck lengths of approximately 15.8 m and 19.8 m. Note the OSIM indicates spans of 15.9 m and 18.7 m which are typically bearing-to-bearing. Being on a horizontal curve there is a slight deflection of approximately 4 degrees between the spans centered on the pier. The gravel covered timber plywood with geotextile fabric deck is supported by transverse timber cross ties, 4 longitudinal steel stringers spanning between transverse floor beams that are in turn supported by 2 exterior steel through-plate girders. The timber cross ties are creosote treated. The pier and abutments consist of cast-in-place concrete. There are timber retaining walls extending away from the concrete ballast walls on all four quadrants. A rounded and sloped pier nose is on the east upstream side. The clearance between the deck railing system is approximately 3.6 m.

The bridge is in generally good condition. The deck appears to have some localized deterioration, likely from rot, as there are isolated areas of granular loss as evidenced from soffit observations. The steel members have light corrosion, with areas of medium corrosion. The abutment and pier concrete has light medium scaling. The north abutment bearing seat east end has concrete disintegration, and the ballast wall west end has a small area of deterioration with exposed reinforcing steel. The pier top has concrete disintegration at the east end.

Hydrology: The bridge spans over the South Saugeen River essentially centered on an S-curve within the river.

Utilities: There are no utilities on or immediately adjacent to the bridge.

2.1.4 Trail Bridge #4

Trail: This site is the fourth crossing north of Concession 2 - South Line/Cemetery Road. The trail is on a straight tangent with a flat vertical profile. There is mature tree and vegetation growth along either side of the trail. There are no approach barriers.

Load Capacity: This site is closed to users and has timber barricades and signage indicating "Bridge Closed to Vehicle and Pedestrian Traffic".

Bridge Condition: This is a 40.0 m five-span steel pony truss with timber approach spans bridge. The four approach spans, two north and two south, are each approximately 3.6 m long totalling 7.2 m per approach or 14.4 m in total, and the centre span pony truss is approximately 24.5 m long. Over the truss, the gravel covered timber plywood with geotextile fabric deck is supported by transverse timber cross ties, which are in turn supported by 4 longitudinal steel stringers spanning between transverse floor beams that are supported by 2 exterior steel trusses. Over the approach spans, the deck is supported by transverse timber cross ties and 6 longitudinal timber stringers spanning abutment to pier and pier to pier. The pier and abutment trestles consist of timber caps bearing on 5 timber piles. The piers supporting the end of the truss consist of a tiered timber column configuration, with cribbing underneath the truss bearing points. All heavy timber is creosote treated. The clearance between the deck railing system is approximately 3.6 m.

The bridge is in generally poor to fair condition. The deck appears to have some localized deterioration, likely from rot, as there are isolated areas of granular loss as evidenced from soffit observations. The ballast walls are deteriorating with significant rot and section loss. The two piers supporting the truss exhibit deterioration including rot, with visible settlement of the truss at the northwest corner due to rotting and crushing of the supporting timber. The remaining pier piles exhibit rot, and section loss generally at the groundline. The steel truss members have light corrosion, with areas of medium corrosion.

Hydrology: The bridge spans over a flood plain immediately adjacent to the South Saugeen River which is located just west of the bridge. There was water within the channel at the time of inspection.

Utilities: There are no utilities on or immediately adjacent to the bridge.

2.2 PROBLEM/OPPORTUNITY STATEMENT

In consideration of the existing conditions, the Problem/Opportunity Statement, which sets the framework for the remainder of the Study, is as follows:

"The Town of Hanover has initiated a Municipal Class Environmental Assessment to consider options and to identify a preferred solution to address the deficiencies associated with Bridges 1 to 4 on the Town's South line section as they relate to safety, structural condition, performance, asset management, hydraulic capacity, and design standards."

3 Consultation – Study Commencement

As per the Class EA process (refer to Figure 2), there are a number of points of stakeholder contact. The first point of contact, as discussed in this Section, is the Notice of Study Commencement, which is used to inform the general public and stakeholders of the desired goals of the study, methods to provide comment and the steps in the process. The remaining points of contact are discussed further in the report following the chronological order in which they occurred.

3.1 NOTIFICATION

A Notice of Study Commencement, which is a discretionary point of contact, was published on the Town's website and social media accounts and published in the November 18th edition of The Post. The notice identified the Study Area, the Study methodology, and the EA guidelines to be followed. In addition, it invited public input and comments such that they could be considered in the overall Study design and completion. A copy of the Notice of Study Commencement is provided in Appendix C.

Similar notices were also submitted to the appropriate review agencies, stakeholder groups and special interest groups, a listing of which is provided in Appendix D Contact Database.

3.2 PUBLIC COMMENTS

The following table is a summary of the feedback from the public that was received following the Notice of study Commencement.

One Town resident and former SVCA employee asked to be added to the project mailing list and provided comments on the project. The comments are summarized below, and the associated correspondence is provided in Appendix C.

- The bridge locations are all within the flood plain;
  - Spring is the most common time for high water, but flooding can occur at any time of the year;
  - A large flood occurred in June 2017 with flood waters overtopping the trail just north of Bridge #2;
  - Construction activity along the trail should plan for storage to accommodate the flood risk;
  - South Saugeen River peaks quickly.

- Some of the existing bridges might not be suitable for construction access due to their existing condition:
  - Temporary access through adjacent private property may be feasible for part of the site;
  - If there is a need for a temporary by-pass road adjacent to the bridge sites during construction, then the cost and environmental impacts should be addressed at the EA stage.
- Flood debris such as tree limbs accumulate at Bridge # 3, necessitating its removal on occasion. During the project heavy equipment will be available, and so it would be an opportune time to remove the debris.
- Requested information regarding whether the bridges will be designed for full size maintenance and emergency vehicles, or just by pedestrians and small service vehicles.
- Noted that with construction costs rising, the full project might come in over budget, and that the scope should prioritize making the full trail useable rather than complete only some of the work due to high construction costs:
  - Possible priority could be to remove all three flood plain structures, replace as many as the budget will allow and for the remaining site(s) construct a low level crossing, which would allow for full trail use while waiting for future funding to install a bridge.

3.3 AGENCY COMMENTS

Comments were received from two review agencies as of the submission of this report in response to the Notice of Study Commencement. The comments are summarized below, and the associated correspondence is provided in Appendix C.

Ministry of Heritage, Sport, Tourism, and Culture Industries (MHSTCI)

The MHSTCI advised of the requirement to determine a projects potential impact on cultural heritage resources. Advised of the Municipal Engineers Association Screening criteria and checklist to determine if archaeological investigation and cultural heritage evaluation reports are required and if heritage features are identified that a heritage impact assessment is recommended.

The MHSTCI asked to be notified as to whether any cultural heritage or archaeological studies will be completed.

Ministry of the Environment, Conservation and Parks (MECP)

The MECP advised on what steps are required for completion of a Schedule B Class EA Process, confirmed contact information, and provided a list of potentially affected indigenous communities to be contacted. These communities were contacted.

3.4 INDIGENOUS COMMUNITY COMMENTS

Prior to the commencement of this Class EA process, indigenous communities were contacted by GM Blueplan on behalf of the Town as part of the ICIP funding requirements. Comments were received from two communities as of the submission of this report in response to the Notice of Study Commencement. The comments are summarized below, and the associated correspondence is provided in Appendix C.

Saugeen Ojibway Nation (SON) Environment Office

The SON asked questions relating to the area that will be impacted by construction, and mitigation measures. They requested to have a Field Liaison Representative present during the Stage 1 and 2 archaeological field assessments and requested a copy of the Archaeological Assessment Report (Stage 1 & 2). SON was provided the opportunity to have a representative attend the archaeological field work, and the Draft Stage 1 & 2 Report was issued for review and comment. They confirmed that they had no comments on the field work or report.

Historic Saugeen Métis

The Historic Saugeen Métis requested a copy of the Archaeological Assessment Report (Stage 1 & 2). The Draft Stage 1 & 2 Report was issued for review and comment.

4 Alternative Solutions

Further to the identification of the Problem Statement, a number of possible bridge improvement solutions for each bridge were developed for consideration and evaluation. The associated tasks have been completed in accordance with Phase 2 of the Class Environmental Assessment process. It is noted that the alternative solutions are focused on improving the safety of the bridges while addressing the existing deficiencies. In accordance with the current bridge code, new structures are to achieve a target service life of 75 years. For rehabilitated structures the target service life can vary depending on a number of factors. The expectation for this project is to achieve a reasonably long service life, and in this regard the alternatives are configured to achieve a 75-year additional service life. It is standard practice and reasonable that regular maintenance and periodic minor and/or major rehabilitations will be required to achieve a 75-year service life. Different components deteriorate at different rates depending on a number of factors such as use and exposure to environmental elements, maintenance, repairs, etc. For example, regarding rough sawn timber, i.e., heavy timber, that would be used in the rehabilitation or replacement alternatives, they would be specified for preservative treatment with a preference to be pressure treated to maximize service life.

This section will discuss the proposed alternative solutions to be considered. The evaluation criteria are discussed further in Section 5 and 6.

4.1 TRAIL BRIDGE 1 ALTERNATIVE SOLUTIONS TO BE CONSIDERED

4.1.1 Alternative A – Do Nothing

Under this alternative, only basic improvements and maintenance needs of the bridge are to be addressed, which will essentially maintain the status quo. No structural improvements or changes to the bridge would be made to solve the identified problems and as such they would remain.

While this alternative would not satisfy the objectives of the Town to improve the safety, condition and performance of the bridge, a Do Nothing alternative is suggested for consideration within the Municipal Class EA guidelines. A decision to do nothing would typically be made when the costs of all other alternatives, either financial and/or environmental, significantly outweigh the benefits.

4.1.2 Alternative B – Rehabilitate the Existing Bridge

This alternative would involve rehabilitation of the existing bridge to address deficiencies with respect to the bridge's superstructure and substructure. The intent of the rehabilitation would be to improve the bridge's load carrying capacity and extend its service life. Rehabilitation will

require considerable modification to the structure due to the condition and material type. The final deck elevations would be similar to existing. The rehabilitation would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle. Despite these improvements, given the age of the existing bridge, the target service life would not be achieved.

Based on the existing conditions, it is expected that rehabilitation will include the following work:

- Strengthening of several substructure elements;
- Replacement of several substructure elements;
- Removal of gravel trail surface and replacement of the timber deck and cross ties;
- Replacement or reinforcement of several timber stringers;
- Replacement of timber barrier; and
- The rehabilitated structure will have a bare timber deck.

This alternative partially considers the problem statement.

4.1.3 Alternative C1 – Replace with Prefabricated Bridge

Under this alternative the complete existing structure, including substructure, would be removed. In its place, a single clear span prefabricated steel truss bridge with exposed timber deck on concrete abutments would be installed. The bridge would have an 18.5 m span similar to the existing bridge's total length, and a clear deck width of 3.6 m. The final deck elevations would be similar to existing. The replacement structure would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle.

This alternative fully considers the problem statement.

4.1.4 Alternative C2 – Replace with Deck on Girder Bridge

Under this alternative the complete existing structure, including substructure, would be removed. In its place, a single clear span steel girder bridge with timber deck on concrete abutments would be installed. The bridge would have an 18.5 m span similar to the existing bridge's total length, and a clear deck width of 3.6 m. The final deck elevations would need to be higher than existing to maintain the existing clearance as the girders would be beneath the deck, versus a truss configuration, and the approach grades would need to be raised. The replacement structure would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle.

This alternative fully considers the problem statement.

4.2 TRAIL BRIDGE 2 ALTERNATIVE SOLUTIONS TO BE CONSIDERED

4.2.1 Alternative A – Do Nothing

Under this alternative, only basic improvements and maintenance needs of the bridge are to be addressed, which will essentially maintain the status quo. No structural improvements or changes to the bridge would be made to solve the identified problems and as such they would remain.

While this alternative would not satisfy the objectives of the Town to improve the safety, condition and performance of the bridge, a Do Nothing alternative is suggested for consideration within the Municipal Class EA guidelines. A decision to do nothing would typically be made when the costs of all other alternatives, either financial and/or environmental, significantly outweigh the benefits.

4.2.2 Alternative B – Rehabilitate the Existing Bridge

This alternative would involve rehabilitation of the existing bridge to address deficiencies with respect to the bridge's superstructure and substructure. The intent of the rehabilitation would be to improve the bridge's load carrying capacity and extend its service life. Rehabilitation will require considerable modification to the structure due to the condition and material type. The final deck elevations would be similar to existing. The rehabilitation would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle. Despite these improvements, given the age of the existing bridge, the target service life would not be achieved.

Based on the existing conditions, it is expected that rehabilitation will include the following work:

- Strengthening of several substructure elements;
- Replacement of several substructure elements;
- Removal of gravel trail surface and replacement of the timber deck and cross ties;
- Install new pedestrian barrier;
- Replacement or reinforcement of several timber stringers;
- Replacement of timber barrier; and
- The rehabilitated structure will have a bare timber deck.

This alternative partially considers the problem statement.

