HERITAGE IMPACT ASSESSMENT

BRIDGE 4-WG
5th Line over a Tributary of the Speed River
Lot 5, Concessions V and VI
Township of Centre Wellington, Wellington County, Ontario

Prepared for:

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EXECUTIVE SUMMARY

ASI was contracted by CIMA Canada Inc. (CIMA+) to conduct a Heritage Impact Assessment of Bridge 4-WG as part of the Improvements for Bridges 24-WG and 4-WG, Township of Centre Wellington Municipal Class Environmental Assessment. The proposed undertaking involves the replacement of Bridge 4-WG and Bridge 24-WG (evaluated in a separate report). Bridge 4-WG (historically known as the Bain Bridge) is a single-span concrete bowstring arch structure resting on concrete abutments. The bridge carries two lanes of northbound and southbound 5th Line vehicular traffic over a tributary of the Speed River approximately 550 metres south of County Road 18 in the Township of Centre Wellington.

This report provides the Heritage Impact Assessment (HIA) based on the Cultural Heritage Evaluation Report (CHER) for Bridge 4-WG prepared by ASI in May 2019. The CHER determined that Bridge 4-WG retains cultural heritage value following the application of O. Reg. 9/06 of the *Ontario Heritage Act*. In particular, the structure retains physical/design value as an early and representative example of a surviving cast-in-place concrete bowstring arch structure in the local context. The structure retains historical/associative value given the design by A.W. Connor, a prominent bridge engineer at the local level and an influential proponent of reinforced concrete structures in southern Ontario. The structure also retains contextual value given the importance of concrete bowstring arch bridges in maintaining the character of the area, and the physical, functional, and historical links to its surroundings. Given that it meets O. Reg. 9/06, the Draft Statement of Cultural Heritage Value or Interest and the list of heritage attributes prepared during the CHER have been included in this report.

Given the identified cultural heritage value of Bridge 4-WG and the preferred option being carried forward as part of the Environmental Assessment involving the complete removal and replacement of the subject bridge, the following recommendations and mitigation measures should be considered and implemented:

1. Where feasible, the preferred alternative should be selected to ensure the fewest direct and permanent impacts to the identified heritage attributes of the subject bridge. In this respect, the subject bridge should be retained and rehabilitated. However, long-term maintenance of the subject bridge and other similar concrete bowstring arch structures was determined to be financially unviable by the Township of Centre Wellington. In the event that additional funding is secured, the Township of Centre Wellington should reconsider the removal and replacement of the subject bridge in favour of rehabilitation (Alternative 2) to reduce the impacts to the

identified cultural heritage value of the subject bridge as member of a locally-important construction type.

2. If the preferred option involving the removal and replacement of the subject bridge is to be selected:

    a. The bridge and setting should be professionally documented prior to construction-related disturbance. The CHER (ASI 2019) and HIA completed for Bridge 4-WG is sufficient documentation.
    b. The replacement structure should be designed in a manner that is sympathetic to the identified cultural heritage attributes of the subject bridge. In this respect, cast concrete barrier walls should be designed to incorporate visual elements that are sympathetic to the 1923 bowstring arch structure, where feasible. Exterior finishes or impressions into the surface of the concrete barrier walls that feature an arched design should be considered as a sympathetic design element in the replacement structure. The contextual associations of the subject bridge as a crossing over the tributary of the Speed River would be maintained in a sympathetically designed replacement structure.
    c. Consideration should be given to a commemorative strategy, such as developing a plaque in the location of the bridge. In this respect, an interpretive historical plaque/commemoration could be prepared including historical information and images and of the subject bridge. Heritage staff at the Township of Centre Wellington should be consulted for input regarding this commemoration.

3. In order to mitigate any unanticipated indirect impacts to the identified cultural heritage resource at 6328 5th Line, construction and staging activities should be suitably planned and executed to ensure all heritage attributes associated with this listed resource are avoided and protected. The general contractor responsible for construction should be notified of the cultural heritage significance of the adjacent residence in advance of the starting construction.

4. This report should be filed with heritage staff at the Township of Centre Wellington, the Wellington County Museum and Archives, and with the Ministry of Heritage, Sport, Tourism and Culture Industries (formerly the Ministry of Tourism, Culture and Sport) for review.

PROJECT PERSONNEL

Senior Project Manager:	Lindsay Graves, MA, CAHP *Senior Cultural Heritage Specialist |* *Senior Project Manager, Cultural Heritage Division*
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

ASI was contracted by CIMA Canada Inc. (CIMA+) to conduct a Heritage Impact Assessment of Bridge 4-WG as part of the Improvements for Bridges 24-WG and 4-WG, Township of Centre Wellington Municipal Class Environmental Assessment. The proposed undertaking involves the replacement of Bridge 4-WG and Bridge 24-WG (evaluated in a separate report). Bridge 4-WG (historically known as the Bain Bridge) is a single-span concrete bowstring arch structure resting on concrete abutments. The bridge carries two lanes of northbound and southbound 5th Line vehicular traffic over a tributary of the Speed River approximately 550 metres south of County Road 18 in the Township of Centre Wellington (Figure 1 and Figure 2).

The bridge was designed by A W. Connor & Co., Engineers from Toronto and built by the construction firm of Quinn and Wilson in 1923. The structure measures 7.3 metres in length, 6.2 metres in overall width, and has a roadway width of 5.3 metres.

Based on the deterioration of structural elements and safety issues observed in 2018 (K Smart and Associates Ltd, 2018), the Class EA process for Bridge 4-WG is required to identify a short and/or long-term plan for the structure. At the time of this report, the preferred option being carried forward as part of the Environmental Assessment is the complete removal of the subject bridge and replacement with a single span precast concrete rigid frame bridge. This report will assess impacts of the preferred alternative in consideration of the determined cultural heritage value of the subject bridge.

