September 17, 2021

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

***Sent via email**: agarnham@ksmart.ca*

RE: Environmental Study to Support the Bridge Street Replacement, south of Haysville, in Wilmot Township

Dear Mr. Garnham:

Environmental Liability Management Inc. (ELM) is pleased to submit this revised Environmental Study to K.Smart Associates Limited (KSAL) to support a proposal for the replacement of the Bridge Street Bridge, south of Haysville, in Wilmot Township (hereinafter, the Site).

It is prudent to note than a draft version was reviewed by Staff from KSAL as well as individuals at the Grand River Conservation Authority (GRCA). These past reviews resulted in improvements to different sections of the draft version, with the final version included with this letter. Following the review of the draft, ELM met with Staff from the GRCA on-Site to discuss these topics in detail. The discussion on-Site guided the revisions within the Environmental Study.

At this time, ELM understands that it is necessary to complete the Environmental Assessment for this proposed activity. We anticipate the information included within this study will enhance KSAL's understanding of the Site.

Thank you for the opportunity to complete this study. We would be pleased to assist with future stages of this activity.

If you have any questions or concerns, please do not hesitate to contact Dr. Fitzgerald, at 226-606-1072 or Dean@elminc.ca.

Sincerely,

Environmental Liability Management Inc.

Dean Fitzgerald, M.Sc., Ph.D.
Senior Ecologist
Director, Environmental Services

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Appendices

MEMORANDUM

To:	Allan Graham, K.Smart Associates Limited
From:	Dean Fitzgerald & Jessica Zadori, ELM Inc.
Subject:	Environmental Screening of the Bridge Street Bridge, Township of Wilmot
Date:	September, 2021

1.0 INTRODUCTION

Environmental Liability Management Inc. (ELM) was retained by K.Smart Associates Limited (hereinafter, K.Smart) to complete environmental screening studies at the Bridge Street Bridge, located in proximity to Haysville and New Dundee in Wilmot Township, Ontario (hereafter, the Site, Figure 1a,b). The Bridge Street Bridge is located along the Nith River, part of the Grand River Watershed. At this time, it is ELM's understanding that it is necessary to replace the Bridge. Therefore, the goal of these screening studies is to assess the natural features present at the Site, evaluate for the possible presence of SAR within a minimum two-kilometer radius of the Site, provide advice regarding appropriate Best Management Practices (BMPs) for on-going activities on-Site and environmental management recommendations for the proposed activities. For this study, ELM assessed the environmental features on-Site such as existing land use, past land use, distance to water, vegetation cover, fish, wildlife, and other facets. This assessment is warranted, to ensure no significant disturbance of fish and wildlife populations from the proposed activity, as required under Ontario's *Fish and Wildlife Conservation Act*.

For the purpose of this evaluation, the possible presence of Species At Risk (SAR) was assessed using a public database (i.e., Natural Heritage Information Centre – NHIC), maintained by Ontario's Ministry of Natural Resources and Forestry (MNRF). Other public databases that include natural heritage information were also considered within this review. It is essential to screen for possible presence of SAR and possible SAR habitat on-Site and within proximity to the Site. This approach to screen for SAR and SAR habitat is required under Ontario's Endangered Species Act -(ESA, Ontario, 2007) as proposed activities are intended to avoid disturbance of SAR specimens and their habitat. Based on ELM's past experience, it is probable the proposed activity will require registration with the Ministry of Environment, Conservation and Parks (MECP), due to the likely presence of SAR in the Nith River. Thus, this document will be used to facilitate relevant communication with the MECP in the future, to reconcile the exact requirements for management of SAR, as defined under Ontario's ESA.

A second purpose for this document is to clarify future study requirements with the Grand River Conservation Authority (GRCA), as this agency provides oversight for the management of habitats associated with the Nith River. Therefore, the whole document will thereby act as a source of information for separate Environmental Assessment (EA) studies currently underway that are assessing how to best replace the bridge on-Site. For example, the findings reported in this document will inform the EA regarding existing environmental features and associated environmental constraints as well as requirements from government agencies including MECP and GRCA.

Figure 1a: A high elevation aerial photograph of the Site during 2019. This study will be focused on completing an environmental screening of the Bridge Street Bridge and nearby natural areas. The Site is located within the red rectangle, with the Bridge Street Bridge indicated with a yellow marker. Aerial imagery was obtained from a public database (i.e., Google Earth).

Figure 1b: A low elevation aerial photograph of the Site during 2019. This study will be focused on completing an environmental screening of the Bridge Street Bridge and nearby natural areas. The Site is located within the red rectangle, with the Bridge Street Bridge indicated with a yellow marker. Aerial imagery was obtained from a public database (i.e., Google Earth).

1.1 Overview of Proposed Activities

It is the understanding of ELM that future on-Site work will involve replacing the current bridge structure with a new structure. It is ELM's understanding that this work is necessary as a result of the Bridge's deterioration from age and harsh weather conditions, such as heavy ice and repetitive flooding. Demolition of the existing bridge will involve the removal of the existing structure, including the abutments. With this process, Staff from K.Smart will design the new bridge structure. This future bridge will extend across the Nith River with two supporting pillars to be placed within the water, and the associated abutments existing on the shoreline. Photographs of a bridge with similar construction, designed by Staff from K.Smart, have been included within Figure 2a,b to illustrate the likely design for the Site. This similar bridge exists on Township Road 11, and also crosses over the Nith River. Staff from K.Smart stated this downstream bridge construction was subject to similar environmental constraints and challenges as the Bridge Street Bridge.

Figure 2a: View, looking south of a bridge located along Township Road 11, near Ayr, ON. This structure also crosses over the Nith River, and was constructed with two in-water pillars.

Figure 2b: View, looking east, atop a bridge located along Township Road 11, near Ayr, ON. This bridge appears to be constructed in a similar manner to that planned for the Bridge Street Bridge. This structure appears to include a gradual incline of the road upwards towards the bridge, likely completed to accommodate the seasonal flooding typical within the Nith River.

With this basis, it is expected that in-water work will be a required step as part of this project, thus also requiring the registration of the project with MECP as a result of SAR likely present in this portion of the Nith River. It is also anticipated that as part of the demolition and construction, a laydown area for materials and equipment will be used, and will be located in the general area. For this proposed construction activity, a prudent activity is to also remove non-native weeds from the area. Such non-native weeds often invade disturbed areas and achieves high densities to the detriment of native plants (Gross and Werner, 1978). It is also expected that demolition and construction activities will be completed using standard Best Management Practices (BMPs) for construction projects. For example, one BMP often used in such projects is to revegetate the construction area after completion using only native vegetation.

1.2 Relevant GRCA Policies

Much of the Grand River and its associated tributaries exist within lands carefully managed by the GRCA. This management is a direct complement to the existing requirement to protect functionality and features with surface waters and wetlands, as defined within the Ontario's Provincial Policy Statement (PPS). That is, the GRCA developed a Wetland Policy, in order to provide a standardized approach to manage and protect wetlands. Thus, the GRCA is responsible for maintaining the careful management and protection of wetlands and associated vegetation, fish habitat, and other significant wildlife habitat along the Grand River watershed. Hence, this study has been completed in accordance with the tenets that define the GRCA Wetlands Policy, more specifically that all projects near water need to evaluate the area for the presence of wetlands during the pre-consultation phase, as explained within Section 6.2.9 of the GRCA Wetlands Policy (GRCA, 2005). Hence, this study assesses the applicability of the GRCA Wetlands Policy to the Site.

Similarly, proposed development within Provincially Significant Wetlands (PSWs) in southern Ontario, is subject to the study requirements defined within the PPS and the GRCA Wetlands Policy (GRCA, 2005). If activities are proposed in proximity to PSWs, a study is required to demonstrate that no negative impacts on the habitats or the ecological function will occur as a result of the proposed development or activities (OMMAH, 2005). With his in mind, this current study acts to document salient information regarding the potential impacts of the proposed bridge construction on surrounding natural areas and habitats.

1.3 Species at Risk

It is appropriate to design on-going activities on-Site with the goal to ideally avoid environmental disturbance or minimally reduce environmental disturbance. This requires the evaluation of proposed activities relative to possible disturbance of SAR specimens and habitat that could be used for SAR. When environmental disturbance is reduced or avoided, it represents a strategy to reduce possible consequences on plant and wildlife communities generally. Such strategies also have the added benefit to reduce and/or avoid disturbance of SAR specimens and associated habitat that may exist within an area.

This Site represents an area that could provide habitat to varied plants and wildlife specimens, including potential habitat for SAR trees along with bats, birds, snakes, and turtles. For example, many freshwater turtles have become protected under the ESA. As a result of habitat degradation, poaching and the introduction of invasive species, many freshwater turtles have reached Special Concern (SC), Threatened (THR) or Endangered (END) status, assigned by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in the province of Ontario (COSEWIC, 2008). Therefore, it is vital to screen for the potential presence of turtles or turtle habitats on or in proximity to the Site. Potential habitat for turtles is largely dependent on the species-specific habitat requirements. Generally, such habitats consist of relatively shallow, slow flowing water, often rich in vegetation and organic substrates. Potential habitats for turtles can include ponds, swamps, marsh, and bogs with sufficient water depth (COSEWIC, 2008).

This Site is also located in an area known to support SAR snake species. A variety of Ontario snakes have become protected under the ESA over the past decade as a result of road expansion and habitat degradation/development among other factors (COSEWIC, 2012). Snakes often can live in a variety of macrohabitats across Ontario, however, they always require microhabitats in the area suitable for hibernation, gestation, and foraging (COSEWIC, 2012). In general, habitats with large rocks or rocky outcrops away from water are preferred by most snake species (COSEWIC, 2012).

It is also prudent to evaluate the possible presence of migratory SAR birds in proximity to the Site. In recent years, many species of migratory birds have become protected under the ESA. Therefore, it is essential to screen for the possible presence of birds, nests or candidate nesting habitat in proximity to the Site. Furthermore, during the last decade, some migratory bat (also referred to as myotis) species and the habitat they use became protected under the ESA, due primarily to the arrival of a disease to North America (COSEWIC, 2013). Due to the prevalence of this disease, the current management strategy is to protect and carefully manage candidate habitat used by migratory and resident SAR bats and this habitat includes large trees, generally defined by a Diameter at Breast Height (DBH) $\geq$ 10 cm, and man-made structures, such as buildings (COSEWIC 2013). Thus, if trees with DBH $\geq$ 10 cm exist in proximity to a proposed activity, then justification exists to assess these trees for cavities that could be used by bats. Thus, the assessment approach used to screen the location of the existing Site considers a suite of environmental, natural heritage, and human-built features.

2.0 METHODS

Information on environmental features for the Site were assessed using three-step process by Staff from ELM described within this Memorandum, as follows:

1. Complete a desktop screening of environmental features on-Site, including inspection of aerial photographs as well as a review of available information on SAR in NHIC databases;
2. Conduct a site visit(s) to document the environmental features on-Site, if justified by the findings from the desktop study. A field visit would involve completing documentation of the natural features of the Site, habitat or significant wildlife habitat, and the collection of representative photographs; and,
3. Share professional opinion on insights for follow-up study requirements based on existing habitat features and other considerations after the visit. This information will be presented in accordance with relevant GRCA guidelines, to ensure proper management of wetlands and other wildlife habitat in the future.

3.0 RESULTS

3.1 Aerial Photographs

For this study, Staff from ELM initially evaluated the Site relative to available aerial photographs from 2006 and 2019 (Figure 3). Inspection of these aerial photographs led to the determination that the Site is predominantly surrounded by natural areas, such as woodlands and agricultural fields. A number of private residences are also visible in proximity to the Bridge Street Bridge.

The Bridge Street Bridge appears to expand approximately 45 m across the Nith River east-west in direction along Bridge Street, west of New Dundee, Ontario. The Site appears to be surrounded predominantly by agricultural fields, with a large woodland located south of the Bridge along the eastern bank of the Nith River. The woodland appears to be composed of both young and mature woody stems, of varying diameters and of varying species. Woody stems are also apparent along the western shoreline of the River and south of the Bridge, however in much less capacity. These stems also appear to range in diameter and species. The shoreline upstream of the Bridge does not appear to have any woody stems, but rather is immediately surrounded by grassy fields or meadowed area. It is also prudent to mention the presence of three private residential properties surrounding the Bridge, with one residence located southeast of the Bridge, one located southwest of the Bridge, and one located northwest of the Bridge. The presence of these varied features led to the determination that a field inspection was justified in order to confirm the spatial distribution of the features of the Site. Thus, Staff from ELM conducted an evaluation to identify environmental features of concern.

Figure 3: View on left displays an aerial view of the Site in 2006 while, view on the right displays an aerial view of the Site in 2019. Images were obtained from public data base (i.e., Google Earth). These two views and Figures 1 and 2 demonstrate the continuous presence of the Bridge Street Bridge and surrounding woodlands and agricultural fields, this suggesting consistent environmental management and no major disturbances such as forest fires during this period.

3.2 Flood Plain Mapping

Available flood plain mapping was examined in order to further identify natural features at the Site. The Nith River falls within the jurisdiction of the GRCA. Flood plain mapping reveals that the Bridge Street Bridge lies within a large area of engineered floodplain, which extends over adjacent fields and woodland areas. West of the Nith River, an area with slopes ranging from steep to over steep is documented. At the base of this sloped area a number of regulated wetlands exist. It is likely that water from flooding is trapped at the base of these slopes following seasonal flooding events, allowing moisture tolerant vegetation to thrive and creating micro wetland ecosystems. It is also prudent to document the presence of two small tributary creeks located downstream of the Bridge and two small tributary creeks located upstream from the Bridge. These areas are not expected to be disturbed by the proposed activities given the distance at which they exist from the Site.

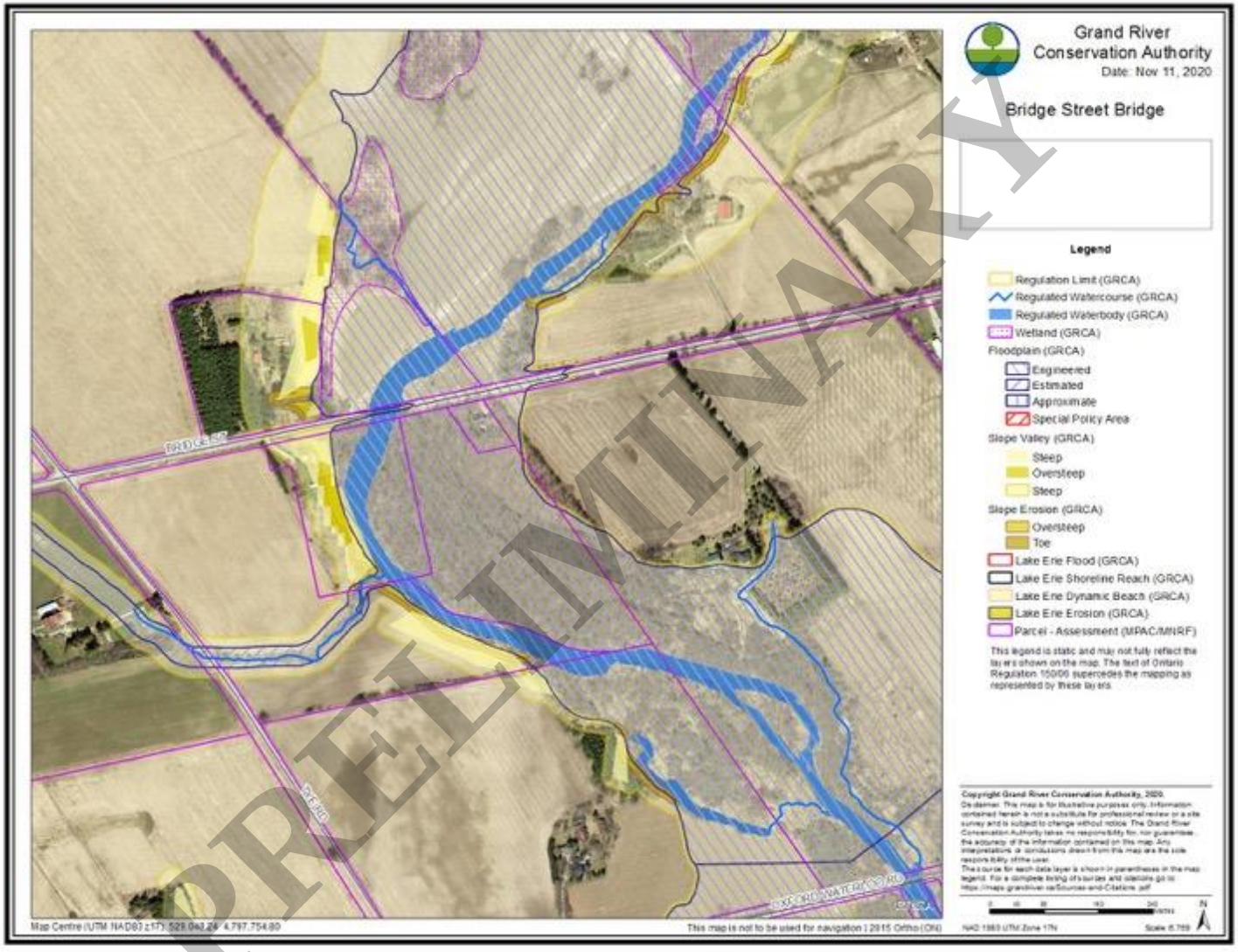

Figure 4: View of available floodplain mapping in proximity to the Bridge Street Bridge. The Nith River exists within land currently regulated by the GRCA. Mapping demonstrates that the Bridge lies in an area with engineered floodplains with steep slopes located west of the Nith River. Produced using information under License with the Grand River Conservation Authority © Grand River Conservation Authority, 2020.

3.3 Review of Natural Heritage

Following the evaluation of the aerial photographs, the Site was then screened for records of SAR using the NHIC database and other natural heritage screening databases, such as the Department of Fisheries and Oceans (DFO) database, and iNaturalist.com. This desktop review identified candidate wildlife habitat in proximity to the Site. It is prudent to note, SAR documented as present at the Site with a most recent observation date of more than 30 years ago, are generally considered no longer present within the area and will be deemed absent from the area.

When the Site was screened through the NHIC database, the Site falls within NHIC Square 17NH2997. This square identified that Bridge Street Bridge exists within three different natural areas, including the Nith River Flood Plain, the Plattsville North – Nith River Wetland, and the Grand River Watershed. This Square also identifies Green Dragon (*Arisaema dracontium*) as a potential SAR present in proximity to the Bridge. Green Dragon is currently listed as Special Concern by COSEWIC. As some SAR species are known to occupy large habitat ranges or are considerably mobile, NHIC database squares located north, south, east and west of the Site were also screened. These squares identified a number of additional SAR potentially in proximity to the Bridge, including Greater Redhorse (*Moxostoma valenciennesi*), Black Redhorse (*Moxostoma duquesnei*), and Snapping Turtle (*Chelydra serpentina*). These species are currently listed as Special Concern, Threatened, and Special Concern, respectively. Dates of the last observation of these species was not listed at the time this review was completed. Squares surrounding the Site also identified an additional natural area in proximity to the Bridge, the Haysville Wetland Complex. All SAR identified by NHIC have been reviewed in Table 1.