4.2.3 Alternative C1 – Replace with Prefabricated Bridge

Under this alternative the complete existing structure, including substructure, would be removed. In its place, a single clear span prefabricated steel truss bridge with exposed timber deck on

concrete abutments would be installed. The bridge would have an 18.3 m span similar to the existing bridge's total length, and a clear deck width of 3.6 m. The final deck elevations would be similar to existing. The replacement structure would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle.

This alternative fully considers the problem statement.

4.2.4 Alternative C2 – Replace with Deck on Girder Bridge

Under this alternative the complete existing structure, including substructure, would be removed. In its place, a single clear span steel girder bridge with timber deck on concrete abutments would be installed. The bridge would have an 18.3 m span similar to the existing bridge's total length, and a clear deck width of 3.6 m. The final deck elevations would need to be higher than existing to maintain the existing clearance as the girders would be beneath the deck, versus a truss configuration, and the approach grades would need to be raised. The replacement structure would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle.

This alternative fully considers the problem statement.

4.3 TRAIL BRIDGE 3 ALTERNATIVE SOLUTIONS TO BE CONSIDERED

4.3.1 Alternative A – Do Nothing

Under this alternative, only basic improvements and maintenance needs of the bridge are to be addressed, which will essentially maintain the status quo. No structural improvements or changes to the bridge would be made to solve the identified problems and as such they would remain.

While this alternative would not satisfy the objectives of the Town to improve the safety, condition and performance of the bridge, a Do Nothing alternative is suggested for consideration within the Municipal Class EA guidelines. A decision to do nothing would typically be made when the costs of all other alternatives, either financial and/or environmental, significantly outweigh the benefits.

4.3.2 Alternative B – Rehabilitate the Existing Bridge

This alternative would involve rehabilitation of the existing bridge to address deficiencies with respect to the bridge's timber deck, and repairs to the concrete substructure. The intent of the rehabilitation would be to maintain the bridge's pedestrian and maintenance vehicle load capacity and extend its service life. Rehabilitation would require replacement of the timber deck and cross ties but would not require rehabilitation or repairs to the steel superstructure. The deck clear width would be 3.6 m. The final deck elevations would be similar to existing. The

replacement deck would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle.

Based on existing conditions, it is expected that rehabilitation will include the following work:

- Removal of gravel trail surface and replacement of the timber deck and cross ties;
- Install new pedestrian barrier;
- Complete concrete repairs to the abutments and pier;
- Replace the timber retaining walls;
- The rehabilitated structure will have a bare timber deck; and

This alternative fully considers the problem statement.

4.3.3 Alternative C – Replace Bridge

Under this alternative, the complete existing superstructure would be removed. In its place, a new superstructure would be installed, using the existing pier and abutments. To maintain existing clearances, clear span prefabricated steel truss bridge superstructures with an exposed timber deck would be installed onto the existing substructure units. The total length would be 36.6 m, with span lengths of 18.3 m and 18.3 m, and a 3.6 m clear deck width. The abutment ballast walls would need to be modified to accommodate the new span lengths. The final deck elevations would be similar to existing. The replacement superstructure would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle.

This alternative fully considers the problem statement.

4.4 TRAIL BRIDGE 4 ALTERNATIVE SOLUTIONS TO BE CONSIDERED

4.4.1 Alternative A – Do Nothing

Under this alternative, only basic improvements and maintenance needs of the bridge are to be addressed, which will essentially maintain the status quo. No structural improvements or changes to the bridge would be made to solve the identified problems and as such they would remain.

While this alternative would not satisfy the objectives of the Town to improve the safety, condition and performance of the bridge, a Do Nothing alternative is suggested for consideration within the Municipal Class EA guidelines. A decision to do nothing would typically be made when the costs of all other alternatives, either financial and/or environmental, significantly outweigh the benefits.

4.4.2 Alternative B1 – Rehabilitate the Existing Bridge

This alternative would involve rehabilitation of the existing bridge to address deficiencies with respect to the bridge's superstructure and substructure. The intent of the rehabilitation would be to improve the bridge's load carrying capacity and extend its service life. Rehabilitation will require considerable modification to the approach spans due to the condition and material type. The deck clear width would be 3.6 m. The final deck elevations would be similar to existing. The rehabilitation would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle. Despite these improvements, given the age of the existing bridge, the target service life would not be achieved.

Based on existing conditions, it is expected that rehabilitation will include the following work:

- Replacement of all substructure elements;
- Removal of gravel trail surface and replacement of the timber deck and cross ties;
- Replacement or reinforcement of several timber stringers;
- Replacement of timber barrier; and
- The rehabilitated structure will have a bare timber deck.

This alternative partially considers the problem statement.

4.4.3 Alternative B2 – Replace the Approach Spans and Foundations

Under this alternative, the approach spans and all foundations would be removed and replaced, while the truss span would be rehabilitated. The approach spans would be replaced with 7.6 m clear span prefabricated steel truss bridge structures with exposed timber deck matching the configuration of the proposed replacement bridges at Trails Bridges 1 and 2. Rehabilitation of the steel truss would require replacement of the timber deck and cross ties but would not require rehabilitation or repairs to the steel superstructure. The truss span would require temporary support while new substructures are constructed. The deck clear width would be 3.6 m. The new foundations would include concrete abutments and piers supported by steel piles. The final deck elevations would be similar to existing. The rehabilitation and replacement structures would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle.

This alternative fully considers the problem statement.

4.4.4 Alternative C – Replace Bridge

Under this alternative, the complete existing structure would be removed. In its place, a new bridge would be installed, including new substructure units. The number of spans could be

reduced to two using the prefabricated steel truss bridge structures with exposed timber deck matching the 18.3 m spans of the proposed replacement bridges at Trails Bridges 1 and 2, for a total length of 36.6 m which approximately matches the existing 40.0 m length. The final deck elevations would be similar to existing. The replacement superstructure would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle.

This alternative fully considers the problem statement.

5 Environmental Inventories

A description of the Study area has been developed considering the following environments:

- Physical Environment;
- Natural Environment;
- Social Environment;
- Economic Environment; and
- Climate Change.

In accordance with the Class EA framework, detailed investigations and analyses with respect to the environment inventories were not required at this point in the Study. Rather, data was obtained based on a number of site visits and from a review of secondary information pertaining to the Study area. The purpose of the inventories is to obtain information upon which the assessment of the alternative solutions can be based. Brief descriptions of the various environments investigated are provided below.

5.1 PHYSICAL ENVIRONMENT

Elements of the physical environment related to the bridge structures and trail were presented in Section 2.1.

The age and condition of the bridges has resulted in closure of portions of the trail. The timber elements of each structure exhibit the most extensive deterioration, with the concrete substructure at Trail Bridge 3 requiring some repairs, and the steel superstructures at Trail Bridges 3 and 4 requiring no repairs or rehabilitation. Trail Bridges 2 and 4 are barricaded and signed “Bridge Closed to Vehicle and Pedestrian Traffic”. These four bridges are along the Town’s South line section which forms part of the Community Trails system.

The geotechnical report indicated that the boreholes encountered a granular pavement structure over deposits of silty sand, silt, sandy gravel, sand and gravel and gravelly sand in wet to saturated conditions. The relative density of the soil deposits is typically loose to compact. The soil deposits encountered at the site appear to be lacustrine deposits within the river valley and floodplain areas. The existing granular pavement structure and soil deposits with organic fibre inclusions/seams at shallow depths are not considered to be suitable bearing strata. The soil deposits are primarily cohesionless soils with relatively low bearing capacities. It is recommended that deep foundations mobilizing soil friction be utilized to support the proposed bridge

structures. The deep foundations could consist of micro-piles, helical piles, or driven piles. The foundation type will be determined through the detailed design.

The On-Site and Excess Soil Management regulation (O.Reg. 406/19) supports improved management of excess construction soil. The geotechnical investigation included soil chemical analysis to determine what type of soil disposal would be feasible. The soils Chemical Analysis Results report is based on chemical results completed on soil and wood samples. They were tested for a number of parameters and compared to Table 1 Full Depth Background Site Condition Standards as per the Ministry of the Environment, Conservation and Parks (MECP) document "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", April 2015, 2011 (Table 1 SCS). Additionally, the soil was also compared with MECP Excess Soil Standards, Table 2.1: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition for residential, parkland, institutional land use presented in O. Reg. 406/19 (Table 2.1 ESQS) for soil disposal purposes. Two soil samples had parameters that exceeded Table 1 SCS and Table 2.1 ESQS. All proposed work will need to include plans to manage the soil as per the regulation, as well as to control the soil during construction including dust control and erosion control to prevent watercourse and groundwater contamination, and specification of approved receiving sites.

Appendix E contains the Geotechnical Investigation Report and soils analysis report consisting of the Chemical Analytical Results.

5.2 NATURAL ENVIRONMENT

Aboud & Associates (AA) completed a natural heritage assessment and scoped Environmental Impact Study (EIS).

Field work was completed on May 27, 2021. This included ecological land classification, botanical inventory, breeding bird survey, amphibian survey, incidental wildlife observation, aquatic assessment, assessment of significant wildlife, and SAR habitat assessment.

An initial search of the natural environment was conducted using the Ministry of Natural Resources (MNR) Natural Heritage Information Centre (NHIC) biodiversity explorer database online within 10 km of the study area. The species are as follows:

- Midland Painted Turtle;
- Scarlet Beebalm;
- Hungerford's Crawling Water Beetle;
- Snapping Turtle; and
- Restricted Species.

A request for information to the MECP identified a sensitive species – at detailed design the MECP should be contacted to determine whether the proposed work may impact the sensitive species.

The MNRF was contacted for fish records for the South Saugeen River.

Seven of the 97 species of birds determined to be breeding (possible, probable or confirmed) in the range of the study area were considered species at risk under the ESA. No habitat for species at risk birds was found present in the study area. Confirmed nesting or overwintering habitat for turtle species was not identified in the subject area, though habitat is likely present within the river. No vegetation communities within the study area are considered rare in the province. No amphibian species observed are considered federal or provincial species at risk.

The small unnamed tributary at Bridge 2 had a high percentage of stream shading and little flow pattern, resulting in a relatively straight morphology and a small pool directly under the bridge and a small riffle downstream. No fish were observed during the assessment. Low flow and low water levels may affect the likelihood of this stream supporting fish habitat.

The South Saugeen River at Bridge 3 has little stream shading at the site, mostly due to the overall size of the river and adjacent agricultural land use. Flow was moderate, and the river is very turbid. There is little buffer between the adjacent agricultural field and the river, which may lead to erosion, especially during flooding events. Juvenile fish and minnow species were observed with the shallow/calm waters near the right bank of the river, immediately downstream of the bridge. There are pockets of candidate habitat for the Fawnsfoot mussel.

The unevaluated wetlands were reviewed following consultation with the SVCA. They are determined to contain amphibian breeding habitat (woodland). The proposed bridge alternatives are unlikely to impact the wildlife habitat, provided no changes to the footprint occur, and all proposed mitigation and timing windows are adhered to.

Candidate habitat for 18 SAR was identified in the study area, including Snapping Turtle, Eastern Ribbonsnake, Milksnake and Fawnsfoot mussel in the study area limits, and Eastern Meadowlark in the lands adjacent to the study area.

AA assessed the proposed replacement or repair of the bridges. The bridges are proposed to be repaired or reconstructed in the same location as existing, with no changes to the existing footprint. Subject to future detailed design of each crossing during the EA process, repair or replacement is anticipated to have minor to no impacts on the watercourse and natural features compared to current conditions, under the assumption that no changes to the existing footprint and no in-water works is proposed at Bridge 3.

Mitigation measures recommended include:

- Prepare and implement an Erosion and Sediment Control Plan (ESC) as part of detailed design;
- Install and monitor a silt and sediment control barrier;
    - Silt fence to be inspected weekly during construction and following a storm event of 25mm of rainfall within 24 hours;
- ESC measures to be kept in place until bridge replacement and repair work is completed, and disturbed soils have been vegetated;
- The area of construction disturbance shall be kept to a minimum;
- Control access and movement of equipment and people;
- Control water contamination through good housekeeping practices, including refueling away from all water sources;
- Minimize the use of heavy equipment in sensitive areas;
- Works are to be located as far away from natural feature boundaries as possible;
- Equipment is to be limited to the construction allowance area and is not to encroach within the adjacent forested and wetland communities or watercourse;
    - Designate an equipment storage area as far as possible from existing natural features;
- Accumulated sediment and debris to be removed before silt fence is removed;
- All disturbed areas will be re-vegetated or restored with site appropriate indigenous plants;
- Implement a restoration and compensation plan within the areas of impact associated with the replacement and repair of the bridges. A compensation plan would include re-vegetation, reinstating trees at a minimum 2:1 replacement ratio, etc. The AA natural heritage assessment and scoped Environmental Impact Study (EIS) report provides additional details.
- Time activities to avoid wildlife disturbance during critical life stages;
    - No in-water works are permitted from March 15 to July 15 (spring timing restrictions) and October 1 to May 31 (fall timing restrictions), as per DFO fisheries timing windows;

- Avoid removal of trees and vegetation during the generalized breeding bird nesting period from April 1 to August 31. If removal of vegetation is to occur during the general nesting period, a nest search should be carried out by a skilled and experienced Biologist;
- Installation of nesting bird exclusion measures (e.g., netting) recommended under all structures prior to the beginning of the generalized breeding bird nesting period (April 1);

- Compensate for trees removed at a 2:1 or 3:1 ratio;
- Choose designs and materials that will minimize impacts;
- Maintain existing footprints for all structures; and
- Limit any cleaning solutions or paint used on the bridges and take appropriate precautions to avoid products entering the watercourse.