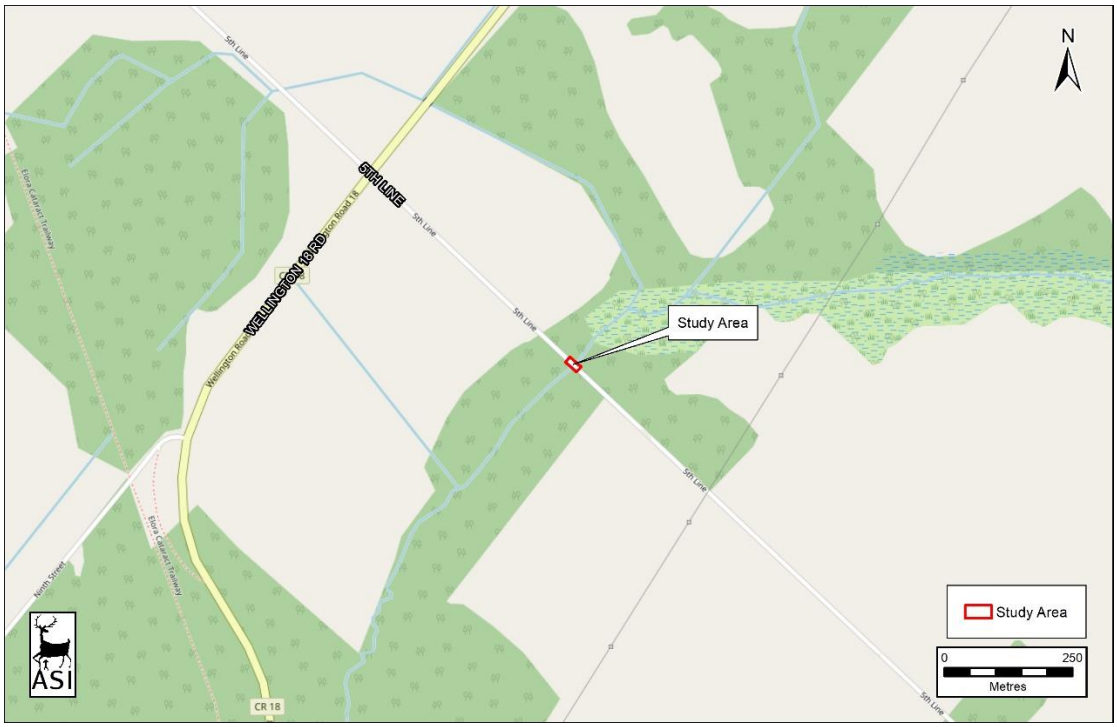

Figure 1: Location of the study area (outlined in red).
Source: ©OpenStreetMap and contributors, Creative Commons-Share Alike License (CC-BY-SA ESRI Street Maps)

Figure 2: East elevation of the subject bridge, looking west

(ASI 2019)

The research, analysis, site visit, and project management for this assessment was conducted by John Sleath, Cultural Heritage Specialist and Project Manager, under the senior project direction of Lindsay Graves, Senior Cultural Heritage Specialist and Senior Project Manager of the Cultural Heritage Division, ASI. The present Heritage Impact Assessment follows the Ministry of Tourism, Culture and Sports' *Ontario Heritage Toolkit* (Ministry of Tourism, Culture and Sport 2006) and the *Standards and Guidelines for the Conservation of Historic Places in Canada* (Parks Canada 2010). Research was completed to investigate, document, and evaluate the property and to measure the impact of the proposed development on the existing cultural heritage resource.

The scope of a HIA is provided by the MTCS's *Ontario Heritage Tool Kit.* An HIA is a useful tool to help identify cultural heritage value and provide guidance in supporting environmental assessment work. As part of a heritage impact assessment, proposed site alterations and project alternatives are analysed to identify impacts of the undertaking on the heritage resource and its heritage attributes. The impact of the proposed development on the cultural heritage resource is assessed, with attention paid to identifying potential negative impacts, which may include, but not limited to:

- Destruction of any, or part of any, significant heritage attributes or features;
- Alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance;
- Shadows created that alter the appearance of a heritage attribute or change the viability of an associated natural feature or plantings, such as a garden;
- Isolation of a heritage attribute from its surrounding environment, context or a significant relationship;

- Direct or indirect obstruction of significant views or vistas within, from, or of built and natural features;
- A change in land use (such as rezoning a church to a multi-unit residence) where the change in use negates the property's cultural heritage value;
- Land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect a cultural heritage resource, including archaeological resources.

Where negative impacts of the development on the cultural heritage resource and/or attributes are identified, mitigative or avoidance measures or alternative development or site alteration approaches are considered. Conservation options as outlined in the *Ontario Heritage Bridge Program* (Ministry of Culture and Communications 1991) which is regarded as current best practice for conserving heritage bridges in Ontario and ensures that heritage concerns, and appropriate mitigation options are considered.

ASI's *Cultural Heritage Evaluation Report: Bridge 4-WG* (ASI 2019), concluded that the subject bridge has cultural heritage value as it meets the criteria outlined in O. Reg. 9/06 of the *Ontario Heritage Act*, and that a resource-specific HIA would be required. The present report satisfies this requirement.

1.1 Description of Property

Bridge 4-WG (historically known as the Bain Bridge) is a single-span concrete bowstring arch structure resting on concrete abutments. The bridge carries two lanes of northbound and southbound 5th Line vehicular traffic over a tributary of the Speed River approximately 550 metres south of County Road 18 in the Township of Centre Wellington. The structure measures 7.3 metres in length, 6.2 metres in overall width, and has a roadway width of 5.3 metres. Historically, the subject bridge is located between Lot 5 Concession V and Lot 5 Concession VI in the former Township of Garafraxa, County of Wellington.

The bridge was designed by A W. Connor & Co., Engineers from Toronto and built by the construction firm of Quinn and Wilson in 1923 to carry 5th Line vehicular traffic over a small tributary of the Speed River. According to available bridge documentation, the subject bridge is not known to have undergone any documented repairs or major rehabilitations. Undocumented modifications include the addition of metal lateral bracing to connect the top chords of the arch, which were added at some point between 2016 and 2019 based on a review of inspection reports and associated documents.

The bridge crossing is bound by vegetated floodplain and active agricultural lands on all sides. The small watercourse that passes underneath the subject bridge is a tributary of the Speed River that is oriented in an east-west direction at the bridge crossing.

