Madawaska–Edmundston International Bridge Replacement Project

Environmental Impact Assessment Registration for the Replacement of the Madawaska-Edmundston International Bridge (E320)

February 2019

Prepared for:

Province of New Brunswick
Department of Transportation and Infrastructure

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Abbreviations

AC CDC	Atlantic Canada Conservation Data Centre
CN Rail	Canadian National Railway
CRA	Commercial, Recreational or Aboriginal
CSBA	Canadian Border Services Agency
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMM	Environmental Management Manual
EMP	Environmental Management Plan
GHG	Greenhouse Gases
LPOE	Land Port of Entry
Maine DOT	Maine Department of Transportation
MBCA	Migratory Birds Convention Act
ME	Maine
NB	New Brunswick
NBAAS	New Brunswick Aboriginal Affairs Secretariat
NBDTI	New Brunswick Department of Transportation and Infrastructure
NBDELG	New Brunswick Department of Environment and Local Government
NBDERD	New Brunswick Department of Energy and Resource Development
NB SARA	New Brunswick Species at Risk Act
NPA	Navigation Protection Act
NWPA	Navigable Waters Protection Act
SAR	Species at Risk
SOCC	Species of Conservation Concern
TRC	Technical Review Committee
US	United States
VC	Valued Component
WAWA	Watercourse and Wetland Alteration
WHMIS	Workplace Hazardous Materials Information System
WNNB	Wolastoqey Nation in New Brunswick

1.0 INTRODUCTION

This document is the registration document for the Environmental Impact Assessment (EIA) process for the proposed Madawaska–Edmundston International Bridge Replacement Project (the Project). The Project consists of the construction and operation of a new international bridge over the Saint John River between the City of Edmundston, New Brunswick, Canada and the Town of Madawaska, Maine, United States, and the demolition of the existing international bridge. The Maine Department of Transportation (Maine DOT) is in charge of designing the bridge, tendering the project, administering the contracts, and overseeing construction. The Maine DOT will also be responsible for obtaining regulatory approvals in the U.S. The New Brunswick Department of Transportation and Infrastructure (NBDTI) is assisting with the design, conducting public consultation in Canada, and seeking regulatory approvals in Canada,

This document is submitted to the New Brunswick Department of Environment and Local Government (NBDELG) as part of the EIA process under Section 5(2) of the *Environmental Impact Assessment Regulation 87-83* of the *Clean Environment Act*. A separate environmental review and permitting process is required by the State of Maine for the United States-based elements of the Project, which is being led by the Maine Department of Transportation (Maine DOT). This EIA Registration is limited to project elements which fall within the Canadian side of the border and are within Canadian jurisdiction. The remaining project elements described in this document are within the United States' jurisdiction and are not subject to, nor assessed in, this EIA Registration.

1.1 ORGANIZATION OF THIS DOCUMENT

This document is intended to fulfill the information requirements for registering the Project under Section 5(1) of the EIA Regulation, as outlined in the NBDELG documents entitled "A Guide to Environmental Impact Assessment in New Brunswick" (NBDELG 2018) and "Additional Information Requirements for Linear Facilities" sector guidelines (NBDELG 2008). It is organized as follows.

- Section 1.0 provides a general introduction and regulatory context
- Section 2.0 describes the Project in detail
- Section 3.0 provides an overview of the scope and methods of the assessment
- Section 4.0 provides an overview of activities related to public, stakeholder, and Indigenous Peoples engagement
- Section 5.0 summarizes proposed mitigation, monitoring, and follow-up
- Section 6.0 lists the references consulted in the preparation of this report
- Appendix A provides preliminary design drawings
- Appendices B to I provide the environmental effects assessment for relevant Valued Components

A number of documents related to the Project have also been used to inform the EIA. These documents provide further detailed information on the Project and include:

- Madawaska/Edmundston International Bridge and Border Crossing–Feasibility and Planning Study. Maine DOT May 2018 (Maine DOTet al. 2018)

- New Madawaska Land Port of Entry and International Bridge Project–Draft Supplemental Environmental Impact Statement and Draft Programmatic Section 4(f) Evaluation. November 2018 (Maine DOT 2018)
- Madawaska/Edmundston International Bridge Replacement – Project Description. NBDTI. Nov.22, 2018 (NBDTI 2018)