If the proposed activities cannot avoid impacting protected species and their habitats, application for an authorization under the Endangered Species Act (ESA) will be required.

AA assessed all related policies and determined the effects of the work and required applications.

The complete report is in Appendix F Environmental Impact Study.

5.2.1 Provincial Policy Statement (PPS)

To fulfill the requirement under the PPS, natural features were inventoried and assessed for potential and actual impacts from the proposed bridge construction.

5.2.2 Federal Fisheries Act

The South Saugeen River is considered a fish-bearing water, and the area and fish are protected under the Federal Fisheries Act. Work must avoid causing serious harm to fish and fish habitat unless authorized to do so by the Department of Fisheries and Oceans Canada (DFO). A DFO self-assessment or DFO request for review of the proposed work at Bridge 3 will be needed to ensure compliance under the Fisheries Act. If it is determined that proposed actions may cause serious harm to fish that cannot be mitigated for, then a Fisheries Act Authorization would be required.

5.2.3 Saugeen Valley Conservation Authority

The structures are located entirely within the Saugeen Valley Conservation Authority (SVCA) and are adjacent to unevaluated wetlands to the east and west of the existing trail and bridges. Wetlands are regulated under the Development, Interference with Wetlands and Alteration to

Shorelines and Watercourses Regulation. Any development or interference within wetlands or development in areas of interference requires permission from the SVCA. This will be necessary for any work at all four structures. An EIS to assess the hydrologic impact may be required if disturbance relating to vegetation, drainage and soil is not avoided/minimized. AA's report goes into further detail on the restrictions and limitations to development. Watercourse crossings are preferred to have an open footing, an alignment compatible with stream morphology, size and location such that there is no increase in upstream or downstream erosion or flooding, and consideration of fish and wildlife passage.

The pedestrian bridge repair and replacements meet SVCA policy, as it is considered Public Infrastructure. Hydrological impacts to the watercourse and changes to flood capacity should be minimized through detailed design, and appropriate mitigation measures should be applied through design and construction planning and disturbed areas restored or enhanced where appropriate.

5.2.4 Town of Hanover Zoning Bylaw & Official Plan

The Town has zoned the study area as Hazard, Open Space and Regulated. Accessory structures for trails such as stiles, stairways, markers, bridges and benches are included on the permitted uses under this zoning by-law (2912-15). Structure replacement will require approval of the SVCA and the Municipality but does not contravene the Zoning by-law. The EIS has addressed the requirements of the Town of Hanover OP, and mitigation measures have been recommended to ensure that there will be no negative impacts to the surrounding natural features or their ecological functions.

5.2.5 County of Bruce Official Plan and the Grey County Official Plan

County of Bruce Official Plan and the Grey County Official Plan designate the study area as a Hazard, and the official plan encourages the conservation, preservation and enhancement of the natural heritage features, ecological functions and water resources. Structures necessary to permit passive outdoor recreation use are permitted but may require the submission of an Environmental Impact Study for development within this area.

Based on the findings of this EIS, the recommended mitigation prior, during and postconstruction ensures that the repair and replacement of the pedestrian bridges will not impair ecological processes or the environmental features and therefore will not contravene the County of Bruce OP.

Since there is no feasible alternative for the location of the pedestrian bridges based on the existing trail alignment, the project does not contravene the Grey County OP.

5.2.6 Source Water Protection

The South Saugeen River is part of the Saugeen, Grey Sauble, Northern Bruce Peninsula Source Protection Region. In this region, Municipal drinking water comes from underground aquifers, drawn from wells located across the region, or Lake Huron and Ruhl Lake surface water intakes.

Based on the Source Protection Region's mapping, the bridges are located near, but outside of, Significant Groundwater Recharge Areas with a vulnerability score of 2. Vulnerability scores represent the susceptibility of an area to contamination and range up to 10. No current policies through the Source Protection Plan for this region apply to areas with a vulnerability of 2.

All work will be completed in compliance with the Source Protection Plan, including measures to prevent groundwater contamination through drainage from construction areas or chemical contamination.

5.2.7 Surface Water

The bridges are located within the Great Lakes – St. Lawrence River primary watershed, Eastern Lake Huron secondary watershed, Saugeen River tertiary watershed and South Saugeen River Outlet quaternary watershed. The South Saugeen River is the main body of water that will need to be protected during construction. No in-water work is anticipated for any of the alternatives discussed below. With no significant surface water impacts, no surface water monitoring program is recommended at this time.

There is no servicing infrastructure within the study area.

If dewatering or bypassing of the river water is required for the proposed work, approval to remove and relocate aquatic communities will be required. At this time, no dewatering is expected.

5.3 SOCIAL ENVIRONMENT

The social environment includes any matters related to existing residents and businesses, as well as the general public. Matters for consideration in relation to the social environment include the following:

- noise impacts to area residents and businesses are to be considered. This will primarily be an issue during construction and can be mitigated by scheduling permitted construction hours;
- the safety of the crossings is of utmost importance; and

- as the structures currently meet the standard geometry for pedestrian bridges, including maintenance vehicles, and they are located within Town property, no expansion of right-of-way will be necessary, and no property acquisition will be required.

The bridges form an integral part of the Community Trails system, and the bridge closures result in portions of the trail being in accessible to the public, with the trail system being approximately 6 km in total length. This section of trail forms the southern terminus of the trail system. Access to the remaining northly portions of the trial is currently from Grey County Road 10 - 7th Avenue.

5.3.1 Archaeological Investigation

Golder Associates Ltd (Golder) completed a Stage 1 & 2 Archaeological Assessment of lands potentially affected by the proposed bridge improvements at Bridges 1, 2 and 4.

Areas retaining archaeological potential were identified at Bridge 1 and Bridge 4, and subject to Stage 2 test pit surveys. No archaeological resources were identified during the Stage 2 Archaeological Assessment.

A copy of the report is included in Appendix G Archaeological and Heritage.

5.3.2 Cultural Heritage Evaluation

Golder completed a Cultural Heritage Evaluation (CHER) of Bridge 1, and Amick Consultants Limited (Amick) completed a CHER of Bridges 2, 3 and 4.

Golder determined that Bridge 1 has no cultural heritage value and does not require further investigation before completion of rehabilitation or replacement work. Amick determined that Bridges 2, 3 and 4 are considered to represent cultural heritage resources with Cultural Heritage Value or Interest (CHVI). A Heritage Impact Assessment (HIA) for each of these structures is required in order to consider viable alternatives to maintain the function of the bridges at each crossing while respecting the CHVI of each structure.

Golder completed an HIA for Bridges 2, 3 and 4, including additional site-specific research for each bridge to supplement the existing CHER. Golder concluded that Bridge 2 should not be considered a cultural heritage resource and does not require an HIA. Through a review of proposed impacts, Golder determined that rehabilitation of Bridges 3 and 4 will result in no shadow, isolation, direct or indirect obstruction or change in land use impacts, but that potential impacts as a result of destruction and alteration of heritage attributes and land disturbances cannot be determined until the rehabilitation plans are prepared. The intent to rehabilitate the bridges is in-line with the best conservation practices that heritage resources be repaired to allow for continued use instead of being replaced.

Bridge 3 is considered a representative example of its type of structure and has potential to yield information about the early operation of CN Rail. The heritage attributes include:

- Two span length;
- Substructure with concrete abutments and concrete pier; and
- Superstructure composed of steel I-shaped girders, stiffener plates, floor beams and stringers with cross-bracing and riveted connections.

Bridge 4 is considered a representative example of the steel warren pony truss bridge and has potential to yield information about the early operation of CN Rail. The heritage attributes include:

- Single span length (the truss span); and
- Superstructure with steel trusses in triangular pattern with vertical members at each node between the bottom and top chords, steel floor beams and stingers with cross-bracing ad riveted connections.

Golder recommends the following in order to protect the cultural heritage value or interest of Bridges 3 and 4:

- Rehabilitation plans include repair to heritage attributes where possible and replacement in kind in keeping with the original design where required; and
- The rehabilitation plans be evaluated by a qualified heritage professional to identify any destruction or alteration impact and recommend appropriate alternatives, mitigation and conservation methods.

A copy of these reports is included in Appendix G Archaeological and Heritage.

5.4 ECONOMIC ENVIRONMENT

With respect to the economic environment, the costs associated with each alternative will be considered, including construction costs and/or maintenance costs. For the purposes of preliminary assessments, the costs will be considered on a qualitative basis only (e.g., least costly, most costly). No expansion of right-of-way will be necessary, and no property acquisition will be required. The trail is pedestrian access only, other than for maintenance vehicles, therefore there are no impacts to commercial vehicle access or to motorized recreational vehicle use. Although this section of the trail system does not access businesses or other related revenue generators, it does add to the overall attractiveness of the Town and can have indirect negative economic impacts through reduced well-being amenities.

5.5 CLIMATE CHANGE

With respect to Climate Change, two factors are considered: The increase in greenhouse gas emissions by fabrication of components, construction, or by the completion of the project; and the alternative's resiliency to climate change.

Road and bridge construction projects can incorporate the use of new and recycled materials to reduce emissions related to manufacture and fabrication of materials and components. These sites will require minimal trail reconstruction, therefore limited any import of new grade building material. Trail Bridge 3 is planned to be rehabilitated by re-using the existing concrete abutments and pier, and the steel superstructure, the only new construction is related to replacement of the timber deck and barriers. Trail Bridge 4 was planned for replacement; however, it is being investigated to be rehabilitated by maintaining the steel truss superstructure, new construction would be related to the approach spans and replacement of the truss timber deck and all barriers. Once constructed the structures would not contribute to further emissions, other than through normal activities such as maintenance, repairs, and future works.

Trail Bridges 1,2 and 4 span flood plain features, and not directly the South Saugeen River. Trail Bridge #3 spans the South Saugeen River. Historical anecdotes indicate the structures have little to no impacts on the South Saugeen River flows. This is likely as a result of being a former rail line which were historically constructed to accommodate flood events and generally remain above flood elevations.

6 Evaluation of Alternative Solutions

This section will discuss the evaluation of the alternative solutions as previously described. The results of the evaluation are considered preliminary given the need to solicit agency and public input. The evaluation is descriptive or qualitative in nature allowing for a comparative evaluation of the pros and cons associated with each option.

6.1 EVALUATION CRITERIA

In completing the evaluation, a number of criteria will be considered as outlined below.

Physical Environment

- Trail geometry and alignment
- Structural integrity and load restrictions
- Trailside protection
- Access
- Maintenance

Natural Environment

- Fisheries/aquatic impact
- Wildlife/terrestrial impacts
- Vegetation impacts

Social Environment

- Noise/construction impacts
- Ease of access for residents (Accessibility for Ontarians with Disabilities Act - AODA)
- Overall safety
- Property acquisition requirements
- Community impacts

Cultural Heritage Environment

- Archaeological impacts
- Cultural heritage impacts

- First Nations Impacts

Economic Environment

- Construction costs
- Future maintenance costs
- Land acquisition costs

Climate Change

- Impact on the environment
- Resiliency to climate change

The key evaluation criteria will focus on issues such as cost (including initial capital costs, and long-term life cycle maintenance and operational costs), structural performance, public safety, environmental impacts, use and justification, traffic management, and construction duration.

6.2 ASSESSMENT OF ALTERNATIVE SOLUTIONS

The potential effects and impacts associated with each alternative are noted in Tables 1, 3, 5 and 7, and a summary of the evaluation is also provided for each alternative.

The above-noted tables indicate with “check marks” and “x’s” whether an evaluation criterion is considered to have a benefit to the assessed environment in that alternative or be unfavorable/make no improvement.

Tables 2, 4, 6, 8 and 9 numerically weigh the alternatives as relates to assessment criteria. The weight of each environment, divided into specific criteria within each environment has been assigned. The scores range from -2 to +2, with -2 representing a significant negative impact, 0 denoting no impact and +2 denoting a significant positive impact.

6.2.1 Score

Scores have been established for each criterion under each alternative to reflect the associated degree of impact in relation to Alternative A (do nothing). A score of -2 denotes a negative impact, 0 denotes no impact and +2 denotes a positive impact. The score was based on a qualitative assessment of the various alternatives.

As Alternative A (do nothing) is intended to maintain the status quo, it has been assigned a score of 0 - all other scores should be read relative to that of Alternative A.

6.2.2 Weight

It is recognized that some of the noted criteria within each environment are more important than others in the overall assessment. Likewise, some of the environments are of greater importance than others. In this regard, further to the scores which reflect the effects and impacts, a weighted scoring system has been employed. Weights have been assigned to the evaluation criteria, to reflect their relative importance within their associated environment, and also in consideration of the individual environments considered. The total environment weights are noted below:

- Physical Environment - total weight of 25;
- Natural Environment - 15;
- Social Environment - 20;
- Cultural Heritage Environment - 10;
- Economic Environment - 25;
- Climate Change – 5; and
- Total Weight - 100 points.