1.1.1 Adjacent Cultural Heritage Resources

The farmscape to the southwest of the property located at 6328 5th Line is currently listed by the Township of Centre Wellington (Township of Centre Wellington 2018). The structure is a cut-stone two storey residence constructed in 1903 and features a medium hip roof, large quoins, and an addition that

is not contemporary to the original structure on the west elevation (Township of Centre Wellington 2018).

2.0 DRAFT STATEMENT OF CULTURAL HERITAGE VALUE

The following draft Statement of Cultural Heritage Value is taken from the CHER for Bridge 4-WG prepared by ASI in 2019.

2.1 Description of Property

Name: Bridge 4-WG, Township of Centre Wellington

Bridge 4-WG was constructed in 1923 by the firm of Quinn and Wilson based on designs prepared by A.W. Connor to carry 5th Line in a north-south orientation over a tributary of the Speed River in the former Township of West Garafraxa, County of Wellington. The bridge is a single-span cast-in-place concrete bowstring arch bridge with an overall deck length of 7.3 metres and an overall width of 6.2 metres.

2.2 Cultural Heritage Value or Interest

Bridge 4-WG was determined to retain physical/design value as an early and representative example of a surviving cast-in-place concrete bowstring arch structure in the local context. The structure retains historical/associative value given the design by A.W. Connor, a prominent bridge engineer at the local level and an influential proponent of reinforced concrete structures in southern Ontario. The structure also retains contextual value given the importance of concrete bowstring arch bridges in maintaining the character of the area, and the physical, functional, and historical links to its surroundings.

2.3 Heritage Attributes

In summary, character-defining elements associated with Bridge 4-WG include but are not limited to:

- Cast-in-place concrete bowstring arch structural members;
- Concrete railing composed of cast-in-place and precast components; and
- Cast-in-place concrete abutments with board formwork visible.

Key heritage attributes that embody the historical, associative, and contextual value of the subject bridge include:

- Early, rare, and representative example of a cast-in-place concrete bowstring arch bridge in the local context;
- One of several local bowstring arch bridges constructed between 1918 and 1928 in a very similar visual style that are highly visible in the landscape and are important structural elements in the transportation network of the local area;

- Association with A.W. Connor, a prominent bridge engineer and proponent of reinforced concrete bridges in southern Ontario; and
- Physically, historically, and functionally carries 5th Line in the Township of Centre Wellington.

Figure 3: Location of the subject bridge

(ESRI Digital Globe 2018)

3.0 ASSESSMENT OF EXISTING CONDITIONS

A field review was undertaken by John Sleath, ASI, on 14 January 2019 to conduct photographic documentation of the bridge crossing and to collect data relevant for completing a heritage evaluation of the structure. Results of the field review and bridge inspection report were then used to describe the existing conditions of the bridge crossing. This section provides a general description of the bridge crossing and immediate vicinity. The location of the subject bridge is provided in Figure 3 and photographic documentation of the bridge crossing is provided in Appendix A of the CHER (ASI 2019). Preliminary design drawings for the proposed replacement precast rigid concrete frame structure are included in Appendix A.

Bridge 4-WG (historically known as the Bain Bridge) is a single-span concrete bowstring arch structure resting on concrete abutments. The bridge carries two lanes of northbound and southbound 5th Line vehicular traffic over a tributary of the Speed River approximately 550 metres south of County Road 18 in the Township of Centre Wellington.The bridge was designed by A W. Connor & Co., Engineers from Toronto and built by the construction firm of Quinn and Wilson in 1923. The structure measures 7.3 metres in length, 6.2 metres in overall width, and has a roadway width of 5.3 metres.

The substructure of the subject bridge features cast-in-place concrete abutments on the north and south elevation. The abutments rigidly support the concrete deck. The abutments appear to be original to the 1923 construction and bear the impression of the board-formed molds from construction. The abutments were cracked and appeared to be in poor condition at the time of field inspection.

The superstructure of the subject bridge is a cast-in-place concrete bowstring arch rigidly integrated with the concrete abutments. The superstructure features a thin slab cast-in-place concrete deck with an asphalt wearing surface. The underside of the deck features impressions from the wooden board formwork used to cast the structure. The concrete deck is supported by a single longitudinal cast-in-place concrete floor beam that is integrated to the bottom chord of the concrete bowstring arch. A single vertical truss member connects the top chord at the apex of the arch to the bottom chord and is placed in the same location as the floor beam. The top chord of the arch is a cast-in-place concrete arch with a rectangular cross-section. The top chord lacks concrete lateral bracing, however, a metal brace was bolted onto the structure at the time of field inspection and is assumed to strengthen the truss in light of the identified structural deficiencies. Several areas of the concrete superstructure exhibited localized spalling and exposed rebar at the time of field inspection.

The road surface on the structure measures 5.3 metres in width and is bound by concrete post and horizontal bar railings that have impressed circular indentations on the tops of the posts to add a slight decorative element. The horizontal concrete railings are undecorated and are directly integrated with the top chord of the arch. These railings are like those that appear on other nearby concrete bowstring arch structures in the area (see Section 4.1 of the CHER). Drainage is provided by two drain holes on the margins of the deck that divert water into the watercourse below. The structure lacks sidewalks and lighting and features a height restriction sign posted on the metal lateral brace at the apex the upper chord.

The approaches to the bridge are at-grade on the north and south sides and feature concrete post railing on both sides of the north and south approaches. The approach railings showed signs of

structural damage including localized concrete spalling and exposed rebar. The lower horizontal bar was broken and hanging off the side of the structure on the northeast approach, and the northwest approach railing was missing a portion that originally integrated with the top chord of the west arch. The approaches also feature caution signs indicating the reduced loading of 5 tonnes on the structure.

The small tributary of the Speed River that flows under the subject bridge is oriented in an east-west alignment in the location of the subject bridge and was largely frozen at the time of field inspection. The margins of the watercourse feature vegetated floodplains to the east and west of the structure.

According to available documentation, Bridge 4-WG is not known to have undergone any documented rehabilitations. Undocumented modifications include the addition of metal lateral bracing to connect the top chords of the arch, which were added at some point between 2016 and 2019 based on a review of inspection reports and associated documents.