The Site was screened through the Ontario Reptiles and Amphibian Atlas (ORAA), a database that documents records of SAR within a 20 x 20 km grid. When screened the Site falls within ORAA database square17NH29. Square 17NH29 identifies three potential SAR reptiles in the area, including Snapping Turtle (*Chelydra serpentina*), Midland Painted Turtle (*Chrysemys picta marginata*), and Eastern Hog-nosed Snake (*Heterodon platirhinos*), These species were last observed in 2019, 1981 and 1944, respectively (reviewed in Table 1).

When the Site was screened through inaturalist.com, a natural heritage database focused on documenting observations of flora and fauna in Ontario, a single SAR specimen was identified in proximity to the Site. Butternut (*Juglans cinerea*) was documented to be observed south of the Site, along the eastern shoreline of the Nith River in 2018. Butternut is currently listed as Threatened by COSEWIC.

When the Site was screened through the DFO database, four SAR were documented as potentially present within 1 km of the Bridge Street Bridge. This database identified Black Redhorse, Silver Shiner (*Notropis photogenis*), Rainbow Mussel (*Villosa iris*), and Wavy-rayed Lampmussel (*Lampsilis fasciola*). Black Redhorse and Silver Shiner are both currently listed as Threatened by COSEWIC, while the Rainbow Mussel and Wavy-rayed Lampmussel are currently listed as Special Concern.

Table 1: Summary of the potential SAR specimens identified during a desktop review as observed in proximity to the Site, located at the Bridge Street Bridge, Township of Wilmot. Species at Risk have been designated as Special Concern (SC), Threatened (THR), Extirpated (EXP) or Endangered (END) in the province of Ontario.

Common Name	Scientific Name	COSEWIC Designation	Date of Last Observation
17NH2997 – NHIC			
Natural Area	Nith River Flood Plain	-	-
Natural Area	Plattsville North - Nith River Wetland	-	-
Natural Area	Grand River	-	-
Green Dragon	*Arisaema dracontium*	SC	N/A
17NH2998 (North) – NHIC			
Natural Area	Haysville Wetland Complex	-	-
Natural Area	Grand River	-	-
Greater Redhorse	*Moxostoma valenciennesi*	SC	N/A
Snapping Turtle	*Chelydra serpentina*	SC	N/A
17NH2996 (South) – NHIC			
Natural Area	Grand River	-	-
Black Redhorse	*Moxostoma duquesnei*	THR	-
17NH2897 (West) – NHIC			
Natural Area	Nith River Flood Plain	-	-
Natural Area	Haysville Wetland Complex	-	-
Natural Area	Grand River	-	-
Green Dragon	*Arisaema dracontium*	SC	N/A
Snapping Turtle	*Chelydra serpentina*	SC	N/A
17NH3097 (East) – NHIC			
Natural Area	Plattsville North - Nith River Wetland	-	-
17NH29 – Herp Atlas			
Midland Painted Turtle	*Chrysemys picta marginata*	SC	1981*
Snapping Turtle	*Chelydra serpentina*	SC	2019
Eastern Hog-nosed Snake	*Heterodon platirhinos*	THR	1944*
inaturalist.com			
Butternut	*Juglans cinerea*	THR	2018
DFO			
Black Redhorse	*Moxostoma duquesnei*	THR	N/A
Silver Shiner	*Notropis photogenis*	THR	N/A
Rainbow Mussel	*Villosa iris*	SC	N/A
Wavy-rayed Lampmussel	*Lampsilis fasciola*	SC	N/A

Table 1 (Continued): Summary of the potential SAR specimens identified during a desktop review as observed in proximity to the Site, located at the Bridge Street Bridge, Township of Wilmot. Species at Risk have been designated as Special Concern (SC), Threatened (THR), Extirpated (EXP) or Endangered (END) in the province of Ontario.

Common Name	Scientific Name	COSEWIC Designation	Date of Last Observation
Barn Swallow	*Hirundo rustica*	THR	-
Bald Eagle	*Haliaeetus leucocephalus,*	SC	-
Eastern Small-footed Myotis	*Myotis leibii*	END	-
Tricoloured Bat	*Perimyotis subflavus*	END	-
Black Ash	*Fraxinus nigra*	THR	-
Monarch	*Danaus plexippus*	END/SC**	-

* - SAR documented as present at the Site with a most recent observation date of more than 30 years ago, are generally considered no longer present within the area and will be deemed absent from the area.
** - the COSEWIC designation is END while the current Ontario SAR website lists this species as SC (https://www.ontario.ca/page/monarch).

Based on the experience of ELM staff members with similar projects in the areas, it is possible that Black Ash may also exist within proximity to the Bridge. Black Ash is currently designated as Threatened by COSEWIC, due to the infestation in Canada by Emerald Ash Borer (*Agrilus planipennis*). The Emerald Ash Borer spread across Ontario since 2000 and resulted in the death of most ash trees (Herms and McCullough, 2014). In southern and central Ontario, most Black Ash have been killed by the Emerald Ash Borer (reviewed in Table 1).

Additionally, other SAR occurrences in the Nith River or adjacent natural areas may include birds such as Barn Swallow (*Hirundo rustica*; Threatened) and Bald Eagle (*Haliaeetus leucocephalus*, Special Concern) In addition, all birds, including these SAR, receive protection from harm and disturbance under the North America *Migratory Bird Treaty Act*.

Other SAR in the area includes Monarch (*Danaus plexippus*), Myotis such as Tricoloured Bat (*Perimyotis subflavus;* Endangered) and Eastern Small-footed Myotis (*Myotis leibii*; Endangered) (reviewed in Table 1). Hence, the future field inspection will search for these SAR and associated habitat on-Site.

Fish Community

A diverse fish community has been previously reported to exist in the Nith River. Such diversity minimally includes more than 30 species representing at least eight families. This diverse fish community includes SAR Silver Shiner and SAR Greater Redhorse. A summary of the fish community is presented within Table 2 and represents information from a suite of sources (Scott and Crossman, 1973; GRCA, 2001; MOE, 1966; XCG Consultants Ltd, 2015; Premier Environmental Services, 2017). For example, Premier Environmental Services (2017) reported the catch of fish in 2017 around the Holland Mills Bridge, about five kilometres upstream of the Site. Since fish are mobile, these species possibly exist upstream and/or downstream of Bridge Street Bridge. The MNRF also reported the Nith River is classified as warm water habitat and is consistent with the water temperature designation from DFO (DFO, 2017).

Table 2: Fish species reported to exist in proximity to the Site based on studies from the 1960s to 2017.

Family	Common Name	Scientific Name
Catostomidae	Northern Hog Sucker	*Hypentelium nigricans*
Catostomidae	White Sucker	*Catostomus commersoni*
Catostomidae	Golden Redhorse	*Moxostoma erythrurum*
Catostomidae	Greater Redhorse	*Moxostoma valenciennesi*
Centrarchidae	Rockbass	*Ambloplites rupestris*
Centrarchidae	Pumpkinseed	*Lepomis gibbosus*
Centrarchidae	Smallmouth Bass	*Micropterus dolomieu*
Cyprinidae	Common Shiner	*Luxilus cornutus*
Cyprinidae	Blackchin Shiner	*Notropis heterodon*
Cyprinidae	Spottail Shiner	*Notropis hudsonius*
Cyprinidae	Rosyface Shiner	*Notropis rubellus*
Cyprinidae	Spotfin Shiner	*Cyprinella spiloptera*
Cyprinidae	Bluntnose Minnow	*Pimephales notatus*
Cyprinidae	Blacknose Dace	*Rhinichthys atratulus*
Cyprinidae	Longnose Dace	*Rhinichthys cataractae*
Cyprinidae	Creek Chub	*Semotilus atromaculatus*
Cyprinidae	Central Stoneroller	*Campostoma anomalum*
Cyprinidae	Striped Shiner	*Luxilus chrysocephalus*
Cyprinidae	Silver Shiner	*Notropis photogenis*
Cyprinidae	Mimic Shiner	*Notropis volucellus*
Cyprinidae	Common Carp	*Cyprinus carpio*
Esocidae	Northern Pike	*Esox lucius*
Gasterosteidae	Brook Stickleback	*Culaea inconstans*
Ictaluridae	Stonecat	*Noturus flavus*
Ictaluridae	Brown bullhead	*Ameiurus nebulosus*
Percidae	Iowa Darter	*Etheostoma exile*
Percidae	Johnny Darter	*Ethoestoma nigrum*
Percidae	Greenside Darter	*Etheostoma blennioides*
Percidae	Rainbow Darter	*Etheostoma caeruleum*
Percidae	Walleye	*Stizostedion vitreum*
Percidae	Johnny Darter	*Etheostoma nigrum*
Percidae	Blackside Darter	*Percina maculata*
Umbridae	Central Mudminnow	*Umbra limi*

3.4 Field Investigations

Based on the results of the desktop review, a field inspection was justified. Multiple Site visits were completed in order to confirm natural heritage features at the Site. Representative photographs of the Site during both inspections are provided within Section 3.4.4.

3.4.1 September 25, 2020

A visit to the Site was completed on September 25, 2020. The visit was led by Dr. Dean Fitzgerald and Dr. Ed Kott. Mr. Chris Tomicoe, representative from the Massasaugas of the Credit First Nation, and Mr. Mark Jeffery, representative from Wilmot Township, were also in attendance. Weather on-Site during the inspection was partly cloudy upon arrival, however developed into full sun throughout the inspection. Ambient air temperature during the visit was around 15ºC. This field study was focused on investigating the natural features in proximity to the Bridge Street Bridge.

Upon arrival water levels in the Nith River appeared low, despite the recent rain. Water at the time of the inspection was considered very clear. A walk around the Bridge area was completed, small dip nets were used to help survey for small fish. Area directly around the Bridge was noted to contain shallow water (30 – 60 cm) with rocks that do not readily move. Rock substrates and other debris in the water was easily observed due to the shallow and clear nature of the water. It is inferred the rocks are embedded around the Bridge area, tightly packed with no obvious spaces between rocks, due to past high flows and floods. At this time, Mr. Jeffery noted that a large flood had occurred in this area in 2018. Additionally, large quantities of small rocks were visible along the east shoreline and within the woodland along the east shoreline, also likely as a result of past flooding.

No evidence of mussels was observed around the west and east Bridge abutments. Although the water was very clear, observations included many fish but no live mussels or dead mussels. The lack of mussels was attributed to the near absence of sediment around the west and east Bridge footings. As mentioned, a number of small fish were observed around the west bridge footing, in the shallow water. A dipnet was used to scooped some of the fish and identify them before releasing them alive. Fish were identified as Common Shiner (*Luxilus cornutus*) and Mimic Shiner (*Notropis volucellus*).

Upstream of the Bridge, water was also shallow (30 – 60 cm). The substrate of the river appeared to transition from rock into softer silt-dominated sediments. When entering the soft sediment area, freshwater mussels were observed in the mud. However, these mussels were not disturbed. The presence of dead mussel shells in the mud of this area was also documented. The first observation of these mussels was approximately 150 m upstream of the Bridge. The area of sediment may be readily observed when one looks at the river, as it contains floating vegetation. This vegetation is rooted in the sediments but it is completely absent around the Bridge, likely due to the prevalence of rock and concrete in the water. This floating vegetation was used as an indicator for the presence of sediment suitable for freshwater mussels.

In addition, a variety of fish were observed in the water upstream of the Bridge in the sediment area among the aquatic vegetation. Dip nets were again used to scoop up some of the fish, identify them and the release them live. This was completed a few times, fish caught were identified as Rock Bass (*Ambloplites rupestris*), Common Shiner, and Mimic Shiner. A number of Darters (*Etheostoma spp.)* were also observed swimming around on the sediment in the shallow water. It was noted that this water was likely too shallow near the Bridge and within the upstream for large-bodied Black Redhorse, however, this part of the River could be used at time of higher water levels, such as during spring after the snow melt, and after the autumn rain rise. Therefore, at this time the shallow water at the Bridge and the area immediately upstream should be considered as not suitable habitat for Black Redhorse use or for spawning.

A walk of the woodland south of the east Bridge footing was completed. This woodlot is owned by Waterloo Region Nature (WRN). In the past, Dr. Kott has walked this woodland with members of WRN, at the time called KW Field Naturalists. Dr. Kott mentioned that SAR Green Dragon (*Arisaema dracontium*); a plant similar to Jack-in-the-pulpit) exists in this woodland and it is listed as Special Concern in Ontario. Green Dragon was not observed during this inspection, however this species is more commonly observed earlier in the year. Furthermore, SAR Black Ash, now listed as Threatened in Ontario, was observed. These Black Ash were documented more than 30 m from the Bridge area.

It is prudent to discussed that while walking in the woodland south of the Bridge, the presence of more than 100 dead freshwater mussels was documented. It appears that the large flood, in 2018, displaced large quantities of gravel and the mussels were swept in to the woodland. When walking it is feasible to observe shells all over the ground. The observation of extensive gravel and sand within the woodland along with freshwater mussel shells provides a simple explanation for the lack of gravel, sediment, and sand in the area of the west and east bridge abutments. It strongly appears the 2018 flood scoured out the Bridge area and displaced massive quantities of rock, sand, woody debris, and other materials along with the freshwater mussels. Hence, it appears this flood resulted in the displacement of the mussels into the woodland or to downstream areas away from the Bridge. Due to this past scouring of the river near the bridge, it represents a simple explanation for the nearly total lack of sediment, sand, and gravel, as well as explains why no freshwater mussels have been observed in this area.

Based on the presence of debris piles, it appears that water was pooled very deep into the woodland for an extended period. This pooling of water appears to have killed some of the Sugar Maple (*Acer saccharum*), American Beech (*Fagus grandifolia*) and other trees in the woodland. A number or the trees documented as dead are known to be intolerant to extended periods of water logged roots (caused by flooding). For example, Sugar Maple can only tolerate about two weeks of water logged roots before the tree dies. It is likely the dead Sugar Maple and American Beech in this woodland represent another consequence of the severe 2018 flood.

Inspection of the Bridge itself was completed. Six Barn Swallow (*Hirundo rustica*) nests were documented as present at the Bridge on the date of inspection. A Bald Eagle (*Haliaeetus leucocephalus*), currently listed as Special Concern in Ontario, was also observed flying overhead during the inspection. As no large nests were observed, it is likely that the Bald Eagle was foraging or simply migrating over. No turtles or other amphibians were observed either near the Bridge or upstream.

During the inspection, a number of noxious and invasive weed species were observed. Wild Parsnip (*Pastinaca sativa*) was observed on the northwest side of the Bridge, while a number of other species, including Field Bindweed, was observed interspersed throughout the Site. The observed species are known to invade disturbed areas and achieve high densities to the detriment of native plants (Gross and Werner, 1978). It is possible that these weeds arrived at the Site through the natural transfer of seed by wildlife and the elements, or via seed transfer by foot or vehicle traffic. It is also prudent to mention, that no Wild Parsnip was observed on the south east side of the Bridge.

3.4.2 October 13, 2020

A visit to the Site was completed on October 13, 2020. The visit was led by Dr. Dean Fitzgerald. Others in attendance included Miss Jessica Zadori, a staff member from ELM, Mr. Chris Tomicoe, a representative from the Massasaugas of the Credit First Nation, and Mr. Mark Jeffery, representative from Wilmot Township, were also in attendance. Weather on-Site during the inspection included full sun with little cloud cover. Ambient air temperature during the visit was around 15ºC. This field study was focused on investigating the natural features and documenting vegetation in proximity to the Bridge Street Bridge (Figure 4). Vegetation species have been reviewed within Table 3.

Figure 5: Aerial view of the Bridge Street Bridge. Polygons depict the areas surveyed at each corner of the Bridge for vegetation. Aerial imagery obtained from a public database (i.e., Google Earth).

Southwest

Vegetation surveys commenced at the southeastern corner of the bridge abutment. Along the roadside, weeds typical of the area were observed, including Wild Carrot (*Daucus carota*), Garlic Mustard (*Alliaria petiolata*), Reed Canary Grass (*Phalaris arundinacea subsp. Arundinacea*), Common Burdock (*Arctium lappa*), Stinging Nettle (*Urtica dioica*), and Common Ragweed (*Ambrosia artemisiifolia*). A steep slope is present along the roadside towards the River and surrounding area, this area including a number of additional species, such as, Beggars Tick (*Bidens frondosa*), Common Bedstraw (*Galium aparine*), Riverbank Grape (*Vitis riparia*), Canada Goldenrod (*Solidago canadensis*), Arrow-leaved Aster (*Symphyotrichum urophyllum*), and Joe Pye Weed (*Eutrochium purpureum*). Along this slope a stem of Manitoba Maple (*Acer negundo*) and a stem of American Elm (*Ulmus americana*) were also documented. In addition, woody debris was observed gathered several meters up the slope from the bank. East of the bank of the River, parallel to Bridge Street an existing 30 meters of vegetation was documented. This area included a number of the species documented along the slope, however also included vegetation such as Wild Mint (*Mentha arvensis*), Coltsfoot (*Tussilago farfara*), Barley (*Hordeum vulgare*), and assorted sedges (*Carex spp.*). The presence of sedge species indicates that this area may be considered a floodplain.

A row of Hybrid Willow (*Salix alba x S. fragilis*) and Crack Willow (*Salix fragilis*) was documented approximately 25 m south of the abutment. These trees were estimated to be around 40-50 years of age, and were likely planted following Hurricane Hazel within a province-wide strategy to improve drainage along all surface waters (Pross and Lambert, 1967). A small, live Green Ash (*Fraxinus pennsylvanica*), and a few stems of Red Osier Dogwood (*Cornus sericea*) were also observed near these larger trees. It is also prudent to note that a small Black Ash was observed approximately 35 m south of the bridge abutment. This Black Ash was documented as live, and growing from a stump sprout. Based on the stump, the original Black Ash appeared to be damaged by beavers. It is unlikely these trees will be disturbed as a result of activities occurring at the Bridge, as a result of their distance and the presence of the existing vegetation buffer.

In line with these trees, the water along the bank of the River was observed to be very shallow (~30 cm depth). Water was clear around the edges of the River, and murkier near the middle, likely as a result of recent rainfall. Sediments in this area were documented as fine. A single dead mussel shell was observed at this location, approximately 30 m south of the Bridge, however no live mussels were observed. Walking north, back towards the eastern abutment of the Bridge, sediment became increasingly coarse. Directly surrounding the abutment, a number of solidified concrete bags and large stones were observed, as wells protective sheeting along the floor of the River. It is likely that the concrete and sheeting were installed during construction of the primary Bridge. The presence of these however, has created an area of scour extending approximately 2-3 m towards the center of the Nith River. Within this area, no vegetation was observed, likely as a result of its inability to root, as no sand or sediment was observed in this area.

In the past, it appears that large rocks were placed along the southeastern edge of Bridge Street as a means to control erosion. These rock piles begin approximately 30 m east of the shoreline and extend an additional 20 m to where a small culvert was documented. This culvert extends north-south under Bridge Street, and likely acts as a small underpass for wildlife. The rocks then continue south, extending past the culvert. These rocks may be considered candidate habitat for SAR snakes, however given the history of flooding in the area, it is unlikely that the first 20 m of rock are utilized by SAR snakes. Rocks beyond the wildlife culvert represent a drier habitat, therefore representing preferrable habitat conditions for snakes. It is unlikely that this area of rock will be disturbed by activities proposed at the Bridge Street Bridge.