The associated criteria and environment weights are indicated in Tables 2, 4, 6, 8 and 9.

6.2.3 Weighted Score

The range of possible weighted scores (individual weight x score) associated with each environment are as follows (and are indicative of the significance placed with each):

- Physical Environment: -50 to +50 points;
- Natural Environment: -30 to +30 points;
- Social Environment: -40 to +40 points;
- Cultural Heritage Environment: -20 to +20 points;
- Economic Environment: -50 to + 50 points;
- Climate Change: -10 to +10; and
- Total: -200 to +200 points.

Based on the total weighted score for each alternative, an overall ranking was determined. The resulting weighted scoring system and ranking is presented in Tables 2, 4, 6, 8 and 9.

Evaluation Criteria	Alternative A Do Nothing	Alternative B Rehabilitate the Existing Bridge	Alternative C1 Replace with Prefabricated Bridge	Alternative C2 Replace with Deck on Girder Bridge
Physical Environment	✗ safety of bridge will decrease over time ✗ no improvement to load carrying capacity ✗ no improvement to barrier protection ✗ No extension to service life ✗ trail length and access will be reduced	✓ safety of bridge can be improved ✓ barrier protection can be upgraded to standard ✓ Vertical alignment will remain unchanged ✗ shortest extension of service life	✓ increased load capacity ✓ barrier protection can be upgraded to standard ✓ longest extension of service life	✓ increased load capacity ✓ barrier protection can be upgraded to standard ✓ longest extension of service life ✗ raise in vertical alignment at structure to accommodate deeper superstructure to maintain hydraulic capacity
Natural Environment	✓ no impacts to environment or habitat	✗ potential for impacts in areas adjacent to existing substructure during construction ✓ potential impacts can be mitigated with best practices	✗ potential for impacts in areas adjacent to existing and new substructure during construction ✗ increased review requirements from agencies ✓ potential impacts can be mitigated with best practices	✗ potential for impacts in areas adjacent to existing substructure during construction ✗ increased review requirements from agencies ✓ potential impacts can be mitigated with best practices
Social Environment	✓ no impacts to existing abutting lands ✓ no construction delays or temporary trail closures during construction	✓ no impacts to existing abutting lands ✗ longer construction time and trail closure	✓ no impacts to existing abutting lands ✓ shorter construction time and length of trail closure compared to rehabilitation	✗ no impacts to existing abutting lands ✓ shorter construction time and length of trail closure compared to rehabilitation
Cultural Heritage Environment	✓ no archaeological or cultural heritage impacts	✓ no archaeological or cultural heritage impacts	✓ no potential for archaeological impacts to existing abutting lands ✓ no cultural heritage impacts	✓ no potential for archaeological impacts to existing abutting lands ✓ no cultural heritage impacts
Economic Environment	✓ no construction costs ✗ greatest maintenance costs	✗ higher overall construction cost ✗ greater maintenance costs	✓ lower overall construction costs compared to rehabilitation ✓ less maintenance costs ✓ Savings in using similarly configured prefabricated bridges	✓ lower overall construction costs compared to rehabilitation ✓ less maintenance costs
Climate Change	✓ no effect on the environment ✗ no improvements to hydraulic capacity or resistance to the effects of climate change	✓ no long-term effect on the environment ✗ no improvements to hydraulic capacity or resistance to the effects of climate change	✓ no long-term effect on the environment ✓ potential to improve hydraulic capacity and resistance to the effects of climate change with removal of piers	✓ no long-term effect on the environment ✓ potential to improve hydraulic capacity and resistance to the effects of climate change with removal of piers

Table 1: Qualitative Evaluation of Alternative Solutions – Trail Bridge 1

Assessment Criteria		Weight	Alternative A Do Nothing		Alternative B Rehabilitate the Existing Bridge		Alternative C1 Replace with Prefabricated Bridge		Alternative C2 Replace with Deck on Girder Bridge	
			score	weighted score	score	weighted score	score	weighted score	score	weighted score
Physical Environment	trail geometry and alignment	5	0	0	0	0	0	0	-1	-5
	structural integrity and load restrictions	5	0	0	1	5	2	10	2	10
	trailside protection, barriers on bridge	5	0	0	1	5	1	5	1	5
	multi-use trail operations	5	0	0	1	5	2	10	2	10
	maintenance	5	0	0	0	0	2	10	2	10
	Sub-Total	**25**		**0**		**15**		**35**		**30**
Natural Environment	fisheries/aquatic impacts	6	0	0	0	0	1	6	1	6
	wildlife/terrestrial impacts	6	0	0	0	0	1	6	1	6
	vegetation impacts	3	0	0	-1	-3	0	0	0	0
	Sub-Total	**15**		**0**		**-3**		**12**		**12**
Social Environment	noise/construction impacts	1	0	0	-1	-1	-1	-1	-1	-1
	ease of access for residents	6	0	0	0	0	0	0	0	0
	emergency services	3	0	0	1	3	2	6	2	6
	property acquisition requirements	3	0	0	0	0	0	0	0	0
	community impacts	7	0	0	1	7	2	14	2	14
	Sub-Total	**20**		**0**		**9**		**19**		**19**
Cultural Heritage Environment	archaeological impacts	3	0	0	0	0	0	0	0	0
	heritage impacts	4	0	0	0	0	0	0	0	0
	First Nations impacts	3	0	0	0	0	0	0	0	0
	Sub-Total	**10**		**0**		**0**		**0**		**0**
Economic Environment	construction costs	10	0	0	-2	-20	-1	-10	-1.5	-15
	future maintenance costs	10	0	0	-1	-10	0	0	0	0
	land acquisition costs	5	0	0	0	0	0	0	0	0
	Sub-Total	**25**		**0**		**-30**		**-10**		**-15**
Climate Change	impact on the environment	2	0	0	0	0	0	0	0	0
	resiliency to climate change	3	0	0	0	0	1	3	1	3
	Sub-Total	**5**		**0**		**0**		**3**		**3**
TOTAL ENVIRONMENT ASSESSMENT		**100**		**0**		**-9**		**59**		**49**
OVERALL RANKING (greatest score = highest ranking)				**3**		**4**		**1**		**2**

Weight: reflects the relative importance of each evaluation criteria within each project environment, and the relative importance of each project environment in relation to one another

Score: reflects the effect of each alternative as it relates to the evaluation criteria in comparison to the Existing Conditions (status quo); -2 denotes a significant negative impact, 0 denotes no impacts and +2 denotes a significant positive impact

Weighted Score: product of weight x score

Table 2: Evaluation of Alternative Solutions with Weighted Scoring – Trail Bridge 1

6.3 TRAIL BRIDGE 1 ALTERNATIVE SOLUTIONS

6.3.1 Alternative A – Do Nothing

The Do Nothing alternative does not adequately address the problem statement. While costs will be negligible for this alternative in the short-term, long-term maintenance costs could become substantial, especially as the bridge ages. A benefit to this alternative is that no immediate negative impacts will be endured by the natural environment, although such impacts are expected to be minimal with the other alternative solutions and appropriately mitigated. Over the remaining life of the bridge, some negative impact to the environment is expected as deterioration of the bridge elements will lead to deleterious material (pieces of creosote treated wood) entering the floodplain. This alternative does not address public safety, or structural inadequacy issues, and thus does not consider the problem statement and as such does not achieve the goals of the study.

Physical Environment – safety will continue to decrease over time as the bridge continues to deteriorate. As with Trail Bridge #2, the bridge will sooner than later need to be closed and being the first bridge from the south access to the trail system will further affect use of the system. The bridge will eventually need to be removed prior to collapse.

Natural Environment - A benefit to this alternative is that no negative impacts will be endured by the natural environment, although such impacts are expected to be minimal with the other alternative solutions and appropriately mitigated. There will be no surface water impacts with this alternative, and no mitigation measures will be required.

Social Environment – there will be no impacts to abutting lands, though the other alternatives have no expected impacts as well, and no immediate change will be made to the trail condition. Bridge 1 will remain open in the short term, though it will also eventually require closure. This alternative will have no noise impacts.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridge was investigated and is considered to have no cultural heritage value. This alternative will eventually lead to the structure collapsing or being removed, but no heritage work is required to account for this occurrence.

Economic Environment – There is no immediate cost associated with this alternative. The maintenance cost, should the Town choose to repair or replace the bridge in the long term, will be the highest.

Climate Change – this alternative does not improve or reduce the bridges' resiliency against the effects of climate change.

This alternative does not address public safety, or structural inadequacy issues. For these reasons, this alternative does not consider the problem statement and does not achieve the goals of the study.

6.3.2 Alternative B – Rehabilitate the Existing Bridge

This alternative would involve rehabilitation of the existing bridge to address deficiencies with respect to the bridge's superstructure and substructure. The intent of the rehabilitation would be to improve the bridge's load capacity and increase its service life. Rehabilitation will require considerable modification to the structure due to the condition and material type. Despite these improvements, given the age of the existing bridge, replacement would still be required in the near future. This alternative partially addresses the problem statement.

Physical Environment – safety will be improved, with code-compliant bridge barriers installed.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work. Bridge 1 crosses a typically dry oxbow, and consideration will be made for ensuring construction work does not occur during times of year when flooding through the oxbow is expected, and to limit work during high flow.

Social Environment – there will be no impacts to abutting lands. Bridge 1 will need to be closed for construction. While typically rehabilitation has a considerably lower construction time than replacement, in this case, with several substructure elements in need of extensive rehabilitation or replacement, it is likely to have a similar rehabilitation timeline as a replacement timeline. Once rehabilitation at this site is complete, the trail will be open between the south entrance and the south end of Bridge 2, which is currently closed to the public. This alternative will have noise impacts during the construction period, though the nearest residence is approximately 400 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridge. The bridge was investigated and is considered to have no cultural heritage value. No heritage work is required to account for modifications made in the rehabilitation of the structure.

Economic Environment – While typically rehabilitation could have a lower construction cost than replacement, in this case there are enough major elements in need of extensive rehabilitation or replacement that the cost is higher than for replacement. There are limited methods of

improvement to timber that is showing signs of decomposition and section loss. Additionally, it is likely that more elements requiring replacement will be discovered during the construction process. Future maintenance costs for this alternative will be high, though not as high as the costs associated with Alternative A.

Climate Change – this alternative does not improve or reduce the bridges resiliency against the effects of climate change.

The cost associated with rehabilitation exceeds the benefit of maintaining the existing structure.

6.3.3 Alternative C1 – Replace with Prefabricated Bridge

Under this alternative the complete existing structure, including substructure, would be removed. In its place, a single clear span prefabricated steel truss bridge with exposed timber deck on concrete abutments would be installed. The bridge would have an overall span similar to the existing bridge's total length. The final deck elevations would be similar to existing. The replacement structure would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle.

Physical Environment – safety will be improved with code-compliant railing systems.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work. Bridge 1 crosses a typically dry oxbow. Consideration will be made for ensuring construction work does not occur during times of year when flooding through the oxbow is expected, and to limit work during high flows.

Social Environment – there will be no impacts to abutting lands. Bridge 1 will need to be closed for construction. The use of a prefabricated superstructure will speed up the construction process. The main work at the site will be the demolition of the existing bridge and then construction of abutments to support the prefabricated bridge. Once rehabilitation at this site is complete, the trail will be open between the south entrance and the south end of Bridge 2, which is currently closed to the public. This alternative will have noise impacts during the construction period, though the nearest residence is approximately 400 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridges were investigated and are considered to have no cultural heritage value. No heritage work is required with replacement of the structure.

Economic Environment – Replacement of the structure could have a higher initial cost, but lowest future maintenance costs. However, in this case the extent of rehabilitation works results in replacement being a more cost effective solution. The exposed timber deck will allow for easier inspection of timber elements, and Town maintenance staff will be able to replace individual deteriorated timbers. There will be a cost savings associated with the use of multiple prefabricated bridges with the same configuration, thus reducing the total number of superstructure drawings needed. This savings may be seen depending on the preferred alternatives for Bridges 1, 2 and 4.

Climate Change – this alternative slightly improves the bridges resiliency against the effects of climate change, with the removal of piers from the design. This will allow the bridge to have a higher flow capacity without significantly changing the vertical alignment or span of the structure.

This alternative fully considers the problem statement.

6.3.4 Alternative C2 – Replace with Deck on Girder Bridge

Under this alternative the complete existing structure, including substructure, would be removed. In its place, a single clear span steel girder bridge with timber deck on concrete abutments would be installed. The bridge would have an overall span similar to the existing bridge's total length. The final deck elevations would need to be higher than existing to maintain the existing clearance as the girders would be beneath the deck, versus a truss configuration, and the approach grades would need to be raised. The replacement structure would be designed in accordance with current code requirements and have capacity for pedestrians, and a 10-tonne maintenance vehicle.

Physical Environment – safety will be improved with code-compliant railing systems. In order to match the existing soffit elevation, it is likely that the replacement structure will have a higher deck than the existing structure, altering the vertical alignment of the trail at this location. The trail is overall very flat, so this would have some impacts to trail use.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work. Bridge 1 crosses a typically dry oxbow, and consideration will be made for ensuring construction work does not occur during times of year when flooding through the oxbow is expected, and to limit work during high flow.