Bridge 4-WG is currently owned/maintained by the Township of Centre Wellington. Inspections undertaken in 2016 noted significant structural deterioration of numerous elements and recommended the complete replacement of the structure within one to five years (MMM Group 2016). Further structural assessments in 2018 (K Smart Associates Ltd. 2018) recommended the complete replacement of the structure within two years due to the following structural deficiencies and observations:

- Height restriction barriers (2.8m) have been installed on top of the truss arches at the centre of the structure.
- There is no approach guide rail present.
- Approach barriers and structure barriers exhibit numerous spalls and delaminations with exposed corroded reinforcement; missing rail at northeast approach barrier.
- Concrete arches exhibit numerous abrasion scars and some spalls; there is a long, wide crack on inside face of east arch.
- Floor beam at the east end is in poor condition, exhibiting a large crack with a spall and exposed corroded reinforcement; rest of beam is in fair condition.
- Soffit exhibits numerous delaminations, cracks, and spalls with exposed corroded reinforcement. Large spalled area at the Northeast soffit.
- Severe cracking and deep spalls at southeast abutment/wingwall corner (concrete arch support element).
- Wide crack in both abutments from top to bottom; displacement along each crack is minimal.

As a result of this structural deterioration, the 2018 report recommended the bridge remain restricted to a loading of five tonnes, that monitoring at six month intervals continues, and that the structure be replaced within two years (K Smart Associates Ltd. 2018).

4.0 DESCRIPTION AND PURPOSE OF PROPOSED ACTIVITY

Based on the structural deficiencies observed in 2018 (K Smart Associates Ltd. 2018) and outlined in Section 3.0, the Class EA process for Bridge 4-WG is required to identify a short and/or long term plan

for the structure. At the time of report preparation four preliminary alternatives were under consideration for Bridge 4-WG (CIMA+ email communication 17 October 2019), including:

- Alternative 1: Do Nothing
- Alternative 2: Rehabilitate the Bridge
- Alternative 3: Replace the Bridge
- Alternative 4: Remove Existing Bridge and Retire Road

Alternative 1: Do Nothing is included in the evaluation to establish baseline conditions for the undertaking, and is not considered a viable option as it does not address the problem/opportunity statement of the Environmental Assessment.

Alternative 2: Rehabilitate the Bridge would involve the rehabilitation of all deteriorated cast-in-place concrete elements in need of repair as noted in the 2018 Structural Inspection (K Smart and Associates Ltd 2018).

Alternative 4: Remove Existing Bridge and Retire Road would result in the demolition of the subject bridge and the permanent closure of 5th Line. Vehicle turn-arounds would be constructed on 5th Line to the north and south of the bridge crossing, and all vehicular traffic would be re-routed to another bridge crossing.

At the time of report preparation, Alternative 3: Replace the Bridge was the preferred option being carried forward as part of the Environmental Assessment. The replacement structure is anticipated to be a single-span precast rigid concrete frame structure. Preliminary designs for the replacement bridge are provided in Appendix A (Figure 4 to Figure 6).

The preferred alternative to address the structural and safety issues identified in Section 3.0 involves the complete removal of the subject bridge including the cast-in-place concrete abutments. The abutments of the 1923 bridge will require removal to accommodate the increased span length of the replacement precast rigid concrete frame structure. The replacement structure is proposed to feature a span of 10 m, an increase of approximately 2.7 m from the 1923 bowstring arch structure to increase the hydraulic capacity of the structure based on updated flood modelling by the Grand River Conservation Authority (GRCA) (CIMA+ email communication, 18 October 2019).

The proposed replacement structure has a span length of 10 m, an overall width of 10.17 m, and a road width of 9 m (including shoulders on both sides). The structure is designed to use five precast concrete segments 2014 mm in width (for a total width of 10170 mm) with a deck thickness of 457 mm. The deck is anticipated to feature a two-degree cross slope from the centerline to facilitate drainage to the sides of the structure. The deck is also anticipated to feature cast concrete barrier walls on both the east and west limits of the deck.

5.0 IMPACT ASSESSMENT AND ALTERNATIVES CONSIDERED

Each of the four options under consideration for the subject bridge has the potential to result in impacts to the heritage attributes identified in Section 2.3.

Alternative 1: Do Nothing is included in the evaluation to establish baseline conditions for the undertaking, but is not considered a viable option as it does not address the problem/opportunity statement of the Environmental Assessment. This option would result in the gradual but continual deterioration of the structure and necessitate a future 5th Line Road closure to ensure public safety. Alternative 1 is not considered a viable option as it would not result in the continuation of the subject bridge as a safe roadway crossing.

Alternative 2: Rehabilitate the Bridge is considered to be the preferred option from a heritage perspective as it would continue the historical function of the subject bridge as a crossing for 5th Line motorists over the tributary of the Speed River. However, this option is not considered viable from a financial perspective by the Township of Centre Wellington due to increased long-term maintenance cost. The subject bridge is part of a family of early twentieth-century concrete bowstring arch bridges, all of which will be in need of major rehabilitation/replacement in the coming years. The Township of Centre Wellington decided to preserve one representative example of a bowstring arch bridge, Bridge 9-N, which carries Irvine Street over Irvine Creek immediately north of Elora. Bridge 9-N was constructed in 1929, measures 25.9 m in length (Township of Centre Wellington 2018a), and was selected as the representative example of this locally-significant bridge type. It is also protected through designation under Part IV of the Ontario Heritage Act (CIMA+ email communication 5 December 2018). According to available documentation Bridge 9-N is subject to a 10-tonne load limit and 4 m height limit (Township of Centre Wellington 2018b) and was rehabilitated in 2016 as depicted in Appendix A, Figure 7 (CIMA+ email communication 5 December 2018). All other examples of this type will be replaced with more durable and modern structures to reduce long term maintenance costs and to ensure continued public safety and feature suitable commemoration (CIMA+ email communication 15 and 22 October 2019).

Alternative 3: Replace the Bridge, and Alternative 4: Remove Existing Bridge and Retire Road, would both result in the complete removal of the 1923 concrete bowstring arch structure and all identified heritage attributes described in Section 2.3. Alternative 3: Replace the Bridge would be less impactful, however, as a sympathetically-designed replacement structure would continue the historical association as a road crossing in this location. Alternative 4 would entail removal of the bridge and installation of vehicle turn-arounds, severing the historical and functional association of 5th Line as a watercourse crossing in this location.