During vegetation surveys in proximity to the southeastern abutment, a local citizen approached surveyors. This gentleman told surveyors he was a local farmer in the area, noting that he farms 30 acres of field in direct proximity to the Bridge Street Bridge, particularly the fields located upstream of the Bridge, along the eastern and western banks of the Nith River. During conversation, the gentleman also noted the Nith River is prone to annual flooding, with water coming as high as two feet from the bottom of the Bridge Street Bridge. Flooding was described to cover a large portion of the surrounding fields, and into the woodland during the spring snow melt and summer rainfall episodes. The area was described to resemble a lake during periods of flood, providing evidence as to why moisture tolerant vegetation was document at distance from the banks of the Nith River.

Northwest

Northwest of the Bridge inspections vegan along the northern side of the Bridge abutment. A steep slope is present from the edge of Bridge Street, towards the Nith River. Along this slope, species such as Wild Raspberry (*Rubus idaeus*), Stinging Nettle, Garlic Mustard, Joe Pye Weed, Beggars Tick, and Bittersweet Nightshade (*Solanum dulcamara* L.) were evident. Two small stems of Manitoba Maple were observed approximately 2.0 and 2.5 m north of the abutment . An area of erosion with an undercut bank, spanning approximately 5x6x3 m, was observed in proximity to the abutment. This area was determined to be a tile drain, functioning to drain water from the field located just northwest of the Bridge. Directly surrounding this tile drain, a large patch, approximately 10 m^2, of Wild Parsnip was document. Wild Parsnip was then surrounded by a number of Giant Ragweed (*Ambrosia trifida*). As the inspection continued north, extensive amounts of Reed Canary Grass was observed. Vegetation such as Common Burdock, Sow Thistle (*Sonchus arvensis*), New England Aster (*Symphyotrichum novae-angliae*), and Daisy Fleabane (*Erigeron annuus*) was observed intermixed among the Reed Canary Grass. This vegetation extended approximately 8 m northwest directly out from the riverbank, before the area transitions to an agricultural field hay field. At the time of the inspection, the hay field had been recently cut.

Further upstream, north of the patch of Common Parsnip, and the patch of extensive Reed Canary Grass, is an area composed of upland terrestrial plants, such as Canada Goldenrod, Common Milkweed (*Asclepias syriaca*), and New England Aster. These plants are indicative of well-drained soils, while the lack of trees present between the bank and the field is likely a result of seasonal flooding. This vegetation also extended approximately 8 northwest of the riverbank at its narrowest point. The presence of Milkweed stems indicates that this area may represent candidate habitat for Monarch (*Danaus plexippus*). Monarch is currently designated as Special Concern in Ontario (MECP, 2019a) and Endangered in Canada by COSEWIC (COSEWIC, 2016).

A third transition in vegetation was then documented. Moving further upstream, vegetation was observed to change back into an area dominated by Reed Canary Grass, Bull Thistle, Burdock and New England Aster. The field was documented to transition from hay to Soybean (*Glycine max*), with a large Manitoba Maple and creek with an associated drainage culvert present at the junction between the fields, approximately 200 m upstream. Water from the culvert, draining to the Nith River, was shallow and clear. Sediment within the drainage path was fine sediment. Surrounding the drainage culvert were species such as Reed Canary Grass, Sow Thistle, Green Foxtail Grass (*Setaria viridis*), and a large patch of Velvetleaf (*Abutilon theophrasti*).

A secondary area of drainage was also documented. In this area, water appeared to be draining directly from the Soybean field towards the Nith River. Water was observed to be pooling along the bank, with limited to no drainage actually entering the River. Water was considerably deeper at this location, and murky brown in colour. Vegetation surrounding the pool was composed of mainly Reed Canary Grass, and dead Common Parsnip. A single stem of Purple Loosestrife (*Lythrum salicaria*), and a single stalk of Common Horsetail was documented to be present.

Water in the Nith River, upstream of the Bridge, was documented to be clear and relatively shallow (>30 cm). The floor of the River appeared to be a mixture of fine sediments and gravel. A small sandbar was observed near the center of the River, this area may represent candidate habitat for nesting SAR turtles. During the inspection, five small birds were observed on the small sandbar. These birds were identified as Sanderling (*Calidris alba*), likely stopping over during their southward migration. In line with this small sand bar, a large dead mussel shell was found on the bank. This mussel shell was collected for the purpose of in-office identification.

Along the most eastern edge of the hay field another meadowed buffer area was documented at the base of a sloping hill. The meadowed area was again dominated by Reed Canary Grass and included a 10 m buffer of Red Osier Dogwood. The slope likely represents the edge of the floodplain, and contained woody stems and shrubs, such as Crack Willow, Norway Maple (*Acer platanoides*) and Manitoba Maple. At the northern edge of the slope a number of Apple trees (*Malus spp.*) were documented, while at the edge of the slope, a small gravel driveway was observed. This driveway enters the field from Bridge Street, and was lined with an number of noxious weeds, including Common Mullein (*Verbascum thapsus*).

Southeast

Southeast of the Bridge is an area of woodland, owned by WRN. A number of woody stems were therefore observed, including Crack Willow, a stem of Ironwood (*Ostrya virginiana*), and more than 10 stems of Manitoba Maple. The Crack Willow appeared similar in age and within the same transect location as those observed on the southeastern bank of the River, and were therefore assumed to be planted at the same time, following Hurricane Hazel.

Vegetation in close proximity to the western abutment was similar to that observed previously, including species such as Crow's Foot, Stinging Nettle, and Riverbank Grape. Surveyors also documented new species such as Dames Rocket (*Hesperis matronalis*) and Zigzag Goldenrod (*Solidago flexicaulis*).

During this visit a number of mussel shells were collected from the woodland. As discussed in s. 3.3.1, it is hypothesized that these shells arrived in the woodland as a result of a large flood event which occurred in 2018. The dead mussel shells were collected for the purpose of identification later in-office. Shells were found in proximity to well-sorted piles of gravel and sediment, which were also likely displaced from the Nith River during seasonal floods.

Northeast

In proximity to the western abutment moisture tolerant species such as Bullrush (*Typha latifolia*) and Cattail were observed. Moving further upstream, species such as Sow Thistle, Reed Canary Grass, Beggars Tick and Chicory (*Cichorium intybus*), became more apparent. Minimal trees were documented on this side of the River, as only two small stems of Manitoba Maple were observed.

A small drainage ditch was observed running towards the river from the roadside. Within this ditch a number of invasive weeds were once again documented, including Colt's Foot, Ragweed, and Common Burdock. A large patch, approximately 10 x 10 m, of Field Bindweed was also documented along the sloped roadside, as well as Garlic Mustard, Poison Ivy (*Toxicodendron radicans*), Daisy Fleabane, Stinging Nettle and Teasel (*Dipsacus fullonum*).

Further upstream, vegetation was documented to be similar to that described within the upstream northeastern habitat consisting mainly of Timothy Grass, Canada Goldenrod, New England Aster, and other upland terrestrial species.

Table 3: Summary of common woody and herbaceous plant species observed in proximity to the four abutments of the Bridge Street Bridge. The origin of each plant is listed as Native (N) or Non-native (I) to Ontario. All native woody plants on-Site below are listed as secure in global rank (i.e., G5) and species rank (S4 or S5). In other words, no woody species of conservation concern were observed.

Common Name	Scientific Name	Abutment			
		Southwest	Southeast	Northwest	Northeast
Woody Species					
American Elm	*Ulmus Americana*, N	X			
American Beech	*Fagus grandifolia*, N		X		
Apple Tree	*Malus pumila*, N			X	
Black Ash	*Fraxinus nigra*, N	X			
Black Willow	*Salix nigra*, N		X		
Black Walnut	*Juglans nigra*, N		X		
Crack Willow	*Salix fragilis*, I	X	X	X	
Green Ash	*Fraxinus pennsylvanica*, N	X	X		
Hybrid Willow	*Salix alba x S. fragilis*	X	X		
Ironwood	*Ostrya virginiana*, N		X		
Manitoba Maple	*Acer negundo*, I	X	X	X	X
Norway Maple	*Acer platanoides*, I			X	
Red Osier Dogwood	*Cornus sericea*, N	X		X	
Silver Maple	*Acer saccharinum*, N	X	X		X
Staghorn Sumac	*Rhus typhina*, N				
Sugar Maple	*Acer saccharum*, N		X		
Herbaceous Species					
Arrow-leaved Aster	*Symphyotrichum urophyllum*, N			X	
Barley	*Hordeum vulgare*, I	X			
Beggar's Tick	*Bidens frondosa*, I	X	X	X	X
Bittersweet Nightshade	*Solanum dulcamara* L., I	X		X	
Bull Thistle	*Cirsium vulgare*, I			X	
Bullrush	*Typha latifolia*, N				X

Canada Goldenrod	*Solidago canadensis*, N	X		X	X
Canada Thistle	*Cirsium arvense*, I				
Common Bedstraw	*Galium aparine*, N	X		X	
Common Chicory	*Cichorium intybus*, I				X
Common Milkweed	*Asclepias syriaca*, N			X	
Common Mullein	*Verbascum thapsus*, I				X
Common Ragweed	*Ambrosia artemisiifolia*, N	X			X
Coltsfoot	*Tussilago farfara*, I	X	X		X
Daisy Fleabane	*Erigeron annuus*, N			X	
Dame's Rocket	*Hesperis matronalis*, I		X		
Field Horsetail	*Equisetum arvense*, N			X	
Field Bindweed	*Convolvulus arvensis*, I			X	X
Garlic Mustard	*Alliaria petiolata*, I	X	X	X	X
Giant Ragweed	*Ambrosia trifida*, N	X	X	X	X
Grass spp.	*Poa spp.*, N				
Great Burdock	*Arctium lappa*, I	X		X	X
Green Foxtail Grass	*Setaria viridis*, I			X	
Jack-in-the-pulpit	*Arisaema triphyllum*, N				
Joe Pye Weed	*Eutrochium purpureum*,N	X		X	X
New England Aster	*Symphyotrichum novae-angliae*, N			X	X
Prickly lettuce	*Lactuca serriola*, I	X			X
Poison Ivy	*Rhus radicans L.*, N				X
Reed Canary Grass	*Phalaris arundinacea subsp. Arundinacea*, I	X	X	X	X
Riverbank Grape	*Vitis riparia*, N	X	X	X	X
Scentless Chamomile	*Tripleurospermum inodorum*, I				
Sedge spp.	*Carex spp.*	X	X	X	X
Sow Thistle	*Sonchus arvensis*, I	X	X	X	X
Spotted Jewelweed	*Impatiens capensis*, N	X			X
Spotted Knapweed	*Centaurea maculosa*, I		X	X	
Stinging Nettle	*Urtica dioica*, I	X	X	X	X
Teasel	*Dipsacus fullonum*, I		X	X	

Velvetleaf	*Abutilon theophrasti*, I			X	X
Wild Carrot	*Daucus carota*, N	X		X	X
Wild Mint	*Mentha arvensis*, N	X			
Wild Parsnip	*Pastinaca sativa*, I		X		
Wild Raspberry	*Rubus idaeus*, I	X	X	X	X
White Clover	*Trifolium repens*, I	X			
Zig Zag Goldenrod	*Solidago flexicaulis*, N		X		

3.4.3 October 16, 2020

A visit to the Site was completed on October 16, 2020. The visit was led by Dr. Dean Fitzgerald. Others in attendance included Miss Jessica Zadori, a staff member from ELM. Weather on-Site during the inspection included full sun with little cloud cover. Heavy rain was recorded within the previous 24 hours, and the River was documented to be slightly higher than on previous visits. Ambient air temperature during the visit was around 13ºC. This field study was focused on measuring the depth of water across the Nith River in proximity to the Bridge Street Bridge. A summary of the water depth and floor composition is included within Table 4.

Water depth across the River was measured at four different transects. All transects were measured form the eastern shoreline or abutment to the western shoreline or abutment. Measurements were completed using two, wooden 1-metre sticks. Transect 1 was measured from abutment to abutment beneath the southern edge of the Bridge. Transect 2 was measured from abutment to abutment beneath the northern edge of the Bridge. Transect 3 was measured from shoreline to shoreline approximately 30 m upstream of the Bridge, while Transect 4 was measured from shoreline to shoreline approximately 30 m downstream of the Bridge. Transects have been depicted within Figure 6.

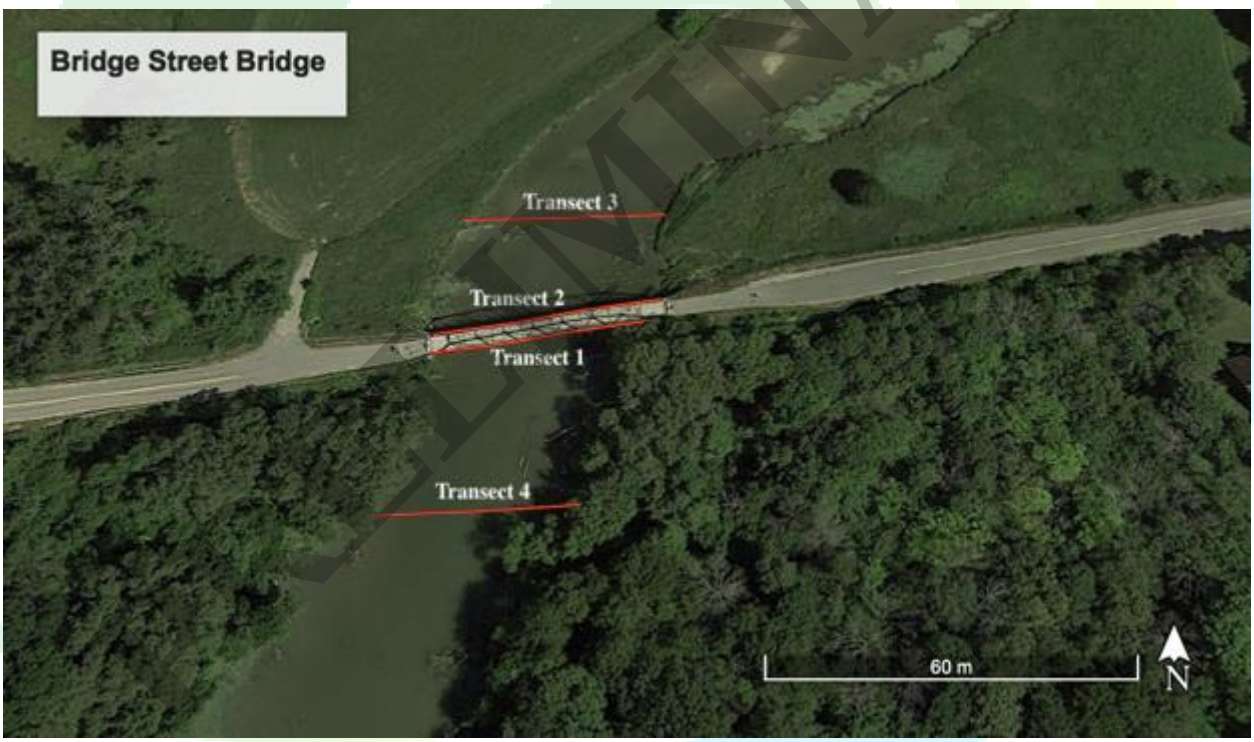

Figure 6: The depth of water across the Nith River was documented to range from approximately 30 cm along the shoreline to more that 1.5 m at the deepest points in proximity to the center of the River. Based on depth measurements, the River appears to be shallowest upstream of the Bridge and gradually gets deeper as water flows downstream.

Composition of the sediment across the River floor was also observed to vary upstream and downstream, however was documented to included sediments ranging from coarse to very fine through the entire survey area, including boulders, rock cobble, gravel, sand and silt. Transects beneath the Bridge were documented to have large boulders and concrete surrounding the abutments leading to the creation of a scour area, expanding 2-3 m towards the center of the River. Upstream and downstream transects were documented to have a greater quantity of silt material, particularly sitting over coarser sediment such as rock cobble and gravel and in proximity to the shoreline. These areas were also largely absent of the large boulders and concrete observed directly beneath the Bridge.

Table 4: Summary of the water depth and sediment composition across four transects of the Nith River in proximity to the Bridge Street Bridge.

Distance from east abutment (m)	Water Depth (m)	Sediment Composition
Transect 1		
0	-	East abutment
1	0.42	95% Boulder, 5% silt
2	0.77	80% boulders and rock cobble, 15% gravel, 5% silt
3	0.94	70% rock cobble, 25% gravel, 5 % silt
4	0.97	80% rock cobble, 15% gravel, 5% silt
5	0.84	40% rock cobble, 40% gravel, 20% silt
6	0.88	40% rock cobble, 40% gravel, 20% silt
7	0.96	50% rock cobble, 40% gravel, 10% sand
8	1.05	50% rock cobble, 30% gravel, 20% sand
9	1.10	50% rock cobble, 30% gravel, 20% sand
10	1.30	50% rock cobble, 30% gravel, 20% sand
11	1.10	50% rock cobble, 30% gravel, 20% sand
12	1.00	50% rock cobble, 30% gravel, 20% sand
13	0.90	50% rock cobble, 40% gravel, 10% sand
14	0.85	40% rock cobble, 40% gravel, 20% silt
15	0.80	80% rock cobble, 15% gravel, 5% silt
16	0.73	80% rock cobble, 15% gravel, 5% silt
17	0.65	80% rock cobble, 15% gravel, 5% silt
18	0.65	80% rock cobble, 15% gravel, 5% silt
19	0.73	70% rock cobble, 25% gravel, 5 % silt
20	0.60	80% boulders and rock cobble, 15% gravel, 5% silt
21	0.36	95% Boulder, 5% silt
22	0.35	Concrete with large boulders
23	0.33	Concrete with large boulders
24	-	West abutment
Transect 2		
0	-	East abutment
1	0.30	100% rock cobble
2	0.30	85% rock cobble, 15% gravel

3	0.60	75% rock cobble, 25% gravel
4	0.95	70% rock cobble, 20% gravel, 10% silt
5	0.91	60% rock cobble, 30% gravel, 10% silt
6	0.87	60% rock cobble, 25% gravel, 15% silt
7	0.84	60% rock cobble, 25% gravel, 15% silt
8	0.83	40% rock cobble, 30% gravel, 25% silt, 5% sand
9	0.90	10% rock cobble, 90% sand
10	0.90	60% rock cobble, 20% gravel, 10% silt, 10% sand
11	0.95	90% rock cobble, 5% silt, 5% sand
12	0.91	70% rock cobble, 10% gravel, 10% silt, 10% sand
13	0.96	60% rock cobble, 20% gravel, 10% silt, 10% sand
14	1.05	90% rock cobble, 10% gravel
15	0.65	100% rock cobble
16	0.46	100% rock cobble
17	0.55	75% rock cobble, 25% gravel
18	0.75	75% rock cobble, 25% gravel
19	0.80	70% rock cobble, 20% gravel, 10% silt
20	0.60	75% rock cobble, 25% gravel
21	0.37	85% rock cobble, 15% gravel
22	0.30	85% rock cobble, 15% gravel
23	0.36	85% rock cobble, 15% gravel
24	0.55	100% rock cobble
25	0.45	100% rock cobble
26	0.26	100% rock cobble
27	-	West abutment
Transect 3 (~30 m upstream)		
0	-	East shoreline
1	0.27	50% rock cobble, 30% gravel, 10% sand, 10% silt
2	0.39	80% rock cobble, 10% gravel, 10% silt
3	0.59	60% rock cobble, 30% gravel, 10% silt
4	0.73	60% rock cobble, 30% gravel, 10% sand
5	0.70	80% rock cobble, 15% gravel, 5% sand
6	0.76	50% rock cobble, 35% gravel, 5% sand
7	0.78	60% rock cobble, 35% gravel, 5% sand
8	0.82	60% rock cobble, 35% gravel, 5% sand
9	0.86	60% rock cobble, 35% gravel, 5% sand
10	0.89	60% rock cobble, 35% gravel, 5% sand
11	0.84	60% rock cobble, 35% gravel, 5% sand
12	0.83	60% rock cobble, 35% gravel, 5% sand
13	0.86	60% rock cobble, 35% gravel, 5% sand
14	0.83	90% rock cobble, 10% sand
15	0.80	90% rock cobble, 10% sand
16	0.67	~10 cm silt over rock cobble
17	0.51	~10 cm silt over rock cobble