Social Environment – there will be no impacts to abutting lands. Bridge 1 will need to be closed for construction. The use of a prefabricated superstructure will speed up the construction process. The main work at the site will be the demolition of the existing bridge and then construction of abutments to support the prefabricated bridge. Once construction at this site is complete, the trail will be open between the south entrance and the south end of Bridge 2, which is currently closed to the public. This alternative will have noise impacts during the construction period, though the nearest residence is approximately 400 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridges were investigated and are considered to have no cultural heritage value. No heritage work is required with replacement of the structure.

Economic Environment – Replacement of the structure could have a higher initial cost, but lowest future maintenance costs. However, in this case the extent of rehabilitation works results in replacement being a more cost effective solution. The exposed timber deck will allow for easier inspection of timber elements, and Town maintenance staff will be able to replace individual deteriorated timbers. There will be a cost savings associated with the use of multiple prefabricated bridges with the same span, requiring only one set of superstructure drawings for several structures. This savings may be seen depending on the preferred alternatives for Bridges 1, 2 and 4.

Climate Change – this alternative slightly improves the bridges resiliency against the effects of climate change, with the removal of piers from the design. This will allow the bridge to have a higher flow capacity without drastically changing the span of the structure.

This alternative fully considers the problem statement.

Evaluation Criteria	Alternative A Do Nothing	Alternative B Rehabilitate the Existing Bridge	Alternative C1 Replace with Prefabricated Bridge	Alternative C2 Replace with Deck on Girder Bridge
Physical Environment	✗ bridge will remain closed ✗ no improvement to load carrying capacity ✗ no improvement to barrier protection ✗ No extension to service life ✗ trail length and access will be reduced	✓ safety of bridge can be improved ✓ barrier protection can be upgraded to standard ✓ Vertical alignment will remain unchanged ✓ Re-open bridge 2 to public access ✗ shortest extension of service life	✓ increased load capacity and re-opening of Bridge 2 ✓ barrier protection can be upgraded to standard ✓ longest extension of service life	✓ increased load capacity and re-opening of Bridge 2 ✓ barrier protection can be upgraded to standard ✓ longest extension of service life ✗ raise in vertical alignment at structure to accommodate deeper superstructure to maintain hydraulic capacity
Natural Environment	✓ no impacts to environment or habitat	✗ potential for impacts in areas adjacent to existing substructure during construction ✓ potential impacts can be mitigated with best practices	✗ potential for impacts in areas adjacent to existing substructure during construction ✗ increased review requirements from agencies ✓ potential impacts can be mitigated with best practices	✗ potential for impacts in areas adjacent to existing substructure during construction ✗ increased review requirements from agencies ✓ potential impacts can be mitigated with best practices
Social Environment	✓ no impacts to existing abutting lands ✓ no construction delays or trail closures (beyond existing closure)	✓ no impacts to existing abutting lands ✗ longer construction time and trail closure	✓ no impacts to existing abutting lands ✓ shorter construction time and length of trail closure compared to rehabilitation	✗ no impacts to existing abutting lands ✓ shorter construction time and length of trail closure compared to rehabilitation
Cultural Heritage Environment	✓ no archaeological or cultural heritage impacts	✓ no archaeological or cultural heritage impacts	✓ no potential for archaeological impacts to existing abutting lands ✓ no cultural heritage impacts	✓ no potential for archaeological impacts to existing abutting lands ✓ no cultural heritage impacts
Economic Environment	✓ no construction costs ✗ greatest maintenance costs	✗ higher overall construction cost ✗ greater maintenance costs	✓ lower overall construction costs compared to rehabilitation ✓ less maintenance costs ✓ Savings in using similarly configured prefabricated bridges	✓ lower overall construction costs compared to rehabilitation ✓ less maintenance costs
Climate Change	✓ no effect on the environment ✗ no improvements to hydraulic capacity or resistance to the effects of climate change	✓ no long-term effect on the environment ✗ no improvements to hydraulic capacity or resistance to the effects of climate change	✓ no long-term effect on the environment ✓ potential to improve hydraulic capacity and resistance to the effects of climate change with removal of piers	✓ no long-term effect on the environment ✓ potential to improve hydraulic capacity and resistance to the effects of climate change with removal of piers

Table 3: Qualitative Evaluation of Alternative Solutions – Trail Bridge 2

Assessment Criteria		Weight	Alternative A Do Nothing		Alternative B Rehabilitate the Existing Bridge		Alternative C1 Replace with Prefabricated Bridge		Alternative C2 Replace with Deck on Girder Bridge	
			score	weighted score	score	weighted score	score	weighted score	score	weighted score
Physical Environment	trail geometry and alignment	5	0	0	0	0	0	0	-1	-5
	structural integrity and load restrictions	5	0	0	1	5	2	10	2	10
	trailside protection, barriers on bridge	5	0	0	1	5	1	5	1	5
	multi-use trail operations	5	0	0	1	5	2	10	2	10
	maintenance	5	0	0	0	0	2	10	2	10
	Sub-Total	**25**		**0**		**15**		**35**		**30**
Natural Environment	fisheries/aquatic impacts	6	0	0	0	0	1	6	1	6
	wildlife/terrestrial impacts	6	0	0	0	0	1	6	1	6
	vegetation impacts	3	0	0	-1	-3	0	0	0	0
	Sub-Total	**15**		**0**		**-3**		**12**		**12**
Social Environment	noise/construction impacts	1	0	0	-1	-1	-1	-1	-1	-1
	ease of access for residents	6	0	0	0	0	0	0	0	0
	emergency services	3	0	0	1	3	2	6	2	6
	property acquisition requirements	3	0	0	0	0	0	0	0	0
	community impacts	7	0	0	1	7	2	14	2	14
	Sub-Total	**20**		**0**		**9**		**19**		**19**
Cultural Heritage Environment	archaeological impacts	3	0	0	0	0	0	0	0	0
	heritage impacts	4	0	0	0	0	0	0	0	0
	First Nations impacts	3	0	0	0	0	0	0	0	0
	Sub-Total	**10**		**0**		**0**		**0**		**0**
Economic Environment	construction costs	10	0	0	-2	-20	-1	-10	-1.5	-15
	future maintenance costs	10	0	0	-1	-10	0	0	0	0
	land acquisition costs	5	0	0	0	0	0	0	0	0
	Sub-Total	**25**		**0**		**-30**		**-10**		**-15**
Climate Change	impact on the environment	2	0	0	0	0	0	0	0	0
	resiliency to climate change	3	0	0	0	0	1	3	1	3
	Sub-Total	**5**		**0**		**0**		**3**		**3**
TOTAL ENVIRONMENT ASSESSMENT		**100**		**0**		**-9**		**59**		**49**
OVERALL RANKING (greatest score = highest ranking)				**3**		**4**		**1**		**2**

Weight: reflects the relative importance of each evaluation criteria within each project environment, and the relative importance of each project environment in relation to one another

Score: reflects the effect of each alternative as it relates to the evaluation criteria in comparison to the Existing Conditions (status quo); -2 denotes a significant negative impact, 0 denotes no impacts and +2 denotes a significant positive impact

Weighted Score: product of weight x score

HANOVER PEDESTRIAN BRIDGES CLASS ENVIRONMENTAL ASSESSMENT SCHEDULE B

Table 4: Evaluation of Alternative Solutions with Weighted Scoring – Trail Bridge 2

6.4 TRAIL BRIDGE 2 ALTERNATIVE SOLUTIONS

6.4.1 Alternative A – Do Nothing

The Do Nothing alternative does not adequately address the problem statement. While costs will be negligible for this alternative in the short-term, long-term maintenance costs could become substantial, especially as the bridge ages. A benefit to this alternative is that no immediate negative impacts will be endured by the natural environment, although such impacts are expected to be minimal with the other alternative solutions and appropriately mitigated. Over the remaining life of the bridge, some negative impact to the environment is expected as deterioration of the bridge elements will lead to deleterious material (pieces of creosote treated wood) entering the floodplain. This alternative does not address public safety, or structural inadequacy issues, and thus does not consider the problem statement and as such does not achieve the goals of the study.

Physical Environment – safety will continue to decrease over time. Bridge 2 is already closed, restricting trail use from the south entrance. The bridge will eventually need to be removed prior to collapse.

Natural Environment - A benefit to this alternative is that no negative impacts will be endured by the natural environment, although such impacts are expected to be minimal with the other alternative solutions and appropriately mitigated. There will be no surface water impacts with this alternative, and no mitigation measures will be required.

Social Environment – there will be no impacts to abutting lands, though the other alternatives have no expected impacts as well, and no immediate change will be made to the trail condition. Bridge 2 will remain closed, so trail access will continue to be restricted. This alternative will have no noise impacts.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridge was investigated and is considered to have no cultural heritage value. This alternative will eventually lead to the structure collapsing or being removed, but no heritage work is required to account for this occurrence.

Economic Environment – There is no immediate cost associated with this alternative. The maintenance cost, should the Town choose to repair or replace the bridge in the long term, will be the highest.

Climate Change – this alternative does not improve or reduce the bridges' resiliency against the effects of climate change.

This alternative does not address public safety, or structural inadequacy issues, and does not re-open the full trail system to public use. For these reasons, this alternative does not consider the problem statement and does not achieve the goals of the study.

6.4.2 Alternative B – Rehabilitate the Existing Bridge

This alternative would involve rehabilitation of the existing bridge to address deficiencies with respect to the bridge's superstructure and substructure. The intent of the rehabilitation would be to improve the bridge's load capacity and increase its service life. Rehabilitation will require considerable modification to the structure due to the condition and material type. Despite these improvements, given the age of the existing bridge, replacement would still be required in the near future. This alternative partially addresses the problem statement.

Physical Environment – safety will be improved, with code-compliant bridge barriers installed and the ability to re-open Bridge 2.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work. Bridge 2 crosses a typically dry oxbow. Consideration will be made to limit work during high flows.

Social Environment – there will be no impacts to abutting lands. Bridge 2 will remain closed until it has been rehabilitated. While typically rehabilitation has a considerably lower construction time than replacement, in this case, with several substructure elements in need of extensive rehabilitation or replacement, it is likely to have a similar rehabilitation timeline as a replacement timeline. Once construction at this site is complete, the trail will be open from the south entrance all the way to Bridge 4, which is currently closed to the public. This alternative will have noise impacts during the construction period, though the nearest residence is approximately 400 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridge. The bridge was investigated and is considered to have no cultural heritage value. No heritage work is required to account for modifications made in the rehabilitation of the structure.

Economic Environment – While typically rehabilitation could have a lower construction cost than replacement, in this case there are enough major elements in need of extensive rehabilitation or replacement that the cost is higher than for replacement. There are limited methods of

improvement to timber that is showing signs of decomposition and section loss. Additionally, it is likely that more elements requiring replacement will be discovered during the construction process. Future maintenance costs for this alternative will be high, though not as high as the costs associated with Alternative A.

Climate Change – this alternative does not improve or reduce the bridges resiliency against the effects of climate change.

The cost associated with rehabilitation exceeds the benefit of maintaining the existing structure.

6.4.3 Alternative C1 – Replace with Prefabricated Bridge

Replacement of the existing structure is higher cost than the other alternatives. Impacts to the environment are increased, since work will occur adjacent to the watercourse. However, considering the condition of the structure, replacement of the bridge has the lowest life cycle cost to the Town and fully addresses the problem statement.

Physical Environment – safety will be improved with code-compliant railing systems, and the trail can be reopened at Bridge 2.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work. Bridge 2 crosses a typically dry oxbow. Work will be limited during expected high flow periods.

Social Environment – there will be no impacts to abutting lands. Bridge 2 will remain closed until it has been replaced. The use of a prefabricated superstructure will accelerate the construction process. The main work at the site will be the demolition of the existing bridge and then construction of abutments to support the prefabricated bridge. When construction at this site is complete, the trail will be open from the south entrance through to Bridge 4, which is currently closed to the public. This alternative will have noise impacts during the construction period, though the nearest residence is approximately 400 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridges were investigated and are considered to have no cultural heritage value. No heritage work is required with replacement of the structure.

Economic Environment – Replacement of the structure could have a higher initial cost, but lowest future maintenance costs. However, in this case the extent of rehabilitation works results in

replacement being a more cost-effective solution. The exposed timber deck will allow for easier inspection of timber elements, and Town maintenance staff will be able to replace individual deteriorated timbers. There will be a cost savings associated with the use of multiple prefabricated bridges with the same configuration, thus reducing the total number of superstructure drawings needed. This savings may be seen depending on the preferred alternatives for Bridges 1, 2 and 4.

Climate Change – this alternative slightly improves the bridges resiliency against the effects of climate change, with the removal of piers from the design. This will allow the bridge to have a higher flow capacity without significantly changing the vertical alignment or span of the structure.

This alternative fully considers the problem statement.