The following table presents the results of ASI's impact assessment of the proposed undertaking, based on the *Ontario Heritage Bridge Guidelines* (OHBG, MCC 1991) Conservation Options. The Conservation Options are also considered appropriate project alternatives for the proposed undertaking. It considers possible direct adverse impacts, indirect adverse impacts, positive impacts, and the viability of this option in relation to the overall Environmental Assessment.

Table 1: OHBG Impact Assessment of Bridge 4-WG

Conservation Options (OHBG 1991)	Analysis	Viable Option
1) Retention of existing bridge with no major modifications undertaken	This option would result in the lowest degree of intervention and fewest impacts to the subject bridge. However, this is not considered a viable option as it would not address the main problem/opportunity of the EA project. This conservation option was considered in the EA as Alternative 1: Do Nothing.	No
2) Retention of existing bridge and restoration of missing or deteriorated elements where physical or documentary evidence (e.g. photographs or drawings) can be used for their design	This option would result in a lesser degree of intervention and fewer impacts to the subject bridge. However, this option is not considered viable from a financial perspective by the Township of Centre Wellington due to increased long-term maintenance cost. This conservation option was considered in the EA as Alternative 2: Rehabilitate the Bridge.	No
3) Retention of existing bridge with sympathetic modification	This option would result in a lesser degree of intervention and fewer impacts to the subject bridge. However, this option is not considered viable from a financial perspective by the Township of Centre Wellington due to increased long-term maintenance cost. This conservation option was considered in the EA as Alternative 2: Rehabilitate the Bridge.	No
4) Retention of existing bridge with sympathetically-designed new structure in proximity	This option is not considered viable as it would not address the underlying structural deficiencies in the subject bridge and would not ensure the preservation of the existing bridge crossing. This conservation option was not considered in the EA.	No

Conservation Options (OHBG 1991)	Analysis	Viable Option
5) Retention of existing bridge no longer in use for vehicle purposes but adapted for pedestrian walkways, cycle paths, scenic viewing etc.	This option is not considered viable as this crossing is required to carry vehicular traffic to service the residences and farm in the immediate area. Further, this option would involve the retention of the existing bridge without rehabilitation, which is not viable as it would not ensure the continued safe function of the existing bridge crossing. This conservation option was not considered in the EA.	No
6) Retention of bridge as heritage monument for viewing purposes only	This option would involve the retention of the existing bridge without rehabilitation, which is not viable as it would not ensure the preservation of the existing bridge crossing. Further, this option is not considered viable as this crossing is required to carry vehicular traffic to service the residences and farms in the immediate area. This conservation option was not considered in the EA.	No
7) Relocation of bridge to appropriate new site for continued use or adaptive re-use	Relocation of the subject bridge is not considered a viable option due to the scale of the structure and the difficulty in relocating the cast-in-place concrete elements due to their deteriorated state. This conservation option was not considered in the EA.	No
8) Bridge removal and replacement with a sympathetically designed structure:	Direct impacts to the cultural heritage values of Bridge 4-WG are expected through the complete removal of the bridge. All cultural heritage attributes of the subject bridge identified in Section 2.3 would be removed. The contextual associations of the subject bridge as a crossing over the tributary of the Speed River would be maintained in a sympathetically designed replacement structure. This option is considered viable and is being carried forward as the preferred alternative for this EA as Alternative 3: Replace the Bridge.	Yes

Conservation Options (OHBG 1991)	Analysis	Viable Option
a) Where possible, salvage elements/ members of heritage bridge for incorporation into new structure or for future conservation work or displays	Direct impacts to the cultural heritage values of Bridge 4-WG are expected through the complete removal of the bridge. The use of salvage elements in a replacement structure or for future conservation works or displays is not considered a viable option. Due to the poor structural condition of the cast-in-place concrete elements and the increased span length of the replacement structure they are not considered to be appropriate for reuse at this crossing. Further, the deteriorated state of the concrete elements and their monolithic design would make removal and transportation infeasible for use in another structure or for commemoration.	No
b) Replacement/removal of existing bridge with full recording and documentation of the heritage bridge	Direct impacts to the cultural heritage values of Bridge 4-WG are expected through the complete removal of the bridge. Full recording with an appropriate commemoration strategy would ensure proper documentation for archival purposes. This option is considered viable and is being carried forward as the preferred alternative for this EA as Alternative 3: Replace the Bridge. Removal of the Bridge without replacement was considered as part of the EA as Alternative 4: Remove Existing Bridge and Retire Road. The permanent road closure is not considered a viable option as vehicular access is preferred for residences and farms on 5th Line.	Yes No

The preferred option (Alternative 3: Replace the Bridge) involving the complete removal and replacement of the 1923 concrete bowstring arch bridge is anticipated to result in the complete removal of all physical heritage attributes outlined in Section 2.3, including the cast-in-place concrete bowstring arch structural members, the concrete railing composed of cast-in-place and precast components, and the cast-in-place concrete abutments with board formwork visible. The replacement structure would, however, continue the historical association of the area as a bridging point over the small tributary of the Speed River.

The replacement bridge is anticipated to be a precast rigid concrete frame structure approximately 2.7 m longer in span than the 1923 structure. This increased span is intended to increase the hydraulic

capacity of the structure based on GRCA flood modelling (CIMA+ email communication, 18 October 2019). The replacement structure is anticipated to feature concrete barrier walls on the east and west margins of the structure to ensure public safety. Consideration should be given to incorporating sympathetic heritage elements in these concrete barrier walls, where feasible.

The replacement structure should be designed in a manner that is sympathetic to the identified cultural heritage attributes of the subject bridge. In this respect, cast concrete barrier walls should be designed to incorporate visual elements that are sympathetic to the 1923 bowstring arch structure, where feasible. Exterior finishes or impressions into the surface of the concrete barrier walls that feature an arched design should be considered as a sympathetic design element in the replacement structure. The contextual associations of the subject bridge as a crossing over the tributary of the Speed River would be maintained in a sympathetically designed replacement structure.

To mitigate any unanticipated indirect impacts to the adjacent heritage property at 6328 5th Line, construction and staging activities should be suitably planned and executed to ensure all heritage attributes associated with this listed resource are avoided and protected. The general contractor responsible for construction should be notified of the cultural heritage significance of the adjacent residence in advance of the starting construction.