18	0.43	~10 cm silt over rock cobble
19	0.51	~10 cm silt over rock cobble
20	0.62	~10 cm silt over rock cobble
21	0.68	~10 cm silt over gravel and rock cobble
22	0.65	~10 cm silt over gravel and sand
23	0.63	~10 cm silt over gravel and sand
24	0.54	~10 cm silt over rock cobble
25	0.50	~10 cm silt over rock cobble
26	0.53	~10 cm silt over rock cobble
27	0.55	~10 cm silt over rock cobble
28	0.54	~10 cm silt over rock cobble
29	0.53	~10 cm silt over rock cobble
30	0.54	~10 cm silt over rock cobble
31	0.50	~10 cm silt over rock cobble
32	0.45	~10 cm silt over rock cobble
33	0.40	~10 cm silt over rock cobble
34	0.33	West shoreline
Transect 4 (~30 m downstream)		
0	-	East shoreline
1	0.63	~ 2 cm silt over sand
2	0.72	~ 10 cm silt over sand
3	0.85	~ 10 cm silt over sand
4	0.89	~ 10 cm silt over gravel
5	0.99	~ 10 cm silt over gravel
6	1.05	~ 10 cm silt over gravel
7	1.10	> 10 cm silt over rock cobble
8	1.20	> 10 cm silt over rock cobble
9	1.20	> 10 cm silt over rock cobble
10	1.20	> 10 cm silt over rock cobble
11	1.30	90% rock cobble, 10% gravel
12	1.30	90% rock cobble, 10% gravel
13	1.30	80% rock cobble, 20% gravel
14	1.40	80% rock cobble, 20% gravel
15	1.50	80% rock cobble, 10% gravel, 10% silt
16	-	Unsafe conditions – too deep to survey
17	-	Unsafe conditions – too deep to survey
18	-	Unsafe conditions – too deep to survey
19	-	Unsafe conditions – too deep to survey
20	-	Unsafe conditions – too deep to survey
21	-	Unsafe conditions – too deep to survey
22	-	Unsafe conditions – too deep to survey
23	-	Unsafe conditions – too deep to survey
24	-	Unsafe conditions – too deep to survey
25	-	Unsafe conditions – too deep to survey

26	-	Unsafe conditions – too deep to survey
27	-	Unsafe conditions – too deep to survey
28	-	Unsafe conditions – too deep to survey
29	-	Unsafe conditions – too deep to survey
30	1.50	80% Rock Cobble, 20% gravel
31	1.20	60% rock cobble, 40% gravel
32	0.82	40% rock cobble, 30% gravel, 30% sand
33	0.67	40% rock cobble, 40% gravel, 20% sand
34	0.50	40% rock cobble, 60% sand
35	0.40	100% sand
36	0.35	100% sand

It is also prudent to note, that during this field inspection a number of individuals from WRN were present working on a fall cleanup of their property. Most notably, Anita Smith, and Fraser Gibson, were among those present. Fraser Gibson is a recognized naturalist, and has been making observations along the Nith River in proximity to the Bridge for a number of years. In conversation with Staff from ELM, Mr. Gibson discussed the presence of freshwater mussel shells along the shoreline and in the woodland for the past four years. Mr. Gibson noted he personally documented a number of freshwater mussel species, including Spike (*Eurynia dilatata*), Giant Floater (*Pyganodon grandis*), Creek Heelsplitter (*Lasmigona compressa*), as well as a single specimen of Wavy-rayed Lampmussel (*Lampsilis fasciola*) since he began collecting shells four years ago. Relevant correspondence with representatives from WRN are included within Appendix B.

3.4.4 Select Photographs of the Site

Select representative photographs are included herein. A full set of Site photographs has been included within Appendix A. Note, Photo No. are consistent with their order as included within Appendix A.

Photo No. 16	
Date: October 13, 2020	
Description: Another view of a culvert, present in proximity to the south-facing rocky slope present along the edge of Bridge Street. This culvert likely allows the safe passage of wildlife under Bridge Street.	

Photo No. 18	
Date: October 13, 2020	
Description: View of a stump sprouting Black Ash (*Fraxinus nigra*) tree. The original Black Ash appears to have been cut and taken by beavers.	

Photo No. 24 **Date:** October 13, 2020 **Description:** View of a number of solidified concrete bags and large boulders documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 45 **Date:** October 13, 2020 **Description:** View of the northeastern bank, from the northwestern bank. A small gravelly area is visible near the center of the River. This area may represent candidate habitat for turtle nesting.	

Photo No. 50 **Date:** October 13, 2020 **Description:** Another view of a drainage culvert, documented upstream of the Bridge Street Bridge. Sediment in the culvert may be described as well-sort, very fine silt.	

Photo No. 61 **Date:** October 13, 2020 **Description:** Another view, looking west, across a nearby hay field. The slope in the background of the photo represents the edge of the floodplain.	

Photo No. 64	
Date: October 13, 2020	
Description: View of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.	

Photo No. 65	
Date: October 13, 2020	
Description: View of a freshwater mussel shell (marked with blue arrow), found within sediment in the Cultural Woodland, near the southeastern bank. Gravel and sediment was hypothesized to have been deposited along the floor of the woodland as a result of flooding	

3.5 Ecological Land Classification

Information on land use and vegetation communities was used to prepare an Ecological Land Classification (ELC) map for the Site. This effort generated polygons to describe the vegetation communities associated with the Site, following standard methods for southern Ontario (Lee et al. 1998; Lee, 2008). This application also follows MNRF's vegetation type classification codes to encompass the range of natural and cultural vegetation communities with reference to the updated list from December, 2008. For this Study, interpretation of aerial photographs and field inspections were used to define vegetation community boundaries as distinct polygons (Figure 7). Then field data on actual plant species community boundaries were identified, and acted as the basis to classify these communities.

For the areas upstream and downstream of the Site, it is well known the lack of large impoundments on the Nith River results in seasonal floods (i.e., flooding each year during spring, after snow melt). On this theme, Staff from ELM previously observed flooding in these areas all along the river shorelines during the springs of 2017, 2018, and 2019 while doing studies associated with the upstream Holland Mills Bridge. Hence, the frequency of seasonal flooding of this portion of the Nith River is well known. For these reasons, Staff from ELM have used this knowledge to understand the disturbance arising from spring floods that vary from minor to severe, dependent on snow pack, rate of temperature warming, and precipitation. Hence, years with large snow pack, quick temperature rise and spring rain often are associated with large floods while small snow pack with slow temperature rise and limited spring rain are associated with small floods. The flooding results in changes to Nith River shoreline soils and vegetation, and is germane to the environmental features used to define the ELC map within this study. The topic of flooding in close proximity to the Site is explicitly addressed in Section 3.6 of this memorandum.

It is prudent to note that the ELC hierarchy recommends that a vegetation community polygon be greater than or equal to 0.5 ha in size before it is defined. Patches of vegetation less than 0.5 ha or areas of disturbance that are small, on the landscape perspective, are often integrated with adjacent communities that are most similar. However, ELM deemed it important to represent each ecosite on-Site even when it was smaller than 0.5 ha, as vegetation communities in proximity to the Site differed to such a large degree.

Various information collected on-Site was used to designate these lands following the ELC framework (Lee et al., 1998; Lee, 2008). Information applied for the designation of lands included general land use, vegetation species, slope, and evidence of past, recent, and current disturbance; surface water features also contributed to this analysis. From this information, a total of seven ELC ecosite polygons types were documented and presented within Figure 7.

These ecosites were as follows:

1. CUM1-1: Dry – Fresh Cultural Meadow

Areas of CUM1-1 are typically dominated by Creeping Thistle, Tufted Vetch, Queen Anne's Lace, Goldenrod species and other Grass species. Species are largely composed of those considered to be "roadside tolerant", with species of Canada Goldenrod and Late Goldenrod often encountered, along with Kentucky Bluegrass, Awnless Brome and Reed Canary Grass as the most frequently encountered grasses.

Figure 7: Aerial view of the Bridge Street Bridge with ELC polygons overlaid. A total of seven different ELC polygons were documented based on vegetation communities and soil.

These ecosites were as follows (continued):

2. CUW1-b: Exotic Cultural Woodland

CUW1-b is defined by the presence of Manitoba Maple, Hybrid Crack Willow, Black Walnut, White Willow, Green or Red Ash, American Elm, and Common Buckthorn. Vegetation such as Thicket Creeper, Riverbank Grape, Spotted Touch-me-not and Garlic Mustard may also be present.

3. FODM6-1: Fresh – Moist Sugar Maple – Lowland Ash Deciduous Forest Type

FODM6-1 may be considered the most common and widespread type of Sugar Maple Deciduous Forest Type across Southern Ontario. This area is defined by the presence of Sugar Maple, Green Ash and Black Ash. Other less dominant species may include Red Maple, White Elm, Yellow Birch, Basswood and Beech species. Species such as Sassafras and Hackberry may be present to a lesser extent.

4. MEFM1-1: Goldenrod Forb Meadow Type

Areas of MEFM1-1 are defined by the presence of open herbaceous species, with tree and shrub cover of less than 25%. These areas may vary from patchy to continuous and are typically dominated by broadleaf species, in the case of this Site, Goldenrod species.

5. MAMM1-16: Reed Canary Grass Graminoid Mineral Meadow Marsh

MAMM1-16 is defined by the presence of dominant grass or sedge species. In the case, the presence of dominate Reed Canary Grass dominates the vegetation. Areas may be considered rich, dominated by clonal species, or sparsely vegetated in areas with evidence of ice scour. Also, MAMM1-1 is commonly found in exposed areas near shorelines associated with a history of human disturbance, often near roads.

6. OAGM1 - Medium Mineral Annual Row Crop

OAGM1 is characterized by the presence of loam soil, utilized for the purpose of row-cropped, open agriculture. Areas of OAGM1 maybe be considered active or fallow.

7. SAGM2 - Abandoned Orchard

SAGM2 represents habitat created previously as an orchard that is now abandoned. This vegetation community is defined by the presence of fruit trees, in the case of this Site, old Apple and Crab-apple. The herbaceous ground cover ranges from grass to common weed species among the fruit trees.

3.6 Flooding Patterns within the Nith River

3.6.1 Seasonal Flooding

As briefly discussed within Section 3.2, the Bridge Street Bridge is located within an engineered floodplain, within an area regulated by the GRCA. This floodplain is documented to extend over adjacent fields, located northwest and northeast of the Bridge, and into nearby woodlands, located southwest and southeast of the Bridge. Areas of steep and over-steep slope are documented along the western boundaries of the northwestern field, marking the edge of the floodplains. As noted during field inspections, often in areas where this continuous flooding occurs, only water-tolerant vegetation was dominant, and this corresponded with no standing surface water at the time of the initial inspections during autumn 2020. The presence of these species was attributed to the seasonal flooding of the Nith River in proximity to the Site. Seasonal spring flooding is predominately attributed to the melting of snowpack from surrounding fields and woodlands, along with increased contributions into the Nith River from the upstream culvert, as well as from upstream tile drains that drain surface runoff from nearby surrounding areas.

In order to capture the extent of the flooding, the Site was visited on March 12, 2021 by staff from ELM. Upon arriving at the Bridge, water was documented to exist approximately 30 cm below the base of the bridge deck (Figure 8). Water was observed as fast flowing, and very turbulent. Flooding was documented to extend into all surrounding fields and woodlands (Figures 9 and 10).

Follow-up field visits were completed a exactly a week later on March 19 and March 20. These follow-up visits documented that water had returned back to a near-normal flow scenario, with little to no standing water remaining within the southeastern woodlands. It is prudent to note that the flooding resulted in significant scouring and disturbance of the woodland. Large amounts of displaced sand, silt, gravel, garbage, wood and other debris were observed upwards of 60 m east into the woodlands (Figure 11). Depositional areas of fine sand were typically observed deeper within the woodlands, while deposition of gravel and larger rock was most frequently observed along the shoreline and within the first 20 m between the woodland and the shore. Similarly, large amounts of garbage, broken glass, and metal fragments were observed. Additionally, depositional areas of vegetation, including tree trunks, branches, sticks, leaves, and grasses were documented to be collecting in different parts of the woodland (Figure 12).

Follow up visits to the Site also documented a number of newly displaced mussel shells within the woodlands in proximity to Area 6. Mussels were documented to range in size from less than 1 cm to greater than 8 cm. Mussel shells also ranged in completeness, with some remaining fully complete (both halves of shell), to partially complete (half a shell or a shell fragment). A number of extremely small fragments were observed in the soil, it was hypothesized that these shells shattered on ground impact, as a result of the fast flowing water through the woodland. Mussel shells were documented to be both sitting on top of displaced soil, as well as partially buried within soil and hence frozen into the ground (Figure 13). It is expected that the seasonal occurrence of these floods acts to continually displace live mussels from within the Nith River into adjacent woodlands, south of the Bridge. A number of mussels and mussel fragments were collected within the woodland on March 19 and 20, and returned to the office for identification. All collected mussel shells were documented to be dead and clear of flesh.

Figure 8: View of the Nith River during the March 12, 2021 flooding event. Water was documented to exist nearly 30 cm from the Bridge deck, and flood into surrounding fields and woodlands.

Figure 9: View of the southeastern woodland from atop the Bridge on May 12, 2021. Water was documented to be fast flowing and very turbulent flowing through the woodlands and fields.

Figure 10: View of the northeastern and northwestern agricultural fields from the roadside of Bridge Street on March 12, 2021. Water was documented to be fast flowing and very turbulent flowing through the woodlands and fields.

Figure 11: View of a large depositional area of gravel and rock present within the southeastern woodland, approximately 10 m from the shoreline of the Nith River, on March 19.

Figure 12: View of a large depositional area of trees, branches and vegetation, present within the southeastern woodland, approximately 5 m from the shoreline of the Nith River, on March 19.

Figure 13: View of a mussel shell (marked with green arrow), displaced from the Nith River during the flood. This mussel shell was buried in displaced gravel and sand, and frozen into the ground, on March 19. It was necessary to use a shovel to carefully extract the specimen.

3.6.2 Episodic Flooding

The Site was visited again on two different dates in March and again during multiple dates of April in order to document the consequences of episodic flooding downstream of the Bridge Street Bridge. A summary of the visits in March and April are included in Table 5. The first visit was on March 26, 2021, to document and collect any remaining mussel shells present in the floodplain located southeast of the Bridge. Weather during the field visit was extremely windy with light scattered showers. During this field visit, an area of shoreline was documented as flood plain, located approximately 225 m downstream of the Bridge, and appeared to have been recently flooded (hereinafter called Area 6; Figure 14). Area 6 included both standing pools of water, as well as a large number of displaced mussel shells evident on top of residual vegetation, sand, rock, and other debris (Figure 15). All shells collected at this location were documented to be dead and free of flesh, with most documented as fully complete (i.e., with specimens including both shell halves). Mussels were collected and returned to the office for identification.

The Bridge was again visited on March 27, 2021 following the occurrence of an overnight rainstorm. This storm resulted in approximately 2-3 mm of precipitation. Field visits completed on this day documented that the area of shoreline surveyed the previous afternoon was now flooded and inaccessible (Figure 16). Flowing water through this location was documented to be relatively fast flowing, turbulent and upwards of 45 cm deep directly off the shoreline.

Follow-up surveys of the area downstream of the bridge were completed to quantify the displacement of mussels to the floodplain, as reviewed within Table 5 (Figures 17 to 19). The survey dates extended from March 19 until May 11, 2021. The goal of these surveys was to view the flood plain area after precipitation events in order to document mussel deposition patterns. Results of these varied field visits indicate that natural areas downstream of the Bridge repetitively flood following even minor precipitation after the major spring flood that follows snow melt. Furthermore, as a result of the repetitive flooding downstream of the Bridge after each precipitation event, it demonstrates this process displaces mussels and represents a constant source of mortality. In general, after each rain, mussels are displaced to the floodplain and apparently do not make it back to the river. For example, during surveys of Area 6 on March 27, nearly 600 mussel shells or mussel shell fragments were collected. In contrast, a total of 65 were found on April 21 and 20 on May 11. These surveys ended with growth of vegetation and baseflows in the river.

Table 5: Summary of dates for all mussel surveys during spring, 2021.

Date of Survey	Approximate Number of Shells Collected
March 19, 2021	173
March 20, 2021	87
March 26, 2021	594
March 27, 2021	249
April 1, 2021	125
April 9, 2021	60
April 21, 2021	65
May 11, 2021	20

Figure 14: View of the shoreline, looking north, of an area that appeared to be recently flooded. This area included pools of standing water, as well as a large number of deposited mussel shells.

Figure 15: View of the deposited mussel shells on March 26, 2021 in an area of shoreline approximately 225 m downstream of the Bridge. This area was titled to be a "mussel graveyard" as a result of the large number of dead and deposited shells. It is expected that the shoreline will again appear like this following the receding of flooding on March 27, 2021. A number of shells have been highlighted with red arrows.

Figure 16: View of the same shoreline, looking north, now flooded. This area now included fast flowing, and turbulent water, documented to be upwards of 45 cm deep off the shoreline.

Figure 17: View of the same shoreline on April 1, looking north, once flooding has receded. This phot demonstrate the effects of episodic flooding, vegetation may be observed to have been matted down in the downstream direction, as a result of past fast flowing water moving through the area.

Figure 18: View of the shoreline on May 11, during the search for mussels. This search was done by Dr. Kott, Ms. Zadori, and Mr. Gibson and Dr. Fitzgerald (not pictured).

Figure 19: View of the shoreline on May 11 with Dr. Kott holding an Elktoe found on top of the vegetation, likely displaced from the river during a recent rain storm. Mr. Gibson is also visible.

3.7 Analysis of Mussel Shells

Mussel shells included for this analysis were collected from five different areas of the woodland on October 13 and October 16, 2020, as well as when found along shorelines upstream and downstream of the Bridge (hereinafter, Areas 1 to 5; Figure 21). In addition, mussels were located during March 2021 from Areas 1 to 5. As a complement, mussel shells collected from Area 6 during visits from March to May of 2021 were excluded from this analysis as a result of their distance from the Bridge (~225 m). The majority of mussel shells were broken in half, with only a limited number including both the left and right halves of the shell. All collected mussel shells were documented to be free of flesh, and were likely displaced into the woodland as a result of seasonal flooding. A single live mussel was collected during surveys in April, 2021 and was gently placed back in the River into sand sediment with a water depth of ~30 cm.

Figure 21: View of the five different areas from which mussel shells were collected. Collection of mussel shells was performed with a radius of approximately 10 m surrounding each marker.

Prior to identification, each mussel shell was washed and given a unique number code (Figure 22). Mussels shells were then identified based on the length, presence and type of pustules/nodules, presence of ridges, type of rays, type of beak sculpture, presence of a dorsal wing, type and formation of teeth (lateral and interdental), and shell colour. Identification was aided through the use of the digital Canadian Freshwater Mussel Guide and the accompanying Clam Counter App, both created in partnership by the Toronto Zoo, and Fisheries and Oceans Canada.