1.2 OVERVIEW OF THE PROJECT

In collaboration with Maine DOT, NBDTI is proposing to replace the 287 m long bridge that currently exists between the Canada Border Services Agency (CBSA) facility in Edmundston, New Brunswick and the US Land Port of Entry (LPOE) in Madawaska, Maine. As part of the Project, a new bridge structure will be constructed upstream of the existing international bridge and will span approximately 560 m to 570 m between the existing CBSA facility and a new US LPOE to be constructed approximately 350 m upstream of the existing US LPOE. Following the construction of the new bridge, the existing bridge structure will be decommissioned and removed. The construction of the proposed US LPOE will take place entirely within the State of Maine and is not included in this assessment. No modifications to the existing CBSA building are proposed as part of the Project.

1.3 PROJECT TITLE AND PROPONENT INFORMATION

The proponent for the proposed undertaking is as follows:

Name of Undertaking:	Madawaska-Edmundston International Bridge Replacement Project
Name of Proponent (Canada):	New Brunswick Department of Transportation and Infrastructure
Mailing Address of Proponent (Canada):	440 King Street Kings Place, 2nd Floor P.O. Box 6000 Fredericton, New Brunswick E3B 5H1
Principal Proponent Contact	Serge Gagnon, P.Eng, Executive Director New Brunswick Department of Transportation Engineering Services 440 King Street, Kings Place, 2nd Floor Fredericton, New Brunswick, E3B 5H1 Telephone: (506) 457-7881 email: Serge.Gagnon@gnb.ca
Principal Contact Person for the Purposes of Environmental Impact Assessment:	Vincent Balland, P.Eng, Environmental Engineer New Brunswick Department of Transportation Design Branch 440 King Street, Kings Place, 2nd Floor Fredericton, New Brunswick, E3B 5H1 Telephone: (506) 453-5344 email: Vincent.Balland@gnb.ca

1.4 PROJECT LOCATION AND PROPERTY OWNERSHIP

The Project is located at the international border between the Town of Madawaska, Maine and the City of Edmundston, in Madawaska County, New Brunswick (Figure 1). The new bridge will span approximately 560 m to 570 m between the existing CBSA facility and a new US LPOE to be constructed approximately 350 m upstream of the existing US LPOE, as shown on Figure 2.

The Project is located on several contiguous federally-owned parcels of land (CBSA customs facility) and a Canadian National (CN) Railway property. Based on preliminary consultation with the New Brunswick Department of Energy and Resource Development (NBDERD), it appears that the river bottom between the shore and the international border (located in the middle of the river) belongs to the upland owner, in this case CN as well.

One private property adjacent to and to the West of the Canadian Border Facility will likely be needed for the project, NBDTI is negotiating with the landowner to acquire their property. The following coordinates are based on the conceptual alignment developed as part of the Project feasibility study. The final coordinates for the bridge may change slightly as the alignment is finalized during preliminary design.

- North end of new proposed bridge (on Canadian bank of Saint John River):
  47° 21’ 41.3” N, 68° 19’ 43.7 W.
- Southern limit of Canadian side of new proposed bridge (border location, approximate center of river):
  47° 21’ 35.8” N, 68° 19’ 51.6” W.
- Southern limit of new proposed bridge in Maine (On US bank of Saint John River):
  47° 21’ 28.6” N, 68° 20’ 02.4 W.

The Project Development Area (PDA) for the Project is defined as the area of physical disturbance associated with the construction and operation and maintenance phases of the Project, as well as decommissioning of the existing bridge. For the purposes of this assessment, the PDA comprises a physical footprint of the Project and includes portions of the CBSA properties and adjacent private properties, east and west of the proposed new bridge location, a portion of land owned by CN, and a portion of the Saint John River (from 250 metres (m) upstream of the new bridge to 250 m downstream of the existing bridge to the east, and up to the international border to the south).

Sources: Government of New Brunswick

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap

Project Location

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Figure 1

121415893 - NBDTI - MADAWASKA-EDMUNDSTON BRIDGE

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