6.0 COMMUNITY ENGAGEMENT

Consultation with staff at the Township of Centre Wellington and at the Wellington County Museum and Archives regarding the subject bridge was undertaken as part of the CHER by ASI in 2019 (ASI 2019). Responses from the various organizations confirmed that the subject bridge is not subject to existing heritage recognition and that it is adjacent to one resource that is listed by the Township of Centre Wellington.

7.0 CONCLUSIONS AND RECOMMENDATIONS

This report provides the HIA based on the recommendations of the CHER for Bridge 4-WG prepared by ASI in May 2019 (ASI 2019). The CHER determined that Bridge 4-WG retains cultural heritage value following the application of O. Reg. 9/06 of the *Ontario Heritage Act*. In particular, the structure retains physical/design value as an early and representative example of a surviving cast-in-place concrete bowstring arch structure in the local context. The structure retains historical/associative value given the design by A.W. Connor, a prominent bridge engineer at the local level and an influential proponent of reinforced concrete structures in southern Ontario. The structure also retains contextual value given the importance of concrete bowstring arch bridges in maintaining the character of the area, and the physical, functional, and historical links to its surroundings. Given that it meets O. Reg. 9/06, the Draft Statement of Cultural Heritage Value or Interest and the list of heritage attributes prepared during the CHER have been included in this report.

At the time of this report, the preferred option being carried forward as part of the Environmental Assessment was Alternative 3: Replace the Bridge. The analysis of OHBG Conservation Options (Section 5.0, Table 1) determined that Conservation Options 8 and 8b were viable given the identified heritage

value of the bridge and the scope of the Environment Assessment. Where feasible, the preferred alternative should be selected to result in the minimum impacts to the heritage resource as possible while still achieving the scope of the EA as identified in the in Section 3.0. Due to the significant financial implications of retaining individual structures in the aging family of early twentieth-century concrete bowstring arch bridges in the Township of Centre Wellington, the Township has proceeded with the rehabilitation and retention of one representative example of this construction type (Bridge 9-N depicted in Figure 7) and the replacement with commemoration of other similar examples (CIMA+ email communication 15 and 22 October 2019). Due to this strategy and the financial implications for the Township, the retention and rehabilitation of the subject bridge is not considered a viable conservation option.

7.1 Mitigation Measures and Recommendations

Given the identified cultural heritage value of Bridge 4-WG and the preferred option being carried forward as part of the Environmental Assessment involving the complete removal and replacement of the subject bridge, the following recommendations and mitigation measures should be considered and implemented:

1. Where feasible, the preferred alternative should be selected to ensure the fewest direct and permanent impacts to the identified heritage attributes of the subject bridge. In this respect, the subject bridge should be retained and rehabilitated. However, long-term maintenance of the subject bridge and other similar concrete bowstring arch structures was determined to be financially unviable by the Township of Centre Wellington. In the event that additional funding is secured, the Township of Centre Wellington should reconsider the removal and replacement of the subject bridge in favour of rehabilitation (Alternative 2) to reduce the impacts to the identified cultural heritage value of the subject bridge as member of a locally-important construction type.

2. If the preferred option involving the removal and replacement of the subject bridge is to be selected:

    a. The bridge and setting should be professionally documented prior to construction-related disturbance. The CHER (ASI 2019) and HIA completed for Bridge 4-WG is sufficient documentation.
    b. The replacement structure should be designed in a manner that is sympathetic to the identified cultural heritage attributes of the subject bridge. In this respect, cast concrete barrier walls should be designed to incorporate visual elements that are sympathetic to the 1923 bowstring arch structure, where feasible. Exterior finishes or impressions into the surface of the concrete barrier walls that feature an arched design should be considered as a sympathetic design element in the replacement structure. The contextual associations of the subject bridge as a crossing over the tributary of the Speed River would be maintained in a sympathetically designed replacement structure.
    c. Consideration should be given to a commemorative strategy, such as developing a plaque in the location of the bridge. In this respect, an interpretive historical plaque/commemoration could be prepared including historical information and images

and of the subject bridge. Heritage staff at the Township of Centre Wellington should be consulted for input regarding this commemoration.

3. In order to mitigate any unanticipated indirect impacts to the identified cultural heritage resource at 6328 5th Line, construction and staging activities should be suitably planned and executed to ensure all heritage attributes associated with this listed resource are avoided and protected. The general contractor responsible for construction should be notified of the cultural heritage significance of the adjacent residence in advance of the starting construction.

4. This report should be filed with heritage staff at the Township of Centre Wellington, the Wellington County Museum and Archives, and with the Ministry of Heritage, Sport, Tourism and Culture Industries (formerly the Ministry of Tourism, Culture and Sport) for review.

8.0 REFERENCES

ASI

2019 *Cultural Heritage Evaluation Report: Bridge 4-WG, Township of Centre Wellington, Wellington County*. Report on file at ASI.

CIMA Canada Inc.

2019 Preliminary Design Drawings of Centre Wellington Bridge 4-WG. Report on file at ASI.

K Smart and Associates Ltd, Consulting Engineers and Planners

2018 *4-WG Bridge Inspections Spring 2018- Update Report*. Memorandum on file at ASI.

Ministry of Culture and Communications

1991 *Ontario Heritage Bridge Program*. Queen's Printer for Ontario, Toronto.

Ministry of Tourism, Culture and Sport

2006 Ontario Heritage Tool Kit: Heritage Property Evaluation. http://www.mtc.gov.on.ca/en/publications/Heritage_Tool_Kit_HPE_Eng.pdf.

Parks Canada

2010 Standards and Guidelines for the Conservation of Historic Places in Canada. Canada's Historic Places. https://www.historicplaces.ca/media/18072/81468-parks-s+g-eng-web2.pdf.

Township of Centre Wellington

2018a Township of Centre Wellington Bridge Data. Data on file at ASI.

2018b 2018 Centre Wellington Structure Locations and Conditions- Updated December 2018.