Figure 22: View of a portion of the mussel shells collected from the woodlands in proximity to the Bridge Street Bridge in 2020. Collected mussels were first washed and given a unique number and letter code before being identified.

It is prudent to note that a number of observations of freshwater mussel shells were documented on iNaturalist (Figure 23). The majority of these observations were made by Mr. Fraser Gibson between 2018 and 2020. Mr. Gibson is affiliated with WRN. During 2020 and 2021, Staff from ELM communicated with Mr. Gibson to learn more about the Site and to gain a more complete set of observations regarding the mussels, spanning over multiple past seasons. Relevant correspondence with Mr. Gibson has been included within Appendix B.

Figure 23: Summary of observations of freshwater mussels made by Mr. Fraser Gibson along the Nith River in proximity to the Bridge Street Bridge.

A total of 215 freshwater mussel shells were collected from the five areas within the woodlands located southeast of the Bridge and identified in-office following field studies in October of 2020. Of these 215 mussels, 98 of them were of a size where identification was possible (> 1 cm in shell length), while the remaining 117 were considered too small (< 1 cm) to properly discern identification features such as teeth, rays and ridges. Mussel shells collected from Area 6 during visits in March and April of 2021 were excluded from this analysis as a result of their distance from the Bridge (~225 m). A total of twelve (12) species were identified from the collected shells in combination with Mr. Gibson's records. All identified species were determined to be typical of the Grand River Watershed. Identified species were as follows:

- Giant Floater *(Pyganodon grandis*)
- Elktoe (*Alasmidonta marginata*)
- Flutedshell (*Lasmigona costata)*
- Fatmucket (*Lampsilis siliquoidea*)
- Creeper (*Strophitus undulatus*)
- Cylindrical Papershell (*Anodontoides ferussacianus*)
- Creek Heelsplitter (Lasmigona compressa)
- Black Sandshell (*Ligumia recta*)
- Spike (*Eurynia* dilatata)
- Fragile Papershell (*Leptodea fragilis*)
- Wavy-rayed Lampmussel (*Lampsilis fasciola*)
- Rainbow (*Villosa iris*)

Lengths of mussels were observed to vary significantly from area to area, with the largest shells located within collection areas closer to the river, with lengths observed to decrease with increasing distance between the collection area and Bridge. Species were documented to range in shell length from 13.9 cm (maximum) to less than 1 cm, often only a few millimeters (minimum). The smallest length of mussel in when the species was identified was 1.3 cm. It is also prudent to note that some shells were unable to be identified as a result of being too worn or too broken. A summary of the results are within Table 6.

Table 6: Summary of shell length by area, with shell maximums, minimums, and averages noted.

Area No.	No. of Shells Collected	Maximum/Minimum (Average) Length of Identifiable Shells*
0**	3	13.5/11.1 (12.8)
1	57	13.9/2.8 (8.0)
2	7	8.2/4.3 (6.4) (6.4)
3	76	9.6/1.3 (3.9) (66 shells < 1 cm length)
4	47	10.8/2.1 (5.4) (36 shells < 1 cm length)
5	15	N/A (<1cm) (15 shells < 1 cm length)

* - Identifiable shells were determined to be those measuring above 1 cm in length, with discernable identification features (i.e. nodules, ridges, rays, teeth, etc.)

** - Area 0 includes shells collected from shorelines upstream and downstream of the Bridge Street Bridge.

3.8 Green Dragon

Specimens of Jack-in-the-pulpit (*Arisaema triphyllum*), a plant very similar to Green Dragon, were found by Dr. Kott on May 11 within 30 m of the river shoreline, 200+ m downstream of the proposed bridge construction area. This area was in close proximity to the area with high numbers of freshwater mussels. Then on May 12, Mr. Gibson found two specimens of Green Dragon near this Jack-in-the-pulpit, and other Green Dragon specimens are suspected in the area. Generally, these Green Dragon are considered as far from the proposed bridge construction area and are very likely not to be disturbed in the future.

Figure 20: View of a Jack-in-the-pulpit, found approximately 30 m from the shoreline on May 11. A subsequent visit by Mr. Gibson located a Green Dragon in close proximity to this Jack-in-the-pulpit on May 12. The Green Dragon specimen is located about 200+ m from the proposed bridge work area. A total of two Green Dragon specimens were in this area by Mr. Gibson but due to the cool weather and recent frost at night, it is possible that other specimens may also emerge in the coming weeks with warmer temperatures.

4.0 DISCUSSION

Studies during the last calendar year provided the opportunity to document and learn about the natural habitats around the Bridge Street Bridge Site. This documentation and learning identified a diverse array of plants and wildlife exist in these habitats. The study also documented the presence of SAR birds, fish, and mussels in the general area as well as on-Site. These efforts also revealed the agriculture and natural habitats on-Site do not include the presence of wetlands managed by the GRCA. With this basis, the following discussion of findings focuses on the plants and wildlife identified in proximity to, or on-Site. This focus includes considerations of appropriate environmental management strategies available to avoid or reduce disturbance on plants and wildlife during the proposed future replacement of the bridge.

4.1 Species At Risk

Observations from the desktop study documented potential habitat on-Site occupied by different types of SAR on-Site as well as within upstream and downstream areas. This documentation led to the completion of the field inspection to determine the likelihood and potential for SAR to be present on-Site. The SAR identified within the desktop review and field inspection included: Greater Redhorse, Black Redhorse, Silver Shiner, Rainbow Mussel, Wavy-rayed Lampmussel, Snapping Turtle, Midland Painted Turtle, Eastern Hog-nosed Snake, Bald Eagle, Barn Swallow, Black Ash, Butternut, Green Dragon, Little Brown Bat, Eastern Small-footed Myotis, and Tri-Coloured Bat. This section now addresses presence/absence for each of the SAR of concern.

Aquatic species such as Greater Redhorse, Black Redhorse, and Silver Shiner, were determined to be potentially present on-Site following the desktop review. Although no fish surveys were completed as part of field inspections, appropriate aquatic habitat for these fishes was observed. For example, the Nith River at this location includes various areas of water less than 2 m deep, with suitable substrate (sand and gravel) for use by Black Redhorse (MECP, 2019b). Given the presence of this habitat, it is entirely possible, if not likely that these species are in fact present at the Site. Due to the assumed presence of these species, specifically, Black Redhorse and Silver Shiner, it will be necessary to register the project with MECP and develop appropriate strategies for mitigation in order to minimize impacts to these species. Appropriate mitigation strategies are discussed further in Section 5.1.

The possible presence of SAR Rainbow Mussel and Wavy-rayed Lampmussel was also documented at the Site. Similar to the case with fishes, no in-water mussel surveys were completed as part of field inspections. However, the presence of mussels within this section of the River was concretely confirmed based on observations and collection of mussel shells from within the nearby woodland. It has been hypothesized that these mussels, along with sediments, were displaced from in-water areas located in proximity to the Bridge as a result of past flooding events. Although only common mussel species were identified from the collected shells, this is thought to be representative of the portions of species within the River, thus since these SAR mussels are rare within the watershed, it is also expected to be rare to find a displaced shell from these mussels within the woodland. Due to the assumed presence of these species, it will be necessary to register the project with MECP and develop appropriate strategies for mitigation in order to minimize impacts to these species. Appropriate avoidance and mitigation strategies are discussed further in s. 5.1.

The presence of Midland Painted Turtle, Snapping Turtle and candidate turtle nesting habitat was documented during the desktop review, as well as with the field inspection. It is prudent to note that Midland Painted Turtle has not been observed near the Site in more than 30 years, leading this species to be assumed absent. However, Snapping Turtle was observed in 2019, indicating it is likely present in proximity to the Site. Although no Snapping Turtles were observed, it is inferred they could possibly exist as areas near the bridge, implying it possible that turtle nesting also occurs in this area. While these two turtles are currently designated as Special Concern and therefore not afford extensive protection under the ESA, it is prudent to identify avoidance and mitigation, in order to avoid disturbance of specimens and habitats. Appropriate avoidance and mitigation strategies are discussed further in Section 5.1.

Desktop review also identified Eastern Hog-nosed Snake as a potential SAR present in proximity to the Bridge. Eastern Hog-nosed Snake was most recently documented at the Site in 1944, over 30 years ago. As there are no more recent documented observations of this species, it is likely no longer present in proximity to the Site, therefore is considered absent from the Site for the purposes of this review. With this in mind, hibernacula suitable for use by snakes was documented approximately 50 m from the western abutment on the southern side. While SAR Eastern Hog-nosed Snake has been deemed likely absent from the Site, it remains possible that species of no conservation concern utilize this hibernacula. However, this habitat is unlikely to be disturbed as a result of its distance from the bridge structure, indicating that snakes are also unlikely to be disturbed as a result of on-gong activities at the Site.

Bald Eagle was observed flying overhead during field inspections, however since no large stick nests were documented within the surrounding woodlands, this species was assumed to just be passing over, possibly searching for forage. While it is possible that Bald Eagle are nesting within surrounding woodlands, no nests were observed in proximity to the Bridge, indicating that any nests are sufficiently distant from the Bridge and will not be disturbed in the case they do exist. Thus Bald Eagle is not nesting in the area.

Barn Swallow are known to use human structures for nesting. Field inspections documented the presence of six Barn Swallow nest the underside of the Bridge. While no Barn Swallow themselves were observed, likely as a result of the inspection taking place in the autumn season, the presence of nests provides evidence of the use of the bridge by Barn Swallow. Based on this, the project will require registration with MNRF, as required by the ESA. For this Site, the SAR Barn Swallow are not expected to be disturbed by the proposed bridge replacement as a result of obligations set out as part of the project's registration. Appropriate mitigation strategies are discussed further in Section 5.1.

Field inspections did not document the presence of any suitable habitat for myotis within proximity to the Bridge. While the presence of large specimens of Crack Willow were documented downstream of the Bridge, these did not appear appropriate for use by SAR myotis (i.e., no visible hollow sections or small holes to be used for entrance). In the past, a common practice in Ontario was to plant Crack Willow along the shorelines of rivers, streams, and lakes, as a low cost means to enhance the woody vegetation community, improve runoff, and enhance soils. Another consideration is the Crack Willow is a hybrid and does not produce viable seeds, so it was inferred to not represent a hazard to ecosystems (Pross and Lambert, 1967). In the unlikely chance that these trees are being utilized by SAR myotis, they exist at distance from the Bridge and are therefore unlikely to be disturbed regardless. It is possible that more suitable habitat for myotis exists within the surrounding woodland, however none were observed, indicating that they also exist at a distance from the Bridge and will not be disturbed. Thus, Little Brown Bat, Eastern Small-footed Myotis, and Tri-Coloured Bat should be considered absent from the Site.

Field inspections documented the presence of Common Milkweed, a plant which is vital to the life process of Monarch. Common Milkweed was predominantly documented within the areas of upland terrestrial vegetation, located on along the northwest shoreline, upstream of the Bridge. Although no Monarch themselves were observe, likely as a result of the time of year the field inspections were completed, based on the presence of this habitat, Monarch should be assumed present in proximity to the Site, however unlikely to be disturbed. Monarch are not expected to be disturbed by the proposed bridge replacement as a result of the distance presence between the upland terrestrial areas and the Bridge, however since Monarch is an extremely mobile species and could possibly pass through the boundaries of the work area, appropriate mitigation strategies are discussed further in Section 5.1.

A few specimens of Black Ash were observed on the south western banks of the Nith River approximately 30 m downstream of the Site. However, these stems are not expected to be disturbed as a result of proposed activities, as a result of this spatial separation. That is, the 30 m distance between the bridge area and the woodland is expected to act as a buffer to environmental impacts on Black Ash. As this is a sessile species, it is also unlikely that Black Ash will become further established closer to the Site prior to the commencement of construction activities. Additionally, it expected that BMPs will be implemented to protect all tree species in proximity to the Bridge, as reviewed in Section 5.1. For these reasons, Black Ash has been confirmed as present in proximity to the Bridge, however absent from the Site.

Field inspections did not document the presence of any Butternut or Green Dragon within 120 m of the Bridge. As these are sessile species, it is also unlikely they will become established at the Site prior to the commencement of construction activities. It is also expected that BMPs will be implemented to protect all tree species in proximity to the Bridge, as reviewed in Section 5.1. For these reason, Butternut and Green Dragon are assumed absent from the Site.

In summary, due to the noted environmental features documented during the desktop review and field inspections, species have been determined as present or absent from the Site as follows:

- Greater Redhorse, Black Redhorse, and Silver Shiner – Assumed present at the Site, based on presence of appropriate habitat in combination with SAR records. As a result of the requirement for in-water work, it will be necessary to register the project with MECP and avoid disturbance.
- Rainbow Mussel and Wavy-rayed Lampmussel - Assumed present at the Site, based on presence of appropriate habitat in combination with SAR records. The discovery of shells of both species in the flood plain implies they are in the river. Hence, due to the need for in-water work, it will be necessary to register the project with MECP and develop appropriate strategies to avoid disturbance of mussels in the river with suitable mitigation.
- Snapping Turtle – Possibly present upstream of the Site, due to the presence of appropriate nesting habitat. Appropriate mitigation strategies will be implemented to ensure this species is unable to enter the Site and will therefore not be disturbed as a result of on-Site activities.
- Midland Painted Turtle – Absent from the Site but could migrate to the Bridge. Appropriate mitigation strategies will be implemented to ensure this species, similar to Snapping Turtle, is unable to enter the Site and will therefore not be disturbed as a result of on-Site activities.
- Eastern Hog-nosed Snake - Absent from the Site, due to the lack of recent observation record of this species in proximity to the Bridge. Mitigation strategies implemented for the protection of Snapping Turtle will also act to protect other non-SAR amphibians and reptiles from the work area.

- Bald Eagle – Absent from the Site but could migrate in area during spring or autumn. Determination of absence due to the lack of stick nests observed on tall trees or other structures within 120 m of the bridge. It is possible that this species nests further upstream/downstream, however nests would remain undisturbed as a result of their distance from the Bridge.
- Barn Swallow – Confirmed to be present at the Site, based on presence of appropriate habitat in combination with SAR records. As a result of the requirement for in-water work, it will be necessary to register the project with MECP and develop appropriate strategies for mitigation.
- Little Brown Bat, Eastern Small-footed Myotis, Tri-Coloured Bat – Absent from the Site due to the lack of suitable habitat for myotis within proximity to the Bridge. In the unlikely chance that these trees are being utilized by SAR myotis, they exist at distance from the Bridge and are therefore unlikely to be disturbed regardless.
- Monarch - Possibly present upstream of the Site, due to the presence of Common Milkweed upstream of the Bridge. Appropriate mitigation strategies will be implemented to ensure this species will therefore not be disturbed as a result of on-Site activities.
- Black Ash - Present in surrounding woodland, however absent from the Site and therefore unlikely to be disturbed. Mitigation strategies will be implemented to protect all tree species.
- Green Dragon – specimens found > 200 m from the bridge. Due to this location, these specimens can be considered spatially separated from a future work area. At this time, it is unclear how many specimens exist in this area downstream of the bridge and members of WRN are currently conducting a survey and will share such information in the future.
- Butternut – no specimens found within 120 m of the bridge work area. It is inferred that this tree is likely absent, as very few Black Walnut exist in the flood plain woodland.
- Possible migratory SAR (e.g., birds) use the bridge area during spring and autumn seasons. Such transient species can be excluded from a future work area and thereby avoid disturbance.

4.2 Flooding Patterns

Based on field visits completed in early March, in combination with past evidence of a major flooding event occurring in 2018, it may be concluded that the Nith River is prone to seasonal flooding within proximity to the Bridge Street Bridge. Seasonal flooding was documented to act as a continual method of natural disturbance within both the watershed and adjacent woodlands. As discussed, large amounts of sediments and gravel have been, and will likely continue to be, deposited into the woodland, causing extreme scour and displacing freshwater mussels in the process. In ELM's opinion, this seasonal disturbance may be considered much more damaging to the woodland, and occurring over a much larger area, than activities occurring at the Bridge for construction would likely ever cause to adjacent areas. It is with this in mind that the implementation of suitable BMPs and tailored mitigation strategies will likely be sufficient to ensure that no further disturbance to the woodland is created as a result of the proposed Bridge replacement.

Field inspections identified the extensive nature of the flood plain associated with the Site. This flood plain extends upstream and downstream of the bridge and corresponds to areas used for agriculture, fallow fields, or natural flood plain forest. Within this mosaic of habitats upstream and downstream of the bridge, plant species classified as hydrophilic (i.e., water loving) and commonly found in wetlands are evident. However, these hydrophilic plants do not form wetlands, due to past agricultural uses of these lands as well as the seasonal flooding that disturbs these habitats on an annual basis. Due to no defined wetlands on-Site, the GRCA policies concerning wetland management is not applicable to these habitats or the Site.

The documentation of the increasing water levels after a rainstorm demonstrates that this portion of the Nith River is extremely prone to episodic flooding in addition to seasonal flooding. It is expected that after even minimal amounts of precipitation (i.e. a couple mm), flooding downstream of the Bridge occurs to some capacity. This repetitive occurrence of flooding along the shorelines, and sometimes into the adjacent woodlands, works to continually disturb the woodlands, creating large areas of scour and debris deposition. Furthermore, this flooding acts as a continuing form of natural disturbance to the freshwater mussel community within the Nith River. Following the receding of the seasonal flooding on March 27, mussel shells were again be trapped on shorelines and floodplains, creating the continual presence of freshwater mussel shell graveyards in proximity to the Bridge. It is expected that this process of receding and deposition, as well as of continuing disturbance to the woodlands, is therefore a reoccurring pattern within this portion of the River as a result of both seasonal and episodic flooding patterns causing the repetitive deposition of mussel shells along the shorelines of the Nith River.

4.3 Fishes

Available information identifies that a diverse fish community exists in the Nith River near the Site. For this proposed project, it should be feasible to use timing windows and other activities such as BMPs to reduce the disturbance of fish habitat. Such BMPs would include fish removal and release from the work area in the future, to avoid harm to fish specimens. In addition, the habitat enhancements that will occur along the shoreline in the future can be expected to represent improvements to the existing habitat features. For example, a wide area around the east bridge abutment shows extensive erosion with concrete debris and garbage in the shallow water. In addition, the west shoreline also shows erosion around the bridge abutments along with numerous bags of cement that exist on top of the native mud and rocks in the river. The future construction will enhance both of these shoreline areas representing a benefit to the native fishes. It will be also necessary to post the area as no fishing during the construction period, as it is a popular area for citizen anglers. This posting for no-fishing will represent a reasonable safety measure for the Site.

4.4 Freshwater Mussels

Surveys of the shoreline areas near the Site resulted in the identification of more than twelve (12) species of freshwater mussels. These results reflect past citizen science records and surveys during this study. These results reflect a study area from along the river shoreline to > 100 m within the flood plain forest. Based on these records and identifications, a number of assumptions may be made regarding the makeup of the mussel community within the adjacent Nith River without doing a dedicated mussel survey or disturbing aquatic habitat.