6.4.4 Alternative C2 – Replace with Deck on Girder Bridge

Replacement of the existing structure is higher cost than the other alternatives. Impacts to the environment are increased, since work will occur adjacent to the watercourse. However, considering the condition of the structure, replacement of the bridge has the lowest life cycle cost to the Town and fully addresses the problem statement.

Physical Environment – safety will be improved with code-compliant railing systems. In order to match the existing soffit elevation so as to not affect flow capacity, the replacement structure will have a higher deck than the existing structure, changing the vertical alignment of the trail at this location. The trail is overall very flat, so this would impact on trail use. The trail will be able to re-open at Bridge 2.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work. Bridge 2 crosses a typically dry oxbow, so work should be limited to avoid time periods where high flow is expected.

Social Environment – there will be no impacts to abutting lands. Bridge 2 will remain closed until it has been replaced. The use of a prefabricated superstructure will accelerate the construction process. The main work at the site will be the demolition of the existing bridge and then construction of abutments to support the prefabricated bridge. When construction at this site is complete, the trail will be open from the south entrance all the way to Bridge 4, which is currently closed to the public. This alternative will have noise impacts during the construction period,

though the nearest residence is approximately 400 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridges were investigated and are considered to have no cultural heritage value. No heritage work is required with replacement of the structure.

Economic Environment – Replacement of the structure could have a higher initial cost, but lowest future maintenance costs. However, in this case the extent of rehabilitation works results in replacement being a more cost-effective solution. The exposed timber deck will allow for easier inspection of timber elements, and Town maintenance staff will be able to replace individual deteriorated timbers. There will be a cost savings associated with the use of multiple prefabricated bridges with the same span, requiring only one set of superstructure drawings for several structures. This savings may be seen depending on the preferred alternatives for Bridges 1, 2 and 4.

Climate Change – this alternative slightly improves the bridges resiliency against the effects of climate change, with the removal of piers from the design. This will allow the bridge to have a higher flow capacity without significantly changing the vertical alignment or span of the structure.

Evaluation Criteria	Alternative A Do Nothing	Alternative B Rehabilitate the Existing Bridge	Alternative C Replace the Bridge
Physical Environment	✗ safety of bridge will decrease over time ✗ no improvement to barrier protection ✗ no extension to service life ✗ trail length and access will be reduced over time	✓ safety of bridge can be improved ✓ barrier protection can be upgraded to standard ✓ Vertical alignment will remain unchanged ✓ long extension of service life due to bridge type ✗ minimal improvement to load carrying capacity	✓ barrier protection can be upgraded to standard ✓ long extension of service life
Natural Environment	✓ no impacts to environment or habitat	✓ no significant impacts to environment or habitat ✓ potential impacts can be mitigated with best practices	✗ potential for impacts in areas adjacent to existing substructure during construction ✗ increased review requirements from agencies
Social Environment	✓ no impacts to existing abutting lands ✓ no construction delays or trail closures during construction	✓ no impacts to existing abutting lands ✗ shorter construction time and trail closure	✓ no impacts to existing abutting lands ✗ longest construction time and length of trail closure
Cultural Heritage Environment	✓ no archaeological or cultural heritage impacts	✓ no archaeological impact; ✓ Little cultural heritage impact – maintenance of bridge aesthetic and no modification to large elements required	✓ no potential for archaeological impacts to existing abutting lands ✗ greatest impacts to cultural heritage by removal of existing bridge ✗ additional studies may need to be undertaken as necessary
Economic Environment	✓ no construction costs ✗ greatest maintenance costs	✗ lower overall construction cost ✓ low maintenance costs	✗ greatest overall construction costs ✓ low maintenance costs
Climate Change	✓ no effect on the environment ✗ no improvements to hydraulic capacity or resistance to the effects of climate change	✓ no long-term effect on the environment ✗ no improvements to hydraulic capacity or resistance to the effects of climate change	✓ no long-term effect on the environment

Table 5: Qualitative Evaluation of Alternative Solutions – Trail Bridge 3

Assessment Criteria		Weight	Alternative A Do Nothing		Alternative B Rehabilitate the Existing Bridge		Alternative C1 Replace Bridge	
			score	weighted score	score	weighted score	score	weighted score
Physical Environment	trail geometry and alignment	5	0	0	0	0	0	0
	structural integrity and load restrictions	5	0	0	2	10	2	10
	trailside protection, barriers on bridge	5	0	0	1	5	1	5
	multi-use trail operations	5	0	0	1	5	1	5
	maintenance	5	0	0	1	5	1	5
	Sub-Total	**25**		**0**		**25**		**25**
Natural Environment	fisheries/aquatic impacts	6	0	0	0	0	0	0
	wildlife/terrestrial impacts	6	0	0	0	0	0	0
	vegetation impacts	3	0	0	-0.5	-1.5	-0.5	-1.5
	Sub-Total	**15**		**0**		**-1.5**		**-1.5**
Social Environment	noise/construction impacts	1	0	0	-0.5	-0.5	-1	-1
	ease of access for residents	6	0	0	0	0	0	0
	emergency services	3	0	0	2	6	2	6
	property acquisition requirements	3	0	0	0	0	0	0
	community impacts	7	0	0	0	0	0	0
	Sub-Total	**20**		**0**		**5.5**		**5**
Cultural Heritage Environment	archaeological impacts	3	0	0	0	0	0	0
	heritage impacts	4	0	0	0	0	-2	-8
	First Nations impacts	3	0	0	0	0	0	0
	Sub-Total	**10**		**0**		**0**		**-8**
Economic Environment	construction costs	10	0	0	-0.5	-5	-2	-20
	future maintenance costs	10	0	0	0	0	0	0
	land acquisition costs	5	0	0	0	0	0	0
	Sub-Total	**25**		**0**		**-5**		**-20**
Climate Change	impact on the environment	2	0	0	0	0	0	0
	resiliency to climate change	3	0	0	0	0	0	0
	Sub-Total	**5**		**0**		**0**		**0**
TOTAL ENVIRONMENT ASSESSMENT		**100**		**0**		**24**		**0.5**
OVERALL RANKING (greatest score = highest ranking)				**3**		**1**		**2**

Weight: reflects the relative importance of each evaluation criteria within each project environment, and the relative importance of each project environment in relation to one another

Score: reflects the effect of each alternative as it relates to the evaluation criteria in comparison to the Existing Conditions (status quo); -2 denotes a significant negative impact, 0 denotes no impacts and +2 denotes a significant positive impact

Weighted Score: product of weight x score

Table 6: Evaluation of Alternative Solutions with Weighted Scoring – Trail Bridge 3

6.5 TRAIL BRIDGE 3 ALTERNATIVE SOLUTIONS

6.5.1 Alternative A – Do Nothing

The Do Nothing alternative does not adequately address the problem statement. While costs will be negligible for this alternative in the short-term, long-term maintenance costs could become substantial, especially as the bridge ages. A benefit to this alternative is that no immediate negative impacts will be endured by the natural environment, although such impacts are expected to be minimal with the other alternative solutions and appropriately mitigated. Over the remaining life of the bridge, some negative impact to the environment is expected as deterioration of the bridge elements will lead to deleterious material (granular material, pieces of creosote treated wood) entering the watercourse. This alternative does not address public safety, or structural inadequacy issues, and thus does not consider the problem statement and as such does not achieve the goals of the study.

Physical Environment – safety will decrease over time, and eventually the bridge will need to be closed or rehabilitated.

Natural Environment - A benefit to this alternative is that no negative impacts will be endured by the natural environment, although such impacts are expected to be minimal with the other alternative solutions and appropriately mitigated. There will be no surface water impacts with this alternative, and no mitigation measures will be required.

Social Environment – there will be no impacts to abutting lands (though the other alternatives have no expected impacts as well), and no immediate change will be made to the trail condition. This alternative will have no noise impacts.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridge was investigated and is considered to have cultural heritage value. This alternative will eventually lead to the structure collapsing or being removed, which would have a negative impact on the heritage elements of the bridge.

Economic Environment – There is no immediate cost associated with this alternative. The maintenance cost, should the Town choose to repair or replace the bridge in the long term, will be the highest.

Climate Change – this alternative does not improve or reduce the bridges resiliency against the effects of climate change.

This alternative does not address public safety, or structural inadequacy issues. For these reasons, this alternative does not consider the problem statement and does not achieve the goals of the study.

6.5.2 Alternative B – Rehabilitate the Existing Bridge

Rehabilitation of the existing structure is higher cost and more intrusive than the do-nothing alternative but will have a lower maintenance cost than that alternative. Impacts to the environment are negligible as the work will generally be restricted to the deck. The structure was originally designed as a railway crossing and the structural steel elements are considerably over-designed for the requirements of a trail bridge. Rehabilitating the timber elements will fully address the problem statement and will have a similar service life and maintenance cost to replacement of the structure.

Physical Environment – safety will be improved with code-compliant bridge railings.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work.

Social Environment – there will be no impacts to abutting lands. The structure will require full closure during rehabilitation work. This alternative will have noise impacts during the construction period, though the nearest residence is approximately 250 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridge was investigated and is considered to have cultural heritage value. The heritage attributes indicated in the HIA for this structure include its two-span length, substructure with concrete abutments and concrete pier, and superstructure composed of steel I-shaped girders, stiffener plates, floor beams and stringers with cross-bracing and riveted connections. The proposed rehabilitation will include replacement of timber cross ties and timber deck, so it will have no impact to the cultural heritage attributes of the bridge.

Economic Environment – Rehabilitation will have a higher cost associated with it than the do-nothing alternative, but a lower cost than replacement of the bridge. This alternative will have a low future maintenance cost as well. The proposed exposed timber deck will be more easily inspected and repaired by Town maintenance crews compared to the existing gravel-topped timber deck.

Climate Change – this alternative does not improve or reduce the bridges resiliency against the effects of climate change.

Rehabilitation is the best solution to the problem/opportunity statement for this structure, with the least heritage impact and best lifecycle cost.

6.5.3 Alternative C – Replace the Superstructure

Replacement of the existing structure is higher cost and more intrusive than the other alternatives. Impacts to the environment are increased, since more extensive work will be done over the watercourse. This alternative fully addresses the problem statement but has the largest impacts overall.

Physical Environment – safety will be improved with code-compliant railing systems.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work.

Social Environment – there will be no impacts to abutting lands. The use of a prefabricated superstructure could speed up the construction process. Removal of the existing bridge superstructure will require the use of large cranes and may require dismantling the structure in place. Maintaining the existing abutments and piers will require modifications before installation of the superstructure elements but will speed up the overall process. This alternative will have noise impacts during the construction period, though the nearest residence is approximately 250 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridge was investigated and is considered to have cultural heritage value. The heritage attributes indicated in the HIA for this structure include its two-span length, substructure with concrete abutments and concrete pier, and superstructure composed of steel I-shaped girders, stiffener plates, floor beams and stringers with cross-bracing and riveted connections. This alternative would require more extensive cultural heritage work, including installation of a superstructure that matches the existing structure aesthetically.

Economic Environment – Replacement of the structure has the highest initial cost, and a similar maintenance cost to that of rehabilitation. The exposed timber deck will allow for easier inspection of timber elements, and Town maintenance staff will be able to replace individual deteriorated timbers.

Climate Change – this alternative does not change the bridges resiliency against the effects of climate change.

This alternative fully considers the problem statement.