Record of Email Communication

Christopher Middleton, CIMA+ email communication to Katherine Hull, ASI, 5 December 2018.
Stephen Keen, CIMA+ email communication with John Sleath, ASI, 15, 17, 18 and 22 October 2019

APPENDIX A: PRELIMINARY DESIGN DRAWINGS OF THE PROPOSED REPLACEMENT BRIDGE

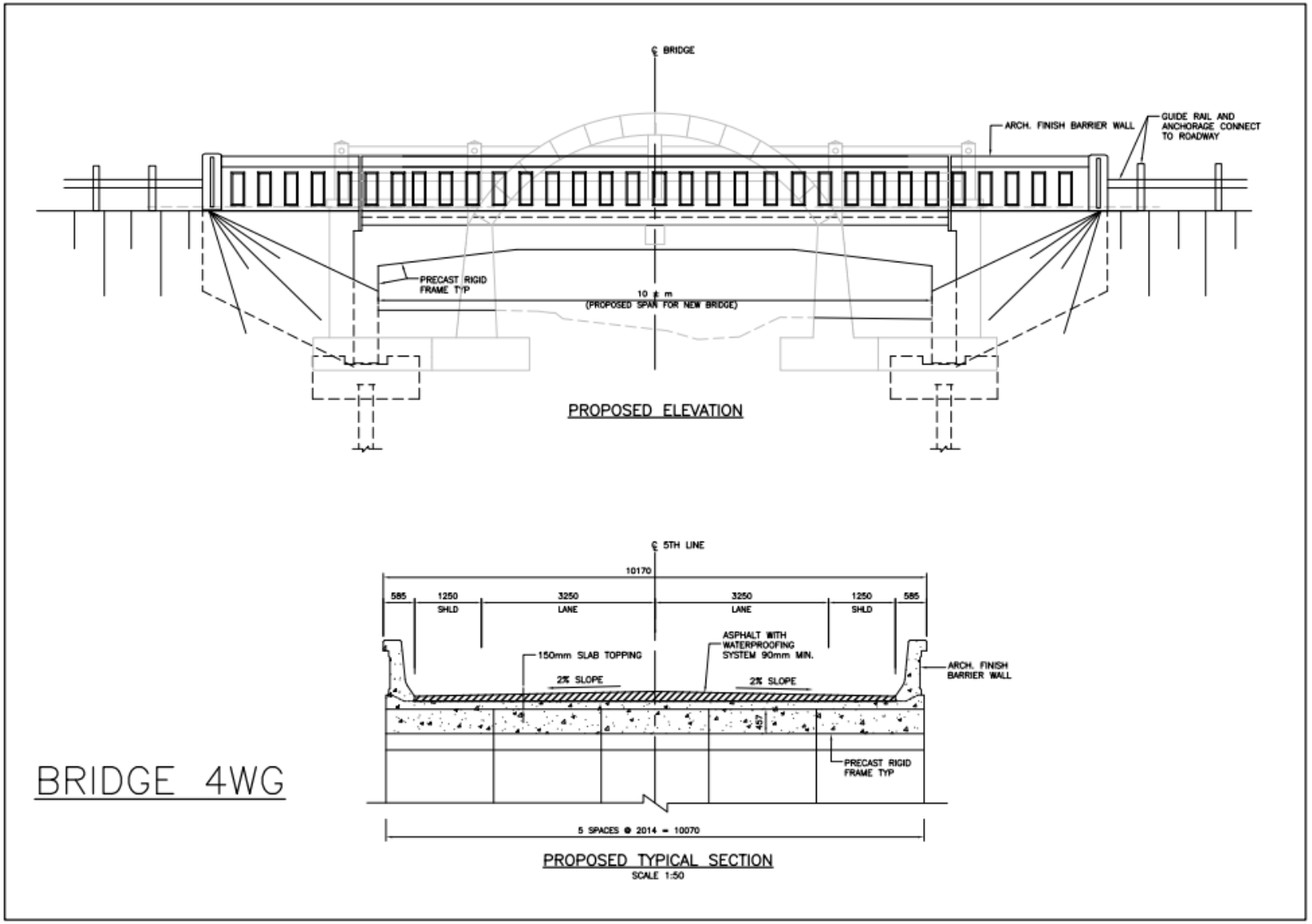

Figure 4: Bridge 4-WG Proposed Elevation and Proposed Typical Section (CIMA Canada Inc. 2019)