It is hypothesized that the freshwater mussel species identified along the shoreline and within the flood plain forest are representative of the species within the Nith River. With that in mind, it may also be hypothesized that the ratio of different species within the mussel communities identified may also be representative of the species ratios within the mussel communities which still remain within the Nith River. For example, Fatmucket and Flutedshell were among the species most frequently identified within the collected shells, thus indicating that these may be the most readily observed in the case a mussel survey was completed within the Nith River near the bridge. This concept can be further extended to the low numbers of SAR Rainbow Mussel or Wavy-rayed Lampmussel, as only a very small number of these specimens were discovered. As noted earlier, these latter two species are of conservation concern, indicating

low population numbers in natural habitats. This information does provide insight into the relative abundances of the different species, from common to SAR. These results confirm the pattern that SAR are present in the River in much lower proportions when compared with other mussel species. While this information does not necessarily provide the exact locations of mussels generally or SAR specifically, it does confirm the presence in this portion of the Nith River. This confirmation of presence represents clear justification to use careful planning to avoid and limit disturbance to freshwater mussels.

A key observation from this study is the continued deposition of mussels on to the flood plain following the spring freshet and then following major rain storms. Hence, these two processes represent meaningful mortality events for mussels. That is, mortality associated with seasonal spring freshet flooding and mortality associated with episodic rainstorms. Identification of mortality events during different parts of the calendar year act to provide context to identify strategies to avoid / limit mortality of freshwater mussels from the proposed bridge construction activities.

4.5 Invasive Vegetation

A number of herbaceous and woody invasive species were documented on-Site, many of which are considered harmful to the native vegetation communities. It is for this reason that ELM recommends the removal of a number of invasive species from the Site, including: Common Mullein, Wild Parsnip and Field Bindweed among others. It is ELM's opinion that these species offer the greatest threat to native vegetation on-Site. Removal of these species should be completed by hand to ensure that surrounding native species are not harmed and that the seeds of non-native vegetation are minimally spread during the removal. Treatment should be completed in a two-step control method following construction. The first step should involve removal when noxious weeds are found at the start of construction. Then the second step is to remove them again after construction is completed. This approach will act to remove mature specimens and any that grow from seed, and provide multiple benefits to the Site.

5.0 ENVIRONMENTAL RECOMMENDATIONS

Based on the findings of the desktop review in combination with observations gathered during the field inspections, a number of environmental recommendations were developed in order to minimize the environmental impact of the proposed activity. Recommendations are discussed herein.

Preferred Approach for the Proposed Activity

With the information collected with this study, ELM recommends that future construction activities occur on the shoreline during July and August with in-water work starting after 1 September. If the in-water work for construction starts in September, it would involve habitat disturbance after all bird, fish, mussel, and turtle species have completed reproduction for the year. If in-water work is completed after 1 September, the progeny of all noted wildlife species will be sufficiently mobile to avoid any disturbance on-Site. Despite the absence of defined wetlands near the bridge, these plant communities do provide habitat to varied wildlife. For this reason alone, BMPs to reduce disturbance on vegetation communities should also be applied during future proposed activities. If construction occurs during autumn, it will correspond to the low water period of the calendar year, and facilitate an efficient process to inspect and possibly clear the work area along the shorelines of any freshwater mussels that could occur in these shallow water habitats.

5.1 Applicability of Government Regulations to the Proposed Activity

With the completion of desktop literature review, field inspections, ecological inventory studies, ELC mapping, and analysis of all available information, it is feasible to identify the government regulations that apply directly to the proposed activity. With the foregoing information in mind, the following interpretation of the requirements for government regulations is presented:

1. GRCA *Wetlands Policy* – no wetlands identified near the Site. However, use of BMPs and timing windows justified to avoid disturbance of plant communities along the Nith River shoreline;

2. *Migratory Bird Treaty Act* – use timing windows to avoid disturbance of birds;

3. Ontario's *Endangered Species Act* – use timing windows and BMPs to avoid and/or reduce disturbance to SAR birds, fish, mussels, plants, turtles, and other wildlife species;

4. Ontario's *Fish and Wildlife Conservation Act* – use timing windows and BMPs to avoid and/or reduce disturbance to common fish and wildlife species. This regulation also includes the need for maintenance of fish and wildlife migration pathways; and,

5. Ontario PPS under *Planning Act* – use timing windows and BMPs to avoid and/or reduce disturbance to common fish and wildlife species and associated habitats. This regulation also includes the need for maintenance of fish and wildlife migration pathways.

5.2 Recommendations for Species At Risk

Field studies suggest a number of SAR are present or likely present on-Site or in proximity to the Site and will require the implementation of avoidance and mitigation strategies to ensure they are not disturbed as a result of on-Site activities. The following SAR that will require specific mitigation approaches include: fish (Greater Redhorse, Black Redhorse, and Silver Shiner), freshwater mussels (Rainbow Mussel and Wavy-rayed Lampmussel), turtles (Midland Painted Turtle, Snapping Turtle), bird (Barn Swallow), and insect (Monarch). For this group of species, standard avoidance and mitigation strategies exist that can be applied to avoid and reduce disturbance within the study area. This strategy will include:

- Timing windows for birds, fish, freshwater mussels, turtles, and vegetation removal;
- Active surveys in the river just before construction followed by translocation of specimens;
- Application of BMPs to exclude specimens from the work area; and
- Use of rehabilitation methods along the shoreline and within the Nith River.

A summary of SAR species on-Site not requiring follow-up surveys are included with Table 7.

Table 7: Summary of the recommendations provided by ELM for future survey efforts for SAR specimens and SAR candidate habitat.

SAR Species	Recommendations for future SAR surveys
Greater Redhorse, Black Redhorse, and Silver Shiner	Both fish species inferred to exist in the river. Propose that the project use timing windows and exclusion strategies to avoid interactions and mitigate habitat disturbance. **No additional SAR surveys are recommended.**
Rainbow Mussel and Wavy-rayed Lampmussel	Studies during the last year demonstrate more than 12 mussel species in the area of the Bridge. Such study in the last year demonstrated the presence of Rainbow Mussel and Wavy-rayed Lampmussel in this area as well. We propose that the project use timing windows and exclusion strategies to avoid interactions and mitigate habitat disturbance. We also propose that the work area along the shoreline near the construction area be screened for mussels using standard methods prior to habitat disturbance during the low water period of late summer – early autumn.
Snapping Turtle	Possibly present upstream of the Site, unlikely to be disturbed. Specimens will be unable to access construction area due to the presence of physical barriers, such as the erosion control fencing, therefore no interaction possible or expected between turtles and activities. **No additional SAR surveys are recommended.**
Midland Painted Turtle	Absent from the Site, as no recent records of this species exist in proximity to the Bridge. **No additional SAR surveys are recommended.**
Eastern Hog-nosed Snake	Absent from the Site, as no recent records of this species exist in proximity to the Bridge. **No additional SAR surveys recommended.**
Bald Eagle	Absent from the Site, however possibly nesting along river, although none observed. Unlikely to be disturbed, a result of the distance these nests would exist from the Bridge. Mitigation Strategies and BMPs will be implemented in order to assure no surrounding natural areas are disturbed as a result of the proposed activities. **No additional SAR surveys recommended.**
Barn Swallow	Present at the Site, unlikely to be disturbed. The original Bridge will be netted prior to the commencement of the bird breeding season, to ensure no nests are present on the Bridge at the time of demolition. A compensation nesting structure will be installed to ensure that Barn Swallow looking to nest in the area still have adequate habitat. **No additional SAR surveys recommended.**
Myotis (Little Brown Bat, Eastern Small-footed Myotis, Tri-Coloured Bat)	Absent from the Site, however possibly present in surrounding woodlands. Unlikely to be disturbed, as no suitable habitat was observed to exist for upwards of 30 m from the Bridge.

	Mitigation and BMPs will be implemented in order to assure no surrounding natural areas are disturbed as a result of the proposed activities. **No additional SAR surveys recommended.**
Monarch	Possibly present upstream of the Site, unlikely to be disturbed. Areas of Common Milkweed exist at a distance from the Bridge, as well as mitigation strategies will be implemented to ensure that this species is not disturbed as a result of on-Site activities. **No additional SAR surveys recommended.**
Black Ash	-Absent from the Site, present in surrounding woodlands. Unlikely to be disturbed, the only specimen observed exists upwards of 30 m from the Bridge. As this is a sessile species, it is also unlikely to become established closer to the Bridge prior to expected construction. Mitigation and BMPs will be implemented in order to assure no surrounding natural areas are disturbed as a result of the proposed activities. **No additional surveys recommended.**
Butternut	Absent from the Site. No Butternut were observed within 120 m of the Bridge during 2020 field inspections. As these are sessile species, it is also not likely to become established at the Bridge prior to the construction period, making it unlikely to be present or disturbed. **No additional SAR surveys are recommended.**
Green Dragon	Specimens found by F. Gibson of WRN located > 200 m from proposed construction area. Hence, no Green Dragon were observed within 120 m of the Bridge during 2020 field inspections. As these are sessile species, it is also not likely to become established at the Bridge prior to the construction period, making it unlikely to be present or disturbed. **No additional SAR surveys are recommended.**

5.2 Recommendations for Species At Risk, continued:

Fishes

The literature review and field studies confirm the presence of SAR fishes on-Site, specifically, Black Redhorse and Silver Shiner, likely both upstream and downstream of the bridge in the Nith River. With this confirmation of the presence of SAR fishes, this project will be registered with the MECP. This future registration is required, as the habitat near the bridge is used by both of these SAR fishes. It is expected that most disturbance of the fish specimens can be avoided through the use of activity timing windows. For example, exclude activity to the time of year when these fish are not actively spawning and all specimens can be excluded from the work areas.

Mussels

The literature review and field studies confirm the presence of SAR mussels on-Site, specifically Rainbow Mussel and Wavy-rayed Lampmussel, likely both upstream and downstream of the bridge in the Nith River. With this confirmation of the presence of SAR mussels, this project will be registered with the MECP. This future registration is required, as the habitat near the bridge is used by both of these SAR mussels. It is expected that most disturbance of the mussel specimens can be avoided through the use of activity timing windows during the low water season. For example, exclude activity to the time of year when the river water is shallow enough to allow for physical and visual searching of the benthic substrate. Then if a mussel is found, move the mussel specimen away from the fish are not actively spawning and all specimens can be excluded from the work areas.

As SAR freshwater mussels, specifically, Rainbow Mussel and Wavy-rayed Lampmussel, were documented to be present in the Nith River in proximity to the Bridge, this project will likely need to be registered with the MECP. However, if the future methods applied to the work demonstrate no risk to the mussels in the river, then it may be possible to avoid registration of the activity.

Barn Swallow

As Barn Swallow were observed nesting on the underside of the Bridge, this project will be registered with the MECP. In preparation for the Bridge removal, it is recommended that fine-mesh netting be placed over the whole Bridge in order to limit bird nesting on the structure prior to the construction period. This ensure that no migratory birds, including Barn Swallow, will be disturbed during the Bridge removal. Furthermore, this registration requires the construction of compensation habitat within 1000 m of the Bridge. Based on this, ELM proposes the construction of a four-post nesting structure. It is recommended that the structure soffit stand at a minimum of 2.8 metres (~ 9 feet) above the ground and contain an aluminum predator guard on each leg of the artificial habitat. Nest cups should be constructed along the interior beams of the structure. The design of the alternative nest structure and the nest cups conform to the standard designs approved in the past for use by MNRF.

Following the 2021 breeding season for Ontario birds (after August 31), a follow up inspection should be completed to ensure the artificial nest structure is functioning as designed. Furthermore, during this future inspection any nest cups occupied by Barn Swallow will be recorded in future monitoring activities. If other birds are using nest cups, this ancillary information will also be reported. It is expected that follow up monitoring of the structure will be required for a period of three years per Ontario's ESA.

Monarch

As it is possible that Monarch will be present in proximity to the Site, specially within areas including upland terrestrial vegetation, during the proposed activities, it is appropriate to implement mitigation strategies on-Site to ensure that this species and habitat will not be disturbed. While it is unlikely that Common milkweed itself with be disturbed, as Monarch is a transient species, a key aspect of these strategies will be the development of an on-Site protocol which may be implemented in the case that a Monarch enters the work area. For example, in the case that a Monarch stops over on a piece of equipment, use of said equipment should be halted immediately until the species has passed as to ensure that it is not harmed. In addition, the use of sediment erosion control fencing will act to protect any stems of Common Milkweed present in surrounding natural areas. This fencing is not only expected to provide protection from sedimentation but will act as a barrier to keep individuals working on-Site from stepping into, or storing equipment within natural areas that potential contain Milkweed specimens.

Turtles

Although not officially protected under the ESA, Snapping Turtle could possibly exist in the Nith River, using nesting habitat located upstream of the Bridge. Hence, it is appropriate to apply BMPs during the construction period, in order to exclude any turtles from the work area and to help minimize impact on the surrounding environmental as a result of on-Site activities (as reviewed in s. 5.5). A key aspect of these BMPs will be the use of erosion control fencing surrounding the entirety of the work area for the duration of the project. Such use of erosion control fencing will ensure that dirt and debris is not entering Nith River as well as neighboring natural areas, such as the surrounding woodlands. The use of erosion control fencing will also create a physical barrier of entrance to the Site, therefore establishing a level of protection for some terrestrial and semi-aquatic SAR such as amphibians and reptiles, as well as other wildlife that may reside in the area. It is also recommended that this fencing be installed prior to April 1st, as to ensure that no SAR or other wildlife may enter the work area prior to the commencement of the project following their hibernation periods.

5.3 Recommendations for Common Fish and Birds

For the proposed construction activities, it is inferred the use of standard activity windows will allow for the avoidance of disturbance to non-SAR fish during the active reproduction period. In addition, the use of standard activity windows is also expected to allow for the avoidance of disturbance to non-SAR breeding birds during the active reproduction period.

5.4 Recommendations for Vegetation

Following the removal of a number of non-native weeds from the Site as recommended in Section 4.5, it is necessary to replant native herbaceous and woody species in different areas. These areas include: the northwest quadrant, the northeast quadrant, the southwest quadrant, and the southeast quadrant. A prudent observation was presence of native plants found in wetlands with no well-defined wetlands present. This absence of wetlands is likely due to past and current agriculture and the seasonal flooding regime. Hence no recommendations for wetland enhancement are included herein.

After the non-native weeds are removed, it will be necessary to add topsoil to the slope in areas where plants were previously removed as part of the construction of the new Bridge Street Bridge structure and for associated equipment laydown areas. Newly placed soil should be mixed with peat moss and disked to offset the potential impacts caused by ground compression by heavy machinery. Following the addition of topsoil, it is then recommended that the slope be hydroseeded as soon as feasible with an OSC mixture. Native seed mixtures such as "Low Maintenance Retention Basin Native Seed Mixture"[1], which contains seeds for species such as Virginia Wild Rye (*Elymus virginicus*), Ticklegrass (*Agrostis scabra*), Fox Sedge (*Carex vulpinoidea*) and Fowl Bluegrass (*Poa palustris*), or "Creek Bank Native Seed Mixture (Wet Meadow Type)"[2], which contains seeds for species such as Big Bluestem (*Andropogon gerardii*), Black Eyed Susan (*Rudbeckia hirta*), Bottlebrush Grass (*Elymus hystrix*), Fowl Bluegrass (*Poa palustris*), Fowl Manngrass (*Glyceria striata*), Fox Sedge (*Carex vulpinoidea*), and New England Aster (*Aster novae-angliae*) are recommended. It is expected that the use of a native wet-meadow type seed mixture will best suit the area, given the frequency of seasonal flooding patterns.

1- https://www.oscseeds.com/product/low-maintenance-retention-basin-native-mixture-8220/
2- https://www.oscseeds.com/product/bank-native-mixture-wet-meadow-type-8215/

Following hydroseeding, ideally it will occur as soon as feasible after bridge construction. It is then recommended that tree planting occur. Additional details on the exact locations of tree planting will be determined following guidance from the Township of Wilmot. Under this scenario, it is expected that tree planting will likely be completed at a 1:1 compensation ratio for woody stems removed during construction activities. The specific location of where compensation plantings could occur has not been discussed, however, pending final detailed design. It is expected that suitable woody stems may include Crack Willow, Shagbark Hickory, Bur Oak, Silver Maple, and Red Osier Dogwood. It is therefore recommended that KSAL will inform ELM of the nature of the future landscape plan, at which time a more detailed list of appropriate species, as well as a specific number of trees recommended for replanting can be determined.

To summarize, it is the opinion of ELM that the following tasks be completed:

1. Control non-native weeds growing on-Site. This control should include removal completed through the construction period. This will involve removal of non-native herbaceous species by hand;
2. The placement of topsoil and moss in areas disturbed by construction activities;
3. Hydroseeding. Hydroseeding should be completed using a native seed mixture, immediately following the removal of non-native species and placement of soil in proximity to the Bridge, and;
4. Plant native trees on-Site, to compensate for removal of native woody stems. Planted trees require fencing, to reduce the risk of herbivory and increase survival.

5.5 Recommendations for Wildlife

Wildlife habitat exists in proximity to the Site and within adjacent areas along the river. It is expected the recommendations presented to protect SAR will also benefit common wildlife species. In addition, the removal of invasive vegetation and the completion of follow-up planting will act to both protect non-SAR wildlife and SAR wildlife habitat during the proposed construction activities, as well as enhance wildlife habitat in proximity to the Bridge following construction. The removal of invasive species during these activities will aid in allowing native vegetation to thrive in proximity to the Bridge, while the compensation planting of native tree species and native seeds is expected to enhance the promotion of native species along the shoreline. It is expected that with careful environmental management during, and following the proposed activities, construction of the new Bridge Street Bridge may actually benefit the area for these reasons. It is also expected that the use of BMPs and developed mitigation strategies, such as erosion control fencing will protect wildlife communities present in proximity to the Nith River in addition to SAR.

During the field inspection, evidence of recreational fishing activities were observed. While this area may be considered somewhat rural, as it is expected that this area is used frequently for recreational fishing activities, it is recommended that additional health and safety measures be considered to protect individuals that may be in close proximity to the Bridge Street Bridge construction zone. Additional considerations may include the increased presence of warning signage, blocking entrance or area with a perimeter fence to limit access where possible, and ensuring that no access to commercial machinery is possible.

5.6 Review of BMPs available for Future Use

As a preamble to the next phase of this study, the following BMPs are recommended for possible implementation on- Site. These recommendations follow standard guidance (e.g., TRCA, 2019). If the BMPs are implemented, they will likely reduce the possible negative effects from the proposed development. Standard BMPs for construction activities should be used to mitigate other types of disturbance on the environment prior to and during the proposed activities on-Site. Standard BMPs involve use of activities to eliminate, reduce, and otherwise manage vegetation, soil, dust, vehicle exhaust, water runoff, and spills. The use of these mitigation measures is expected to reduce the extent and duration of negative effects of proposed activities. These BMPs and mitigation measures are framed on a site-specific basis to reflect existing conditions and natural heritage features. In addition, other BMPs include the use of appropriate timing windows for removal of vegetation and disturbance of soils. These timing windows are defined by the MNRF. Staff on-Site should also visually inspect all BMPs when it will be inactive for several days, such as over weekends and holidays. Such inspections will help to prepare for rain events that may occur when workers are away. These planned preparation procedures will reduce risk of environmental disturbance. In the future, exact use of the BMPs will need to occur in conjunction with different phases of the proposed development, however basic sediment and erosion control measures have been outlined within Table 8, obtained from the “Erosion and Sediment Control Guide for Urban Construction” published in 2019 by the Toronto and Region Conservation Authority. It is expected that the use of these BMPs will result in the avoidance or reduction of disturbance on-Site. However, it is essential for proper timing of use of BMPs, to ensure they reflect seasonal constraints, such as high runoff events during autumn rains etc.