Evaluation Criteria	Alternative A Do Nothing	Alternative B1 Rehabilitate the Entire Existing Bridge	Alternative B2 Replace the Approach Spans and Foundations	Alternative C Replace Entire Bridge
Physical Environment	✗ safety of bridge will decrease over time ✗ no improvement to load carrying capacity ✗ no improvement to barrier protection ✗ No extension to service life ✗ trail will continue to be closed at this location	✓ safety of bridge can be improved ✓ barrier protection can be upgraded to standard ✓ Vertical alignment will remain unchanged ✓ Re-open bridge 4 to public access ✓ improvement to load carrying capacity	✓ safety of bridge can be improved ✓ barrier protection can be upgraded to standard ✓ Long extension of service life due to approach span replacement ✓ Re-open bridge 4 to public access ✓ improvement to load carrying capacity	✓ barrier protection can be upgraded to standard ✓ long extension of service life ✓ improvement to load carrying capacity
Natural Environment	✓ no impacts to environment or habitat	✗ potential for impacts in areas adjacent to existing substructure during construction ✓ potential impacts can be mitigated with best practices	✗ potential for impacts in areas adjacent to existing substructure during construction ✓ potential impacts can be mitigated with best practices	✗ potential for impacts in areas adjacent to existing substructure during construction ✗ increased review requirements from agencies ✓ potential impacts can be mitigated with best practices
Social Environment	✓ no impacts to existing abutting lands ✓ no construction delays or trail closures during construction	✓ no impacts to existing abutting lands ✗ shorter construction time and trail closure	✓ no impacts to existing abutting lands ✗ short construction time and trail closure	✓ no impacts to existing abutting lands ✗ longest construction time and length of trail closure
Cultural Heritage Environment	✓ no archaeological or cultural/heritage impacts	✓ no archaeological impact; ✓ Little cultural heritage impact – maintenance of bridge aesthetic	✓ no archaeological impact; ✓ Little cultural heritage impact – maintenance of bridge aesthetic	✓ no potential for archaeological impacts to existing abutting lands ✗ greatest impacts to cultural heritage by removal of existing bridge ✗ additional studies to be undertaken as necessary
Economic Environment	✓ no construction costs ✗ greatest maintenance costs	✗ moderate overall construction cost ✓ high maintenance costs	✓ lowest overall construction cost ✓ less maintenance costs	✗ Greatest overall construction costs ✓ low maintenance costs
Climate Change	✓ no effect on the environment ✗ no improvements to hydraulic capacity or resistance to the effects of climate change	✓ no long-term effect on the environment ✗ no improvements to hydraulic capacity or resistance to the effects of climate change	✓ no long-term effect on the environment ✗ no improvements to hydraulic capacity or resistance to the effects of climate change	✓ no long-term effect on the environment ✓ potential to improve hydraulic capacity and resistance to the effects of climate change

Table 7: Qualitative Evaluation of Alternative Solutions – Trail Bridge 4

Assessment Criteria		Weight	Alternative A Do Nothing		Alternative B1 Rehabilitate the Existing Bridge		Alternative B2 Replace the Approach Spans and Foundations		Alternative C Replace Bridge	
			score	weighted score	score	weighted score	score	weighted score	score	weighted score
Physical Environment	trail geometry and alignment	5	0	0	0	0	0	0	0	0
	structural integrity and load restrictions	5	0	0	1	5	2	10	2	10
	trailside protection, barriers on bridge	5	0	0	1	5	1	5	1	5
	multi-use trail operations	5	0	0	1	5	2	10	2	10
	maintenance	5	0	0	1	5	2	10	2	10
	Sub-Total	**25**		**0**		**20**		**35**		**35**
Natural Environment	fisheries/aquatic impacts	6	0	0	-0.5	-3	-0.5	-3	-0.5	-3
	wildlife/terrestrial impacts	6	0	0	-0.5	-3	-0.5	-3	-0.5	-3
	vegetation impacts	3	0	0	-1	-3	-1	-3	-1	-3
	Sub-Total	**15**		**0**		**-9**		**-9**		**-9**
Social Environment	noise/construction impacts	1	0	0	-0.5	-0.5	-1	-1	-1	-1
	ease of access for residents	6	0	0	1	6	1	6	1	6
	emergency services	3	0	0	1	3	2	6	2	6
	property acquisition requirements	3	0	0	0	0	0	0	0	0
	community impacts	7	0	0	0	0	0	0	0	0
	Sub-Total	**20**		**0**		**8.5**		**11**		**11**
Cultural Heritage Environment	archaeological impacts	3	0	0	0	0	0	0	0	0
	heritage impacts	4	0	0	-0.5	-2	-0.5	-2	-2	-8
	First Nations impacts	3	0	0	0	0	0	0	0	0
	Sub-Total	**10**		**0**		**-2**		**-2**		**-8**
Economic Environment	construction costs	10	0	0	-2	-20	-1	-10	-2	-20
	future maintenance costs	10	0	0	-1	-10	0	0	0	0
	land acquisition costs	5	0	0	0	0	0	0	0	0
	Sub-Total	**25**		**0**		**-30**		**-10**		**-20**
Climate Change	impact on the environment	2	0	0	0	0	0	0	0	0
	resiliency to climate change	3	0	0	0	0	1	3	1	3
	Sub-Total	**5**		**0**		**0**		**3**		**3**
TOTAL ENVIRONMENT ASSESSMENT		**100**		**0**		**-12.5**		**28**		**12**
OVERALL RANKING (greatest score = highest ranking)				**3**		**4**		**1**		**2**

Weight: reflects the relative importance of each evaluation criteria within each project environment, and the relative importance of each project environment in relation to one another

Score: reflects the effect of each alternative as it relates to the evaluation criteria in comparison to the Existing Conditions (status quo); -2 denotes a significant negative impact, 0 denotes no impacts and +2 denotes a significant positive impact

Weighted Score: product of weight x score

Table 8: Evaluation of Alternative Solutions with Weighted Scoring – Trail Bridge 4

6.6 TRAIL BRIDGE 4 ALTERNATIVE SOLUTIONS

6.6.1 Alternative A – Do Nothing

The Do Nothing alternative does not adequately address the problem statement. While costs will be negligible for this alternative in the short-term, long-term maintenance costs could become substantial, especially as the bridge ages. A benefit to this alternative is that no immediate negative impacts will be endured by the natural environment, although such impacts are expected to be minimal with the other alternative solutions and appropriately mitigated. Over the remaining life of the bridge, some negative impact to the environment is expected as deterioration of the bridge elements will lead to deleterious material (granular material, pieces of creosote treated wood) falling into the flood plain below. This alternative does not address public safety, or structural inadequacy issues, and will not allow the bridge to be re-opened to use, and thus does not consider the problem statement and as such does not achieve the goals of the study.

Physical Environment – safety will decrease over time, and the structure will remain closed.

Natural Environment - A benefit to this alternative is that no negative impacts will be endured by the natural environment, although such impacts are expected to be minimal with the other alternative solutions and appropriately mitigated. There will be no surface water impacts with this alternative, and no mitigation measures will be required.

Social Environment – there will be no impacts to abutting lands, though the other alternatives have no expected impacts as well, and no immediate change will be made to the trail condition, as it will remain closed. This alternative will have no noise impacts.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridge was investigated and is considered to have cultural heritage value. This alternative will eventually lead to the structure collapsing or being removed, which would have a negative impact on the heritage elements of the bridge.

Economic Environment – There is no immediate cost associated with this alternative. The maintenance cost, should the Town choose to repair or replace the bridge in the long term, will be the highest.

Climate Change – this alternative does not improve or reduce the bridges resiliency against the effects of climate change.

This alternative does not address public safety, or structural inadequacy issues. For these reasons, this alternative does not consider the problem statement and does not achieve the goals of the study.

6.6.2 Alternative B1 – Rehabilitate the Existing Bridge

Rehabilitation of the existing structure is higher cost and more intrusive than the do-nothing alternative but will have a lower maintenance cost than that alternative. Impacts to the environment are increased, since work will occur adjacent to the watercourse. The structure was originally designed as a railway crossing and the structural steel elements are considerably over-designed for the requirements of a trail bridge. The approach spans and support timbers are in poor condition, however, and rehabilitation work will require extensive improvements to these spans, similar in cost to replacement.

Physical Environment – safety will be improved with code-compliant bridge railings, and the bridge will be re-opened to the public.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work.

Social Environment – there will be no impacts to abutting lands. The structure will remain closed during rehabilitation work, but when work is complete, the trail will be open from the north access through to the north end of Bridge 2, which is currently closed to the public. This alternative will have noise impacts during the construction period, though the nearest residence is approximately 130 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridge was investigated and is considered to have cultural heritage value. The heritage attributes indicated in the HIA for this structure include the truss span's single span length, and superstructure with steel trusses in triangular pattern with vertical members at each node between the bottom and top chords, steel floor beams and stringers with cross-bracing and riveted connections. The proposed rehabilitation will include replacement of timber cross ties, timber deck, and repair and replacement of timber elements in the substructure and approach spans so it will have little to no impact to the cultural heritage attributes of the bridge.

Economic Environment – While typically rehabilitation could have a lower construction cost than replacement, in this case for the approach spans there are enough major elements in need of extensive rehabilitation or replacement that the cost is higher than for replacement. There are limited methods of improvement to timber that is showing signs of decomposition and section loss. Additionally, it is likely that more elements requiring replacement will be discovered during

the construction process. Future maintenance costs for this alternative will be high, though not as high as the costs associated with Alternative A.

Climate Change – this alternative does not improve or reduce the bridges resiliency against the effects of climate change.

The cost associated with rehabilitation exceeds the benefit of maintaining the existing structure.

6.6.3 Alternative B2 – Replace the Approach Spans and Foundations

This alternative has a higher cost than Alternative A and B, but a lower cost than Alternative D. Impacts to the environment are increased, since more extensive work will be done over the watercourse. This alternative fully addresses the problem statement in a manner that most effectively maintains the heritage value of the site.

Physical Environment – safety will be improved with code-compliant railing systems, and the bridge will be re-opened to the public.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work.

Social Environment – there will be no impacts to abutting lands. The use of a prefabricated superstructure on the approach spans can be considered and accelerate the construction process. Replacement of the piers supporting the truss span will require temporary supports to be constructed below the truss span. This alternative will have noise impacts during the construction period, though the nearest residence is approximately 130 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridge was investigated and is considered to have cultural heritage value. The heritage attributes indicated in the HIA for this structure include the truss span's single span length, and superstructure with steel trusses in triangular pattern with vertical members at each node between the bottom and top chords, steel floor beams and stringers with cross-bracing and riveted connections. The proposed replacement will include replacement of timber cross ties, timber deck on the truss span, and replacement of the approach spans and substructure so it will have no impact to the cultural heritage attributes of the bridge.

Economic Environment – Rehabilitation of the truss span and replacement of the approach spans will have a lower cost than Alternative B, and a similar maintenance cost to full replacement of

the structure. The reason for a lower cost in this case is that for the approach spans there are enough major elements in need of extensive rehabilitation or replacement that associated costs would be significant. The exposed timber deck will allow for easier inspection of timber elements, and Town maintenance staff will be able to replace individual deteriorated timbers.

Climate Change – this alternative does not change the bridges resiliency against the effects of climate change.

This alternative fully considers the problem statement.

6.6.4 Alternative C – Replace the Bridge

Replacement of the existing structure is higher cost and more intrusive than the other alternatives. Impacts to the environment are increased, since more extensive work will be done over the watercourse. This alternative fully addresses the problem statement but has the largest impacts overall.

Physical Environment – safety will be improved with code-compliant railing systems, and the bridge will be re-opened to the public.

Natural Environment – during construction there is potential for impact to the natural environment in areas adjacent to and below the bridge. Surface water impacts can be mitigated with an erosion and sediment control plan. Environmental protection throughout the construction process will be required, including avoiding in-water work, preventing debris from falling in the water, erosion control fencing and consideration of nesting windows and fish spawning when scheduling work.

Social Environment – there will be no impacts to abutting lands. The bridge will remain closed until it has been replaced. The use of a prefabricated superstructure could accelerate the construction process. Removal of the existing bridge superstructure will require the use of large cranes and may require dismantling the structure in place. This alternative will have noise impacts during the construction period, though the nearest residence is approximately 130 m away and impacts will be minimal. These can be mitigated by scheduling permitted construction hours.

Cultural Heritage Environment – no archaeological concerns were identified near the bridges. The bridge was investigated and is considered to have cultural heritage value. The heritage attributes indicated in the HIA for this structure include the truss span's single span length, and superstructure with steel trusses in triangular pattern with vertical members at each node between the bottom and top chords, steel floor beams and stringers with cross-bracing and riveted connections. This alternative would require more extensive cultural heritage work, including installation of a superstructure that best matches the existing structure aesthetically.

Economic Environment – Replacement of the structure has the highest initial cost, and a similar maintenance cost to that of Alternative C. The exposed timber deck will allow for easier inspection of timber elements, and Town maintenance staff will be able to replace individual deteriorated timbers.

Climate Change – this alternative does not change the bridges resiliency against the effects of climate change.

This alternative fully considers the problem statement.

Assessment Criteria		Weight	Alternative A Do Nothing	Alternative B/B1 Rehabilitate	Alternative B2 Rehabilitate	Alternative C/C1 Replace	Alternative C2 Replace
			weighted score	weighted score	weighted score	weighted score	weighted score
TRAIL BRIDGE 1	Physical Environment	25	0	15	n/a	35	30
	Natural Environment	15	0	-3	n/a	12	12
	Social Environment	20	0	9	n/a	19	19
	Cultural Heritage Environment	10	0	0	n/a	0	0
	Economic Environment	25	0	-30	n/a	-10	-15
	Climate Change	5	0	0	n/a	3	3
	TOTAL ENVIRONMENT ASSESSMENT	**100**	**0**	**-9**	**n/a**	**59**	**49**
	RANK		**3**	**4**	**n/a**	**1**	**2**
TRAIL BRIDGE 2	Physical Environment	25	0	15	n/a	35	30
	Natural Environment	15	0	-3	n/a	12	12
	Social Environment	20	0	9	n/a	19	19
	Cultural Heritage Environment	10	0	0	n/a	0	0
	Economic Environment	25	0	-30	n/a	-10	-15
	Climate Change	5	0	0	n/a	3	3
	TOTAL ENVIRONMENT ASSESSMENT	**100**	**0**	**-9**	**n/a**	**59**	**49**
	RANK		**3**	**4**	**n/a**	**1**	**2**
TRAIL BRIDGE 3	Physical Environment	25	0	25	n/a	25	n/a
	Natural Environment	15	0	-1.5	n/a	-1.5	n/a
	Social Environment	20	0	5.5	n/a	5	n/a
	Cultural Heritage Environment	10	0	0	n/a	-8	n/a
	Economic Environment	25	0	-5	n/a	-20	n/a
	Climate Change	5	0	0	n/a	0	n/a
	TOTAL ENVIRONMENT ASSESSMENT	**100**	**0**	**24**	**n/a**	**0.5**	**n/a**
	RANK		**3**	**1**	**n/a**	**2**	**n/a**
TRAIL BRIDGE 4	Physical Environment	25	0	20	35	35	n/a
	Natural Environment	15	0	-9	-9	-9	n/a
	Social Environment	20	0	8.5	11	11	n/a
	Cultural Heritage Environment	10	0	-2	-2	-8	n/a
	Economic Environment	25	0	-30	-10	-20	n/a
	Climate Change	5	0	0	3	3	n/a
	TOTAL ENVIRONMENT ASSESSMENT	**100**	**0**	**-12.5**	**28**	**12**	**n/a**
	RANK		**3**	**4**	**1**	**2**	**n/a**

Table 9: Summary of Evaluation of Alternative Solutions with Weighted Scoring

6.7 PRELIMINARY PREFERRED ALTERNATIVE

In consideration of the above, Alternative A Do Nothing is not considered suitable for all four sites as it does not address the problem statement for any of the structures. Existing deficiencies will persist, and deterioration will continue and accelerate over time if no work is done. Two structures are currently barricaded to the public, and a Do Nothing approach will result in additional structure closures. Additional structure closures, and in turn a continued and expanded trail closure, is not considered an acceptable alternative. Table 9 summarizes the numeric assessment of all four bridges.

6.7.1 Trail Bridge 1

Both rehabilitation and replacement address the problem statement with minimal impact to the social or natural environment. However, rehabilitation will require more frequent maintenance and earlier onset for the next rehabilitation as the structure continues to deteriorate, generally as a result from existing members that are incorporated into the rehabilitation.

There is no heritage value associated with the bridge. Based on the reduced life cycle cost, replacement is the preferred solution. Replacement with a prefabricated bridge will reduce trail closure time, and based on the preferred alternative at Bridge 2, will have a cost savings with the incorporation of identical prefabricated superstructure spans. Further, the same truss configuration, albeit a shorter span, would then be incorporated into the Bridge #4 rehabilitation alternative. In addition, using a prefabricated truss system will fit with the history of the trail as a rail line.

6.7.2 Trail Bridge 2

Bridge 2 is nearly identical to Bridge 1, with the exception that it has already been closed to access. Similar to Bridge 1, replacement with a prefabricated bridge provides the highest benefit.

6.7.3 Trail Bridge 3

Both rehabilitation and replacement address the problem statement with minimal impact to the social or natural environment. Considering the overall good condition of the main structural steel and concrete elements of the bridge, both rehabilitation and replacement alternatives will have similar maintenance costs, however in this case rehabilitation is more cost effective than replacement. Full replacement of the structure will have a considerably higher cost, and a high impact on the cultural heritage elements of the site.

Rehabilitation maintains all the elements having heritage value, and lower construction duration.

6.7.4 Trail Bridge 4

Alternative B and C address the problem statement with minimal impact to the social or natural environment. However, Alternative B1 will require continued and more frequent costly maintenance for the Town as the structure continues to deteriorate.

Considering the overall good condition of the main structural steel elements of the truss span, Alternative B2 will have lower maintenance costs than Alternative B1, while Alternative C will have considerably higher initial costs, and a higher impact on the cultural heritage elements of the site. The reason for a lower cost in this case for replacement of the approach spans is that there are enough major elements in need of extensive rehabilitation or replacement that associated costs would be significant.

Rehabilitation of the truss span and replacement of the approach spans and substructure maintains all the elements having heritage value and has the lowest life cycle cost and construction duration.

7 Identification of the Preferred Solution

7.1 PREFERRED SOLUTION

Based on the evaluation of the alternative solutions, which considered several technical and ancillary criteria, the following alternatives have been identified as the recommended solutions:

- Trail Bridge 1 – Replace the existing timber structure with a prefabricated steel truss and timber deck, install new concrete abutments supported by steel piles.
- Trail Bridge 2 – Replace the existing timber structure with a prefabricated steel truss and timber deck, install new concrete abutments supported by steel piles.
- Trail Bridge 3 – Rehabilitate by replacing the existing timber deck with a new timber deck, complete abutment and pier concrete repairs, and replace the timber retaining walls at each abutment. Maintain the steel through-plate girders.
- Trail Bridge 4 – Replace the structure that will include replacing the existing timber approach spans with prefabricated steel trusses and timber deck, replacing the foundations with new concrete abutments and piers supported by steel piles, and incorporating rehabilitation of the steel pony truss that includes replacing its existing timber deck.

These preferred solutions address the problem statement. Appendix H contains the Preliminary General Arrangements of these preferred solutions.

7.2 CONSTRUCTION STAGING

Staging and equipment access need to account for accessibility, materials procurement lead times, and other factors. Trail Bridges 2 and 4 are currently closed.

The proposed staging includes replacing Trail Bridge 1 and 2 in 2023 and replacing Trail Bridge 4 and rehabilitating Trail Bridge 3 in 2024. A driving factor for this sequence is that rehabilitating Bridge 3 and Bridge 4 includes replacing the steel through plate girder and pony truss timber decks with new timber decks. The new decks would incorporate the use rough sawn heavy timber that would be specified to have a preservative treatment applied, with a preference to be pressure treated to maximize service life. This type of treatment requires the timber to be sent out of province, likely to Quebec, and current lead times can range from four to six months or more depending on a number of factors. Assuming tendering in late 2022 to early 2023, there are risks that the treated timber would not be available until mid to late summer 2023 which can add risks to completing those structures in 2023, there is less risk with having this timber available for a 2024 construction season.

With regards to replacing Bridge 1 and Bridge 2 and assuming tendering in late 2022 to early 2023, prefabricated steel trusses can be readily available for a 2023 construction season, thus reducing risks to scheduling. Installation of the new abutments includes driving piles. As the existing or proposed bridges would not be able to support pile driving equipment which can weight 60,000 lbs. or more, temporary access ramps and an access road along the flood plain would enable pile driving equipment to access both abutments and both bridges. This equipment ideally traverses terrain or ramps with a 1:10 slope or less and can be approximately 16 feet wide. The configuration would be to have an access ramp down at the south end of Bridge 1 to access the floodplain, install a temporary granular access road along the bridge to access to north abutment, then have a ramp up to access the trail. The equipment could utilize the trail to travel to Bridge 2, then the same type of ramp and temporary road would be installed. The ramps and temporary roads could also accommodate crane equipment that could be used to lift the new trusses into place. Note that this ramp and temporary road configuration would also be used for Bridge #4 as the approach spans are proposed to be replaced and the bridge also spans a floodplain, not a waterway channel.

7.3 CONFIRMATION OF EA SCHEDULE

As previously noted, the Schedule B guidelines apply to road and/or structure construction or reconstruction provided the cost to implement is less than $2.6M, not including land acquisition or engineering costs. Based on the extent of works anticipated, this cost threshold will not be surpassed and hence the Schedule B guidelines are appropriate.

8 Completion of the Class EA Process

This chapter details the steps remaining to complete the Schedule B Class Environmental process and to proceed to Phase 5: Implementation, which entails completion of the engineering drawings and construction.

8.1 SUBMISSION TO THE TOWN OF HANOVER

The Project File was submitted to the Town of Hanover in draft for review. Comments were addressed, and the project file was finalized.

8.2 STAKEHOLDER CONSULTATION – STUDY COMPLETION

This represents the second mandatory point of stakeholder consultation in the Schedule B Class EA process. The purpose of such is to identify the conclusion of the study and provide an opportunity for additional review of the study findings and recommendations within a 30-day review period.

In accordance with the Class EA guidelines, a Notice of Completion was prepared to identify the preferred improvement solution and the opportunity for further review (a copy of the notice is provided in Appendix I). Notices will be distributed as follows:

- Mailed or e-mailed to each of the review agencies and other stakeholder groups as previously contacted;
- Mailed or e-mailed to those that requested to be added to the mailing list;
- Advertised in the local newspaper on two separate occasions, in accordance with the Class EA guidelines; and
- Posted on the Town's website.

8.3 30 DAY REVIEW PERIOD

The Project File will be placed on public record for a period of 30 days following the Notice of Completion. As per the notice, the public and review agencies will be encouraged to further review the report and provide written comments to the Town on or before the end of the 30-day period.

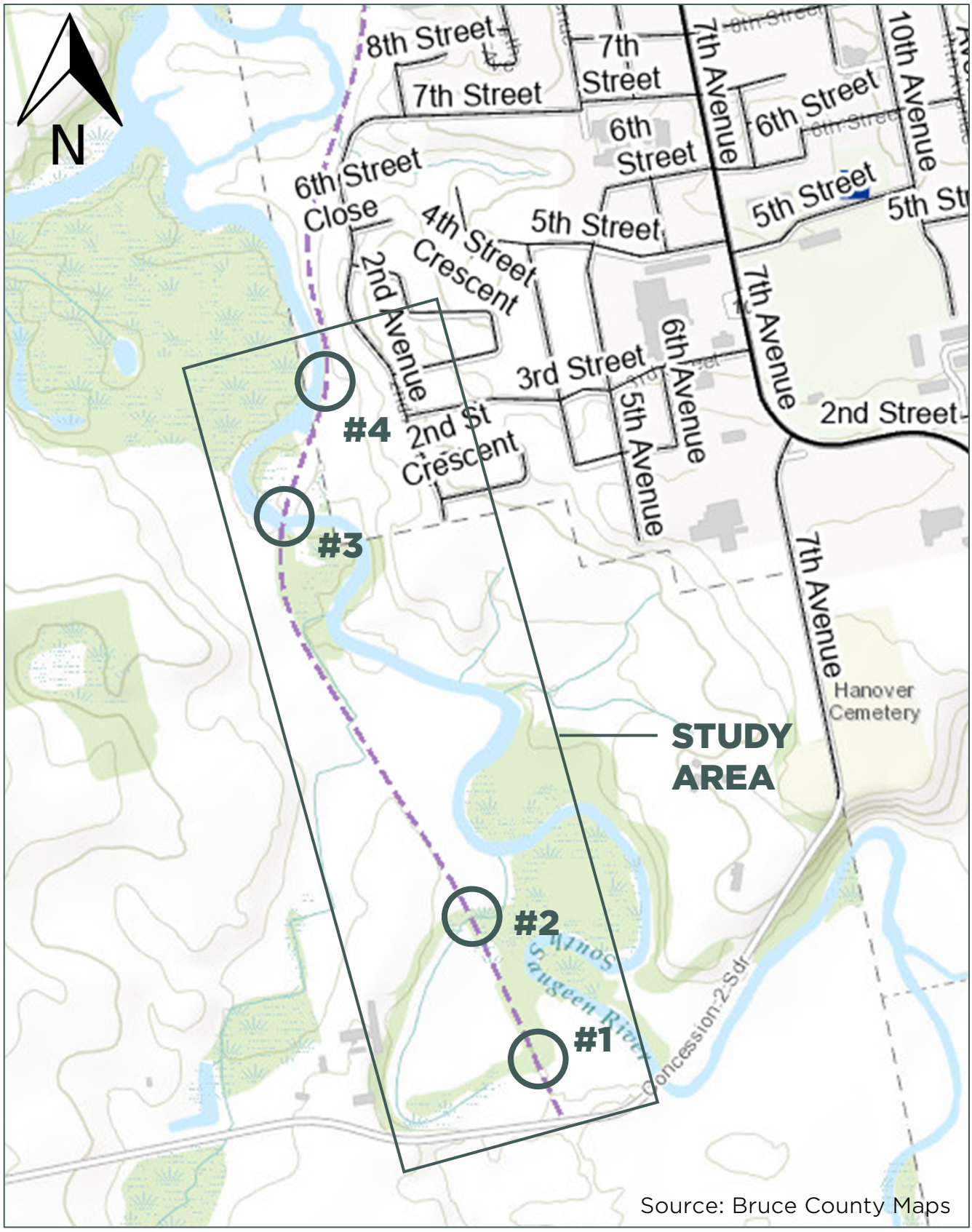
In addition, a request may be made to the Ministry of the Environment, Conservation and Parks for an order requiring a higher level of study (i.e., requiring an individual/comprehensive EA approval before being able to proceed), or that conditions be imposed (e.g., require further studies), only on the grounds that the requested order may prevent, mitigate or remedy adverse

impacts on constitutionally protected Aboriginal and treaty rights. Requests on other grounds will not be considered. Requests are to be submitted to the Minister and copied to the Town before the end of the 30-day review period.

If there is no request to the Ministry, the project may proceed based on the identified preferred improvements.

8.4 PHASE 5: IMPLEMENTATION

It is the intent of the Town to complete the design in 2022 and undertake the works in 2023 and 2024. As such, engineering drawings detailing the required works, including the need for mitigation measures to address impacts to the natural environment will be completed. Drawings will be submitted to the Town and the relevant agencies as required, to obtain the necessary approvals prior to construction. If any permits or changes to the project appear to be of interest or concern to indigenous communities, this information will be provided to them. There are no further requirements with respect to public consultation during Phase 5.



HANOVER COMMUNITY TRAIL BRIDGES CLASS ENVIRONMENTAL ASSESSMENT SCHEDULE B

Figure 1 – Key Map

Figure 2: Municipal Class Environmental Assessment Process