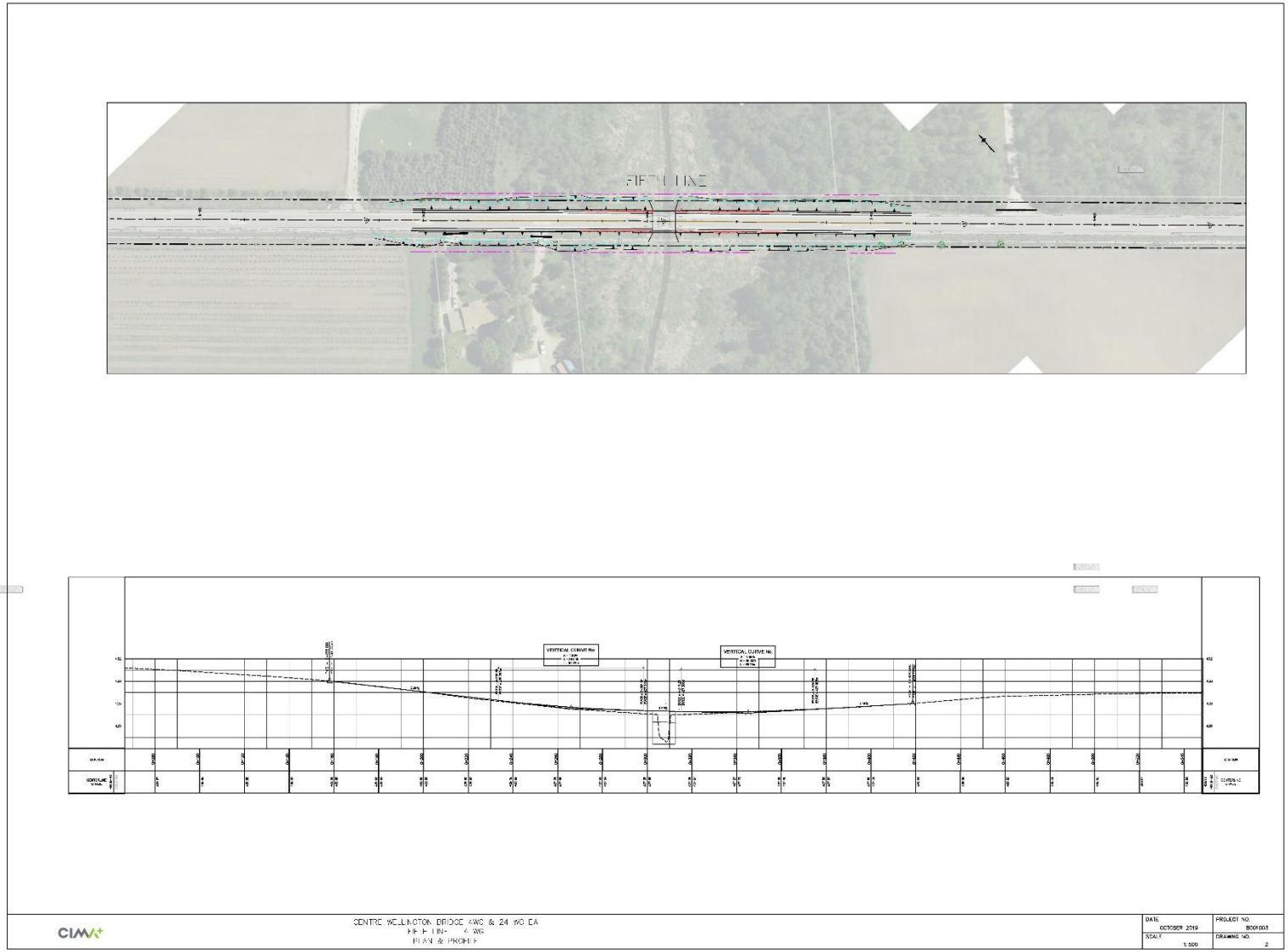

Figure 5: Centre Wellington Fifth Line Bridge 4-WG Plan and Profile (CIMA Canada Inc. 2019)

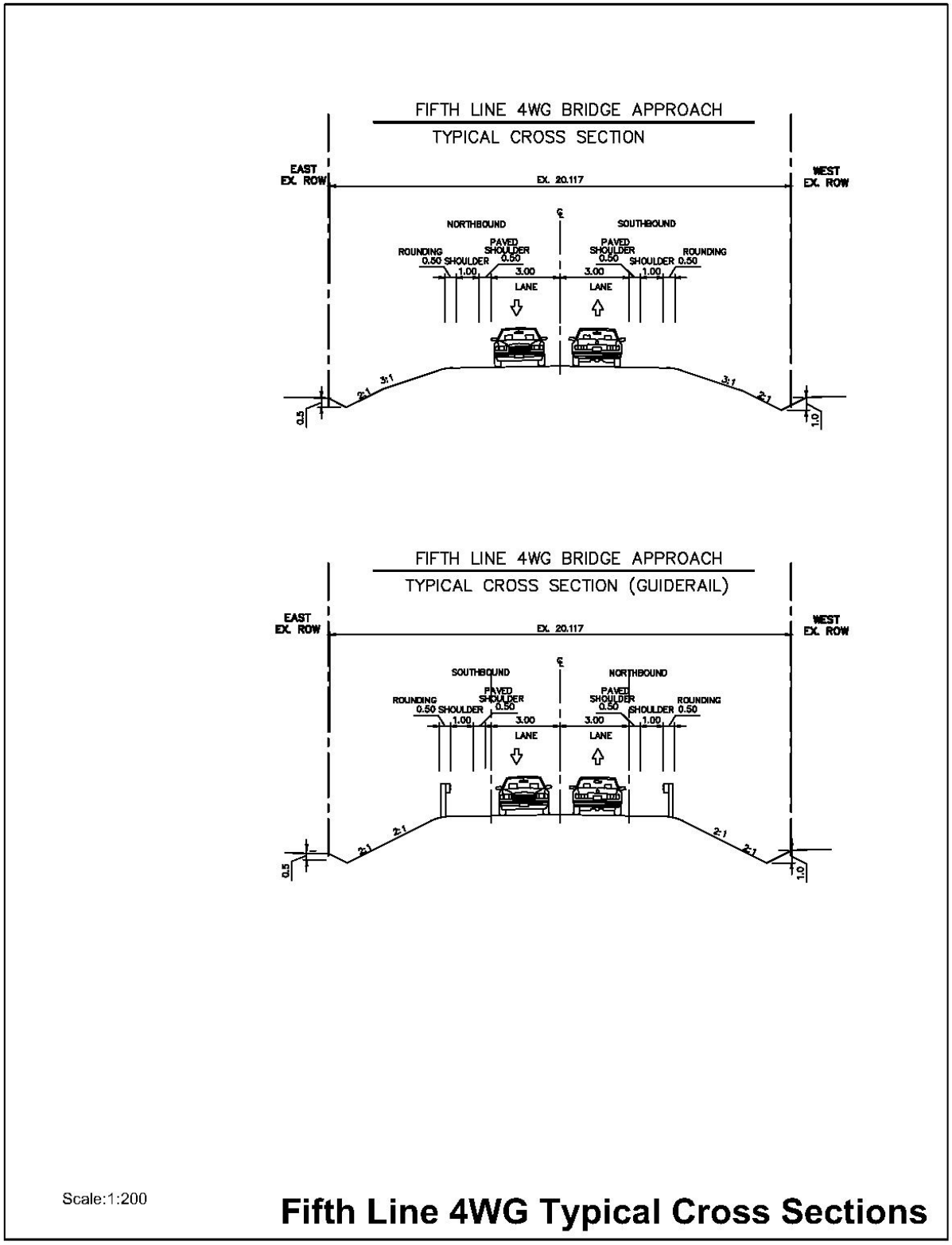

Figure 6: Fifth Line 4-WG Typical Cross Sections (CIMA Canada Inc. 2019)

Figure 7: Bridge 9-N after rehabilitations in 2016, a representative example of a concrete bowstring arch bridge Designated under Part IV of the Ontario Heritage Act (CIMA+ email communication 5 December 2018).