With this basis, the following BMPs are available for use:

- Completion of demolition activities throughout the winter months when the River is frozen over. This will work to expedite the cleanup process and minimize ground compaction as a result of heavy equipment use;
- Install sediment erosion fences around the entire work area prior to completion of any earthworks or construction activities. Such fences will act to reduce erosion and sediment transport from the work area into natural areas and also exclude wildlife species from the equipment and heavy machines used for the demolition activities. For example, these fences will prevent wildlife such as frogs or snakes from entering the area from the adjacent grassed slopes as well as limit wildlife such as turtles from entering the work area from the water-shoreline area;
- Regularly inspect the sediment erosion fences for damage. These inspections will ensure that no erosion is able to occur through damaged or non-functioning fencing. In addition, these inspections will identify if wildlife is able to enter the work area. In the case that SAR turtles migrate to the demolition area, a qualified biologist should be contacted to remove these species;
- Ensure no refueling of vehicles occurs near the watercourse. It is appropriate to refuel vehicles or equipment at a distance of 30 m from surface waters;
- Install spill containment devices around ground drains located in proximity to the work area, to prevent spills draining to the drainage creek and subsequently into the Nith River;
- Develop a clean equipment protocol that involves the decontamination or washing of equipment prior to entering the Site or changing areas on-Site. This will help to limit the transferring of invasive vegetation through seed to the Site.

Table 8: Summary of basic sediment and erosion control measures to be implemented during construction on-Site to reduce risk of environmental disturbance. Table obtained from the "Erosion and Sediment Control Guide for Urban Construction" published by the TRCA in 2019.

Erosion Controls (Appendix B1)	Sediment Controls (Appendix B2)	In-water controls (Appendix C)
Minimized or phased land clearing	Sediment control fence	Horizontal Directional Drilling
Vegetated filter strips	Filter socks	Sediment / Turbidity Curtains
Slope drains	Natural fibre logs and wattles	Temporary Stream Crossings via Temporary bridge or Culvert(s)
Interceptor swales	Rock check dams	Waterproof isolation barriers (e.g. cofferdams)
Outlet protection	Vehicle tracking controls	Diversion / bypass channel
Mulching	Sediment (dewatering) bags	Flume bypass
Seeding	Storm drain inlet protection	Bypass pumping
Surface roughening	Sediment traps	Dewatering
Rolled erosion control products	Sediment control ponds	
Chemical soil stabilization (e.g. tackifiers)	Weir tanks	
	Polymer flocculants	
	Active treatment systems	

5.6.1 Timing Windows for BMPs

With the information derived from the desktop review, it is feasible to present a strategy that will generally allow for the avoidance and mitigation of disturbance for habitat, wildlife, and SAR from the proposed activity. This allowance to avoid and mitigate disturbance is predicated on careful timing of activities through use of BMPs. With this approach, it allows for activity to occur whereby habitat and specific wildlife will not be disturbed. If this approach is not followed within the set schedule, it will require either a deferral of activities for one calendar year, to meet the schedule requirements or the completion of additional field surveys. These schedule requirements are now presented in Table 9.

Table 9: Recommended use of BMPs to allow for avoidance and mitigation of disturbance for habitat, wildlife, and SAR.

Species of Concern	Recommended BMP Activity	Required Schedule	Comments
Turtles and Amphibians	Install sediment fences for work area, along edge of the tributary, and around laydown area in early spring	By April 1	If sediment fence is not used to isolate the work area and laydown area by April 1, turtles will enter the work area, requiring work to halt and a certified biologist to be notified.
	Install spill containment devices	Prior to heavy machinery entering the Site	If not installed prior to heavy machinery entering the Site, accidental spills that may occur have the potential to drain into the tributary, contaminating and damaging natural areas. Responsible parties will then be held liable for cleanup.
Monarch	Development of an on-Site protocol for when Monarch enter the work area	By May 1	Monarchs begin to arrive back in Ontario throughout the late spring and early summer months. Therefore, protocols should be in pace prior to their potential arrival at the Site.
Non-native vegetation	Remove via hand picking or focal herbicide application	As soon as feasible after demolition completed	Presence of non-native vegetation in demolition area. This vegetation needs to be removed as soon as feasible. Otherwise, it will spread and result in further disturbance of the natural habitats on-Site.
Wildlife	Completion of demolition throughout the winter months when feasible	November – March	Completion of demolition during the winter months will expediate the cleanup process and minimize the amount of ground compaction resulting from heavy equipment use.
	Remove any specimens found in work area or laydown area	As soon as feasible	If SAR are found in the work area or laydown area, it may be necessary to contact MNRF.

The findings from this study are framed within the Statement of Limitations in Appendix C.

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Appendix A

Representative Photographs

Photo No. 1	
Date: October 13, 2020	
Description: View, looking west, of the Bridge Street Bridge and Nith River.	

Photo No. 2	
Date: October 13, 2020	
Description: View, looking east, of the Bridge Street Bridge and Nith River.	

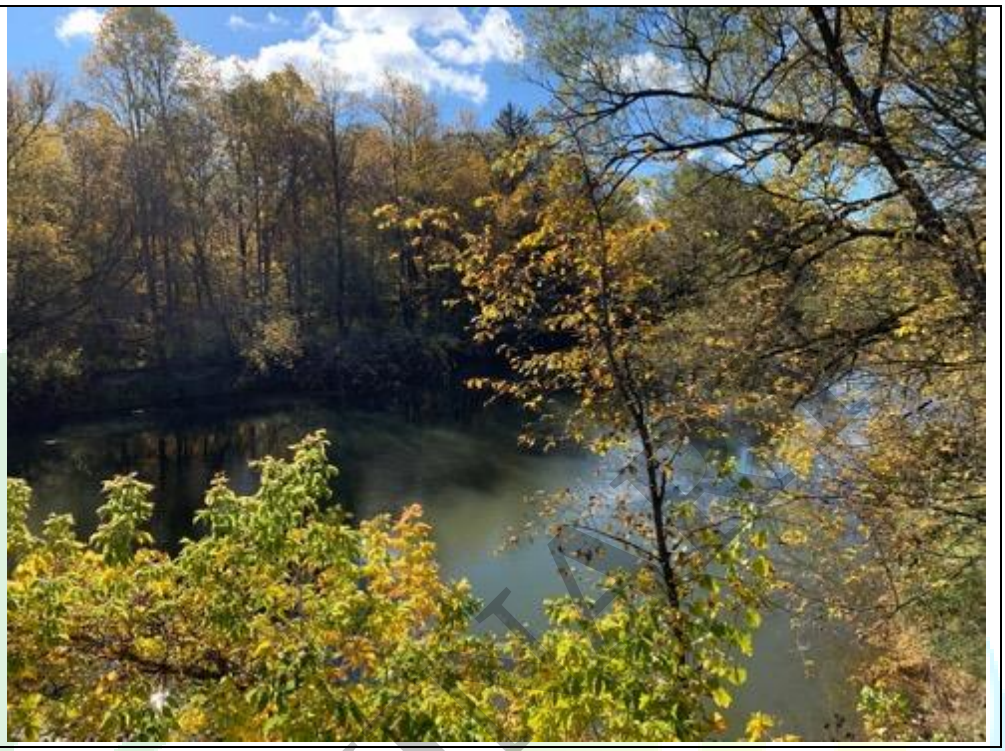
Photo No. 3 **Date:** October 13, 2020 **Description:** View, looking southeast, from the western abutment.	

Photo No. 4 **Date:** October 13, 2020 **Description:** View, looking east, from the south side of the western abutment.	

Photo No. 5 **Date:** October 13, 2020 **Description:** View, looking south, from the south side of the western abutment.	

Photo No. 6 **Date:** October 13, 2020 **Description:** View of woody debris present near the southern side of the western abutment. Woody debris was present 3-5 metres up the undercut bank from the Nith River.	

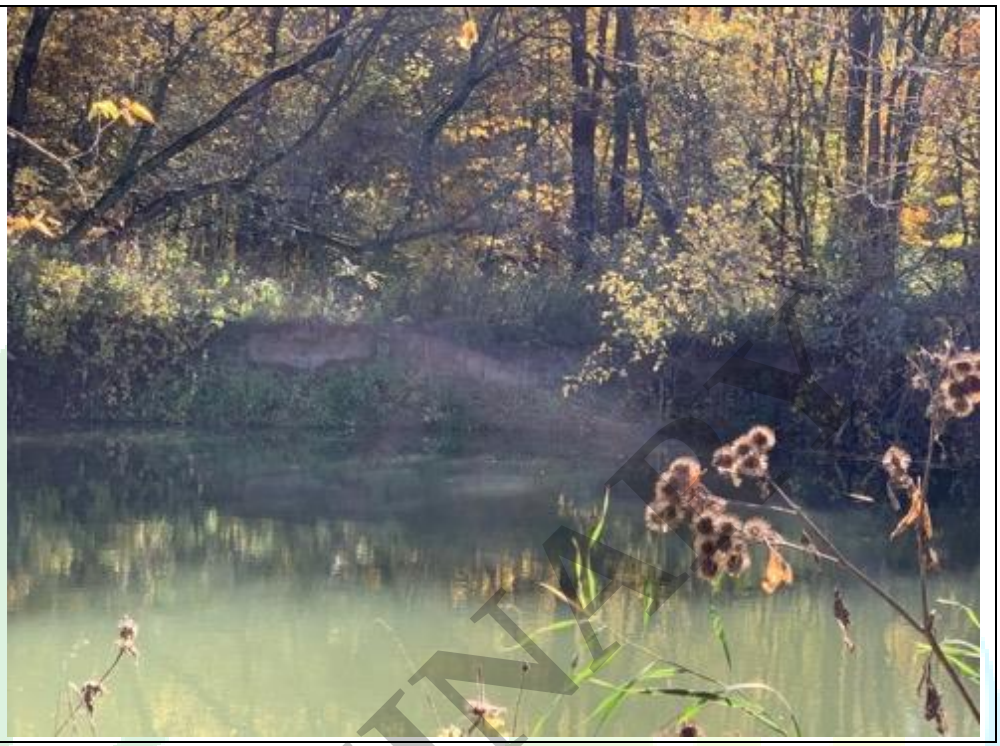
Photo No. 7 **Date:** October 13, 2020 **Description:** View of the southeastern bank, from the southwestern bank.	

Photo No. 8 **Date:** October 13, 2020 **Description:** View of the Bridge Street Bridge from the western bank, downstream.	

Photo No. 9 **Date:** October 13, 2020 **Description:** View of a number of Crack Willow and Hybrid Willow, present downstream of the Bridge along the western bank.	

Photo No. 10 **Date:** October 13, 2020 **Description:** Another view of a number of a Willow, present downstream of the Bridge along the western bank.	

Photo No. 11	
Date: October 13, 2020	
Description: View of Arrow-leaved Aster (*Symphyotrichum urophyllum*), documented along the southwestern bank.	

Photo No. 12	
Date: October 13, 2020	
Description: Another view of the Bridge from the southwestern bank of the Nith River.	

Photo No. 13 **Date:** October 13, 2020 **Description:** View of woody debris present on top of a south-facing rocky slope along the edge of Bridge Street, approximately 20 m west of the Bridge.	

Photo No. 14 **Date:** October 13, 2020 **Description:** Another view of woody debris present on top of a south-facing rocky slope along the edge of Bridge Street, approximately 20 m west of the Bridge.	

Photo No. 15 **Date:** October 13, 2020 **Description:** View of a culvert, present in proximity to the south-facing rocky slope present along the edge of Bridge Street. This culvert likely allows the safe passage of wildlife under Bridge Street.	

Photo No. 16 **Date:** October 13, 2020 **Description:** Another view of a culvert, present in proximity to the south-facing rocky slope present along the edge of Bridge Street. This culvert likely allows the safe passage of wildlife under Bridge Street.	

Photo No. 17 **Date:** October 13, 2020 **Description:** View of sedges, documented within the Cultural Woodland, located southwest of the Bridge. Sedges are moisture tolerant species and therefore indicate that waterlogged soil previously existed in this location.	

Photo No. 18 **Date:** October 13, 2020 **Description:** View of a stump sprouting Black Ash (*Fraxinus nigra*) tree. The original Black Ash appears to have been cut and taken by beavers.	

Photo No. 19 **Date:** October 13, 2020 **Description:** Another view of a stump sprouting Black Ash tree. The original Black Ash appears to have been cut and taken by beavers.	

Photo No. 20 **Date:** October 13, 2020 **Description:** View of an especially shallow area of water, present along the western bank of the River. The shallow area was documented to contain predominately well-sorted, fine silt material as well as leafy debris.	

Photo No. 21 **Date:** October 13, 2020 **Description:** Another view of an especially shallow area of water, present along the western bank of the River. The shallow area was documented to contain predominately well-sorted, fine silt material as well as leafy debris	

Photo No. 22 **Date:** October 13, 2020 **Description:** View, looking downstream (south), from the western bank of the Nith River.	

Photo No. 23 **Date:** October 13, 2020 **Description:** Another view of an especially shallow area of water, present along the western bank of the River. The shallow area was documented to contain predominately well-sorted, fine silt material as well as leafy debris	

Photo No. 24 **Date:** October 13, 2020 **Description:** View of a number of solidified concrete bags and large boulders documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 25 **Date:** October 13, 2020 **Description:** Another view of a number of solidified concrete bags documented to be covering the River floor and along the banks in proximity to the western abutment of the Bridge.	

Photo No. 26 **Date:** October 13, 2020 **Description:** Another view of a number of solidified concrete bags and large boulders documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 27 **Date:** October 13, 2020 **Description:** View of the underside of the Bridge Street Bridge.	

Photo No. 28 **Date:** October 13, 2020 **Description:** Another view of a number of solidified concrete bags, large boulders and sheeting documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 29 **Date:** October 13, 2020 **Description:** View, looking upstream, from the western abutment.	

Photo No. 30 **Date:** October 13, 2020 **Description:** A closer view of sheeting documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 31	
Date: October 13, 2020	
Description: Another view of a number of solidified concrete bags, large boulders and sheeting documented to be covering the River floor in proximity to the western abutment of the Bridge.	

Photo No. 32	
Date: October 13, 2020	
Description: Another view of a number of solidified concrete bags documented to be covering the River floor in proximity to the western abutment of the Bridge.	

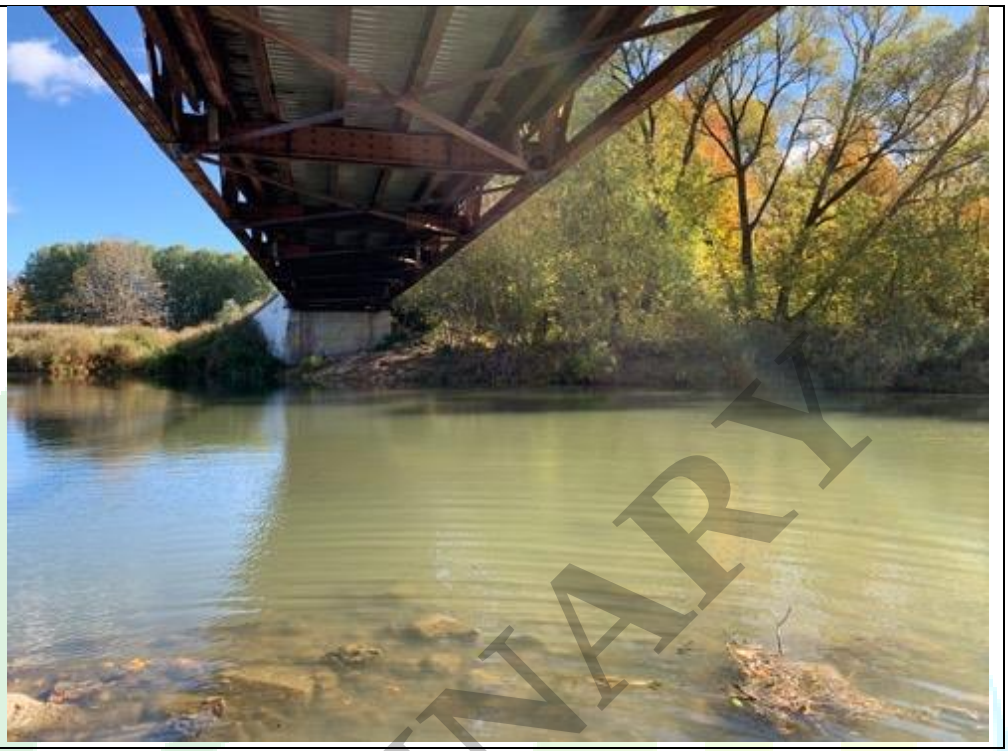
Photo No. 33 **Date:** October 13, 2020 **Description:** View of the eastern abutment, from the western abutment.	

Photo No. 34 **Date:** October 13, 2020 **Description:** View of some aquatic vegetation, observed growing in proximity to the northern side of the western abutment.	

Photo No. 35 **Date:** October 13, 2020 **Description:** View of vegetation present along the slope on the northern side of the western abutment.	

Photo No. 36 **Date:** October 13, 2020 **Description:** View of a large specimen of Wild Parsnip (*Pastinaca sativa*), documented in proximity to the western abutment. Staff member, Jessica Zadori, standing beside for scale.	

Photo No. 37 **Date:** October 13, 2020 **Description:** View, looking upstream, of vegetation along the western bank of the Nith River.	

Photo No. 38 **Date:** October 13, 2020 **Description:** View of an area with a sharp drop, documented in proximity to the western abutment (north side). It is hypothesized that this represents a tile drain, draining from a nearby agricultural field.	

Photo No. 39 **Date:** October 13, 2020 **Description:** View of the Bridge Street Bridge, looking southeast, from the northern side of the western abutment.	

Photo No. 40 **Date:** October 13, 2020 **Description:** View of Reed Canary Grass (*Phalaris arundinacea*), documented to dominant vegetation communities along the western bank, upstream of the Bridge.	

Photo No. 41 **Date:** October 13, 2020 **Description:** View, looking along the boundary of a field looked in proximity to the Bridge. Approximately 8 m of vegetation separate this field from the Nith River.	

Photo No. 42 **Date:** October 13, 2020 **Description:** View of a large are of Canada Goldenrod (*Solidago canadensis*), documented to dominate vegetation communities, upstream of the Bridge.	

Photo No. 43 **Date:** October 13, 2020 **Description:** Another view of a large are of Canada Goldenrod and Common Milkweed (*Asclepias syriaca*), documented to dominate vegetation communities, upstream of the Bridge.	

Photo No. 44 **Date:** October 13, 2020 **Description:** Another view of a large are of Canada Goldenrod and Common Milkweed, documented to dominate vegetation communities, upstream of the Bridge.	

Photo No. 45 **Date:** October 13, 2020 **Description:** View of the northeastern bank, from the northwestern bank. A small gravelly area is visible near the center of the River. This area may represent candidate habitat for turtle nesting.	

Photo No. 46 **Date:** October 13, 2020 **Description:** View of the northeastern bank, from the northwestern bank.	

Photo No. 47 **Date:** October 13, 2020 **Description:** View of the northeastern bank, from the northwestern bank. This photograph demonstrates how shallow and clear much of the River is.	

Photo No. 48 **Date:** October 13, 2020 **Description:** View of a drainage culvert, documented upstream of the Bridge Street Bridge.	

Photo No. 49 **Date:** October 13, 2020 **Description:** Another view of a drainage culvert, documented upstream of the Bridge Street Bridge.	

Photo No. 50 **Date:** October 13, 2020 **Description:** Another view of a drainage culvert, documented upstream of the Bridge Street Bridge. Sediment in the culvert may be described as well-sort, very fine silt.	

Photo No. 51 **Date:** October 13, 2020 **Description:** Another view of a drainage culvert, documented upstream of the Bridge Street Bridge. Sediment in the culvert may be described as well-sort, very fine silt.	

Photo No. 52 **Date:** October 13, 2020 **Description:** View of a Green Frog (*Rana clamitans*), observed swimming from the Nith River, towards the upstream drainage culvert.	

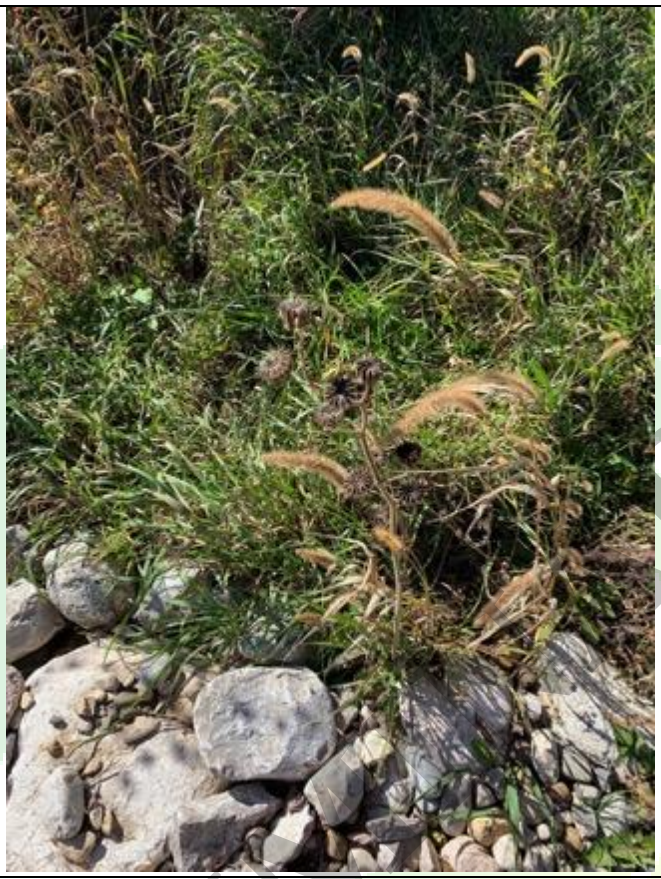
Photo No. 53 **Date:** October 13, 2020 **Description:** View of Velvetleaf (*Abutilon theophrasti*), and Green Foxtail Grass (*Setaria viridis*), documented along the western bank of the River, in proximity to the drainage culvert.	

Photo No. 54 **Date:** October 13, 2020 **Description:** View of a shallow area along the bank of the Nith River. This area was documented to contain very fine, well-sorted silt sediments.	

Photo No. 55 **Date:** October 13, 2020 **Description:** View of an area of standing water, present upstream of the Bridge and drainage culvert. Standing water appears to be a result of runoff originating from a nearby soybean field.	

Photo No. 56 **Date:** October 13, 2020 **Description:** View of another patch of Giant Ragweed (*Ambrosia trifida*). This patch is located in proximity to the standing water, upstream of the culvert and Bridge.	

Photo No. 57 **Date:** October 13, 2020 **Description:** Another view of an area of standing water, present upstream of the Bridge and drainage culvert. Standing water appears to be a result of runoff from a nearby soybean field. In this photo, Dr. Fitzgerald holds up a single stalk of Purple Loosestrife (*Lythrum salicaria*).	

Photo No. 58 **Date:** October 13, 2020 **Description:** Another view of an area of standing water, present upstream of the Bridge and drainage culvert. Standing water appears to be a result of runoff originating from a nearby soybean field. In this photo, Dr. Dean Fitzgerald holds up a stalk of Wild Parsnip.	

Photo No. 59 **Date:** October 13, 2020 **Description:** View, looking west, alongside the soybean field located upstream of the Bridge in proximity to the western bank of the River.	

Photo No. 60 **Date:** October 13, 2020 **Description:** View, looking west, across a nearby hay field. The slope in the background of the photo represents the edge of the floodplain.	

Photo No. 61 **Date:** October 13, 2020 **Description:** Another view, looking west, across a nearby hay field. The slope in the background of the photo represents the edge of the floodplain.	

Photo No. 62 **Date:** October 13, 2020 **Description:** View of Common Mullein (*Verbascum thapsus*), documented along the driveway, leading off Bridge Street and into the hay field, located northwest of the Bridge.	

Photo No. 63 **Date:** October 13, 2020 **Description:** View looking east, from atop the western abutment, along Bridge Street.	

Photo No. 64 **Date:** October 13, 2020 **Description:** View of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.	

Photo No. 65 **Date:** October 13, 2020 **Description:** View of a freshwater mussel shell, found within a pile of sediment located within the Cultural Woodland in proximity to the southeastern bank. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding	

Photo No. 66 **Date:** October 13, 2020 **Description:** Another view of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.	

Photo No. 67 **Date:** October 13, 2020 **Description:** Another view of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.	

Photo No. 68 **Date:** October 13, 2020 **Description:** View of the woodland, located along the southern side of Bridge Street, in proximity to the eastern bank of the Nith River. This area is the property of WRN.	

Photo No. 69 **Date:** October 13, 2020 **Description:** Another view of the woodland, located along the southern side of Bridge Street, in proximity to the eastern bank of the Nith River. This area is the property of Waterloo Nature. A large amount of woody debris is visible, likely a result of past flooding events.	

Photo No. 70 **Date:** October 13, 2020 **Description:** Another view of the woodland, located along the southern side of Bridge Street, in proximity to the eastern bank of the Nith River. This area is the property of the Waterloo Nature. A large amount of debris is visible, likely a result of past flooding events.	

Photo No. 71 **Date:** October 13, 2020 **Description:** Another view of the woodland, owned by Waterloo Nature.	

Photo No. 72 **Date:** October 13, 2020 **Description:** View of the eastern abutment, looking upstream. At the time of the field inspection, the abutment was not submerged.	

Photo No. 73 **Date:** October 13, 2020 **Description:** Another view of the eastern abutment, looking upstream. At the time of the field inspection, the abutment was not submerged.	

Photo No. 74 **Date:** October 13, 2020 **Description:** View of vegetation along the slope present along the northern side of the eastern abutment.	

Photo No. 75 **Date:** October 13, 2020 **Description:** View of the vegetation, present along the northeastern bank of the Nith River.	

Photo No. 76 **Date:** October 13, 2020 **Description:** Another view of the vegetation, present along the northeastern bank of the Nith River.	

Photo No. 77 **Date:** October 16, 2020 **Description:** View, looking west, of the Bridge Street Bridge.	

Photo No. 78 **Date:** October 16, 2020 **Description:** View, looking upstream, from the edge of Bridge Street.	

Photo No. 79 **Date:** October 16, 2020 **Description:** View, looking upstream, from the Bridge Street Bridge.	

Photo No. 80 **Date:** October 16, 2020 **Description:** View, looking downstream, from the Bridge Street Bridge.	

Photo No. 81 **Date:** October 16, 2020 **Description:** View of a stem of Giant Ragweed (*Ambrosia trifida*), located in proximity to the northwestern abutment.	

Photo No. 82 **Date:** October 16, 2020 **Description:** View, looking east, from the south side of the western abutment. Water depth (Transect 1) was measured across the River, just under the southern edge of the Bridge Street Bridge.	

Photo No. 83	
Date: October 16, 2020	
Description: View, looking east, from the western bank of the Nith River approximately 30 m downstream of the Bridge Street Bridge. Water depth (Transect 4) was measured across the River at this location.	

Photo No. 84	
Date: October 16, 2020	
Description: View of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.	

Photo No. 85 **Date:** October 16, 2020 **Description:** Another view of a pile of gravel and sediment observed within the Cultural Woodland, located southeast of the Bridge. Gravel and sediment is hypothesized to have been deposited along the floor of the woodland as a result of flooding.	

Photo No. 86 **Date:** October 16, 2020 **Description:** View of sedges, documented within the Cultural Woodland, located southeast of the Bridge. Sedges are moisture tolerant species and therefore indicate that waterlogged soil previously existed in this location.	

Photo No. 87 **Date:** March, 26, 2021 **Description:** View of collecting sediment and sand within the nearby woodland. Sediment and sand was likely deposited during past seasonal flooding events	

Photo No. 88 **Date:** March, 26, 2021 **Description:** View of Area 6, a floodplain located approximately 225 m downstream from the Bridge. Vegetation is visibly flattened in the direction of flowing water as a result of past seasonal and episodic flooding.	

Photo No. 89 **Date:** March, 26, 2021 **Description:** View of mussel shells deposited along the banks of the downstream floodplain (Area 6). Mussel shells were collected for in-office identification.	

Photo No. 90 **Date:** March, 27, 2021 **Description:** Another view of the woodland in proximity to the Bridge. Areas of deposited sticks, trunks, and vegetation are visible as a result of past flooding.	

Photo No. 91	
Date: March, 27, 2021	
Description: View of Area 6 following an overnight rain event. Water depth was documented to be upwards of 45 cm off the bank, fast flowing and turbulent.	

Photo No. 92	
Date: April 1, 2021	
Description: Another view of Area 6, following the receding of water from episodic flooding. Vegetation appears flattened in the direction that the water was flowing.	

Photo No. 93 **Date:** April 1, 2021 **Description:** Another view of Area 6, slightly upstream of the floodplain area. This area appeared to be at least a meter higher in grade than the floodplain, however was documented to still experience episodic flooding patterns.	

Photo No. 94 **Date:** April 1, 2021 **Description:** View of more mussel shells, deposited following another recent flooding event.	

Photo No. 95 **Date:** April 21, 2021 **Description:** View of Dr. Fitzgerald on a small grassed island just offshore. This area was previously completed overcovered by flowing water.	

Photo No. 96 **Date:** April 21, 2021 **Description:** View of a Flutedshell mussel, found during surveys completed on April 21, 2021.	

Photo No. 97	
Date: May 11, 2021	
Description: View of Area 6 on May 11, following the spring growth of vegetation. Water appeared lower on this day, and limited mussels shells were found in comparison to previous survey dates.	

Appendix B

Relevant Correspondence with Waterloo Region Nature

From: Fraser <fn.gib@sympatico.ca>
Sent: October 26, 2020 12:38 PM
To: Dean Fitzgerald <Dean@elminc.ca>
Subject: Re: Good Morning

Hi Dean,
Yes, Hidden Valley has received as much protection as it is likely to get at this point. Neil's tenacity made it clear that the original salamander survey had not been done in appropriate weather/timeline which resulted in further studies. The Friends of Hidden Valley, spearheaded by Gord and Daphnie Nichols, is how I got involved. Through their efforts and those such as yourself and Neil, much was achieved.
Thank you for keeping us (WRN) informed about the Bridge St bridge. It will be great to be connected to ongoing work. The Green Dragon that we know about on the site is well back from the bridge but unfortunately I am not aware of anyone being able to locate it in the last approx 8 years. We have found numerous mussels washed ashore. I began looking for them specifically about 4 years ago. Since then the empty shells of Giant Floater, Spike, Flutedshell, Fatmucket, Elktoe, one likely Cylindrical Papershell, one Wavy Rayed Lampmussel and one Creek Heelsplitter have been found. Many were washed ashore immediately downstream of the bridge but some were found further downstream. From the abundance of some of these, I am assuming these mussels live nearby upstream.

Fraser

> On Oct 26, 2020, at 10:50 AM, Dean Fitzgerald <Dean@elminc.ca> wrote:
>
> Good Morning Fraser,
>
> Thank you very much for this note. Just found it hiding among other mail!
>
> Yes, I have an archive of old email within my Hotmail account. So it is very good to know that we are connected and my email from you that is more than 7 years old was worth keeping! The last notes we shared imostly concerned Hidden Valley. Generally that place seems to be OK now. When Neil Taylor asked me to help him protect the place in 2005, it seemed like they had already gassed up the chain saws! At this stage, at least the environmental sensitivities are documented and can be used to achieve reasonable long-term management. In the past, the 2005 LGL report I reviewed was more fiction than fact. Very happy to have helped Neil write letters, and to have given my own presentations. It is such a precious place and deserves as much protection as we can muster!
>
> About Bridge Street Bridge, I have also shared email with Anita Smith (copied on this note) in the last few days as well. For the bridge, we will compile an environmental screening baseline report with a description of natural heritage features. In this regard, your group is an important stakeholder for the bridge and the report. So, we will provide a draft document to you in the near term. This approach will allow your group to be fully involved and aware of what is going on.
>
> See below for a copy of the note I sent Anita last week:

Another topic for the bridge that I want to discuss with you and Anita (and Waterloo Region Nature) concerns the freshwater mussels in the river. For this bridge, it represents a unique challenge, since the freshwater mussels are currently upstream but I have not observed one near the bridge area; not even found a shell at all (after four visits of walking in the river). A key challenge for our work is to provide an explanation of baseline mussel distribution and then to explain how we will avoid and limit disturbance in the bridge area during construction. At this time, myself and Dr. Kott both feel the bridge creates a unique situation where the mussels are washed downstream or in to the woodland. We discussed this process while we stood on the roadway when we met you and the group. Indeed, you mentioned as we stood on the road a list of mussels you identified in the past, attributable to the flood. My feeling is that we need to include a section in the baseline report that documents how flooding regularly displaces mussels downstream and the constriction of the river in combination with the river bend (also called thalweg) causes the mussels to be directed downstream or in to the flood plain forest. Hence, the observation of mussels around the bridge and the deposition of gravel, sand, and silt in this area as well. Let me explain this another way: we need to state to MECP where the mussels are and why we did not see any around the bridge. If we provide a detailed response, based on my observations and your historical context, then it will be more readily understood by the MECP folks.

If you are willing to help us explain the distribution of freshwater mussels around the bridge, I am willing to take this activity one step further. That is, due to the unique situation, I think it is justified to try to publish this natural heritage knowledge. The context would be the opportunity for learning due to the ownership of the woodland and observation of annual or bi-annual flooding. These floods create the learning whereby mussels are naturally displaced in to the flood plain forest and thereby represent a random sample of the mussels evident in the river. So, we could write a manuscript focused on mussel survey results with very little in-water survey efforts. I think the Canadian Field Naturalist or other ecology-themed conservation journal would publish such a manuscript. The data would come from the mussel shells we saw around the bridge and combine these observations with your list of species already available. If you are willing to go down this opportunity, my gut feeling is that we would also survey the woodland next spring, after any 2021 flood (if it happens), to have a recent example of observations close to the flood event.

What do you think of the idea of writing a manuscript concerning the freshwater mussels? I mention it now, as we could use information from the baseline study that we will write as the core content of the manuscript. But we cannot do such without direct approval of your group. Plus, we would also engage Dr. Kott, to provide independent validation of the identity of the mussel shells we have handy.

I will leave this note at this stage, pending your response.

Look forward to reading your response.

Until later,
Dean F.

Dean Fitzgerald, M.Sc., Ph.D.
Senior Ecologist
Director of Environmental Services | ELM Inc.

From: Dean Fitzgerald
Sent: October 22, 2020 1:49 PM
To: 'montgomery@waterlooregionnature.ca' <montgomery@waterlooregionnature.ca>
Subject: Hello, again!

Hi Anita,

We met last Friday at the Bridge Street Bridge in Wilmot Township.

So sorry for the slow response. On my side, I misplaced the white paper after I placed it I the field notebook (hiding somewhere!), and so I looked for it and now I am using this generic email address.

It was very nice to interact with you and the others on the side of the road etc.

Going forward, I will be sure to share the findings from the field inspections. I also have a call coming up soon with the Bridge Engineer, and I will mention your concerns about parking and other details along the edge of the club's preserve.

Here is a quick summary of key observations:

- Six active Barn Swallow nests were observed on the bridge deck and will be compensated with artificial habitat before construction;
- Few specimens of Species At Risk (SAR) Threatened Black Ash observed on both sides of the river, including in the club's preserve. All specimens are > 120m from the bridge and will not be disturbed by construction;
- Presence of SAR freshwater mussels upstream and downstream of the bridge. However, after four inspections in the river, we did not see any in close proximity to the bridge deck. My hypothesis is the seasonal floods wash the mussels downstream or in to the club's preserve;
- SAR Silver Shiner evident in the river upstream and downstream of the bridge;
- SAR Black Redhorse evident in the river upstream and downstream of the bridge;
- Dr. Ed Kott reported that SAR Green Dragon at unknown location(s) within the club's preserve; and
- Nasty Parsnip (common or cow) evident around the bridge and should be avoided (but I did not see any within the club's preserve).

In terms of time for the report, I imagine we will pull something together before the end of November. I am willing to send to you for comment. Another consideration is this: if you don't want some details included that refer to the club's preserve, then we can remove them, as you direct us. After the report has been approved by your group, then we will want to submit a version to the Ministry of Environment, Conservation, and Parks in light of SAR observations etc.

Note I have not yet written to Fraser Gibson, as I wanted to contact you first.

Again, I am very sorry for misplacing the paper you gave me. It will turn up, I am sure!

Look forward to reading your response. Recall my mobile line is 226-606-1072 and that I live in Cambridge (south Galt actually).

Until later,
Dean F.

Appendix C

Statement of Limitations

Statement of Limitations

For this study, the information, conclusions and recommendations given herein are specifically for the Client only and for the scope of work described herein completed at the Bridge Street Bridge in Township of Wilmot. The scope of work involves environmental screening for constraints based on a desk top review and focused field study. Hence, the findings from study may not be sufficient for other uses. ELM Inc. does not accept responsibility for this or other uses by third parties.

The data, conclusions and recommendations included within this report, and the quality thereof, are based on the scope authorized by the Client. Note however, that no scope of work, no matter how exhaustive, can identify all environmental constraints, environmental contaminants or all conditions above and below ground that may exist. For example, environmental observations may differ across survey dates. Hence, conditions may differ from those encountered in the investigation. Similarly, flood zone features may vary dramatically from year to year even when the site in question is not mapped as flood plain by government agencies. This report therefore cannot warrant that all conditions on or off the site are presented by those identified at specific locations on the focal inspection date. Also, Species At Risk migrate and could possibly enter the site boundaries at any time, and could have been missed by this review and field survey. Any recommendations and conclusions provided that are based on conditions or assumptions reported herein will inherently include any uncertainty associated with those conditions or assumptions. In fact, many aspects involving professional judgment such as habitat available for Species At Risk, potential for Species At Risk to migrate to the site in question and follow up study recommendations inherently contain a degree of uncertainty that cannot be eliminated. This uncertainty should be managed by periodic review and refinement as additional information becomes available. The same challenges apply to wetland boundaries that change from one year to the next.

Note also that standards, guidelines and practice related to environmental investigations may change with time. Those which are applied at the time of this investigation may be obsolete or unacceptable at a later date. The scope of work and findings reported may not be sufficient to determine all of the factors that may affect construction or other on-site activities. Contractors bidding on future aspects of this undertaking should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the conditions may affect their work. Similarly, ELM Inc. cannot warranty the accuracy of information supplied by the Client regarding the legal boundaries of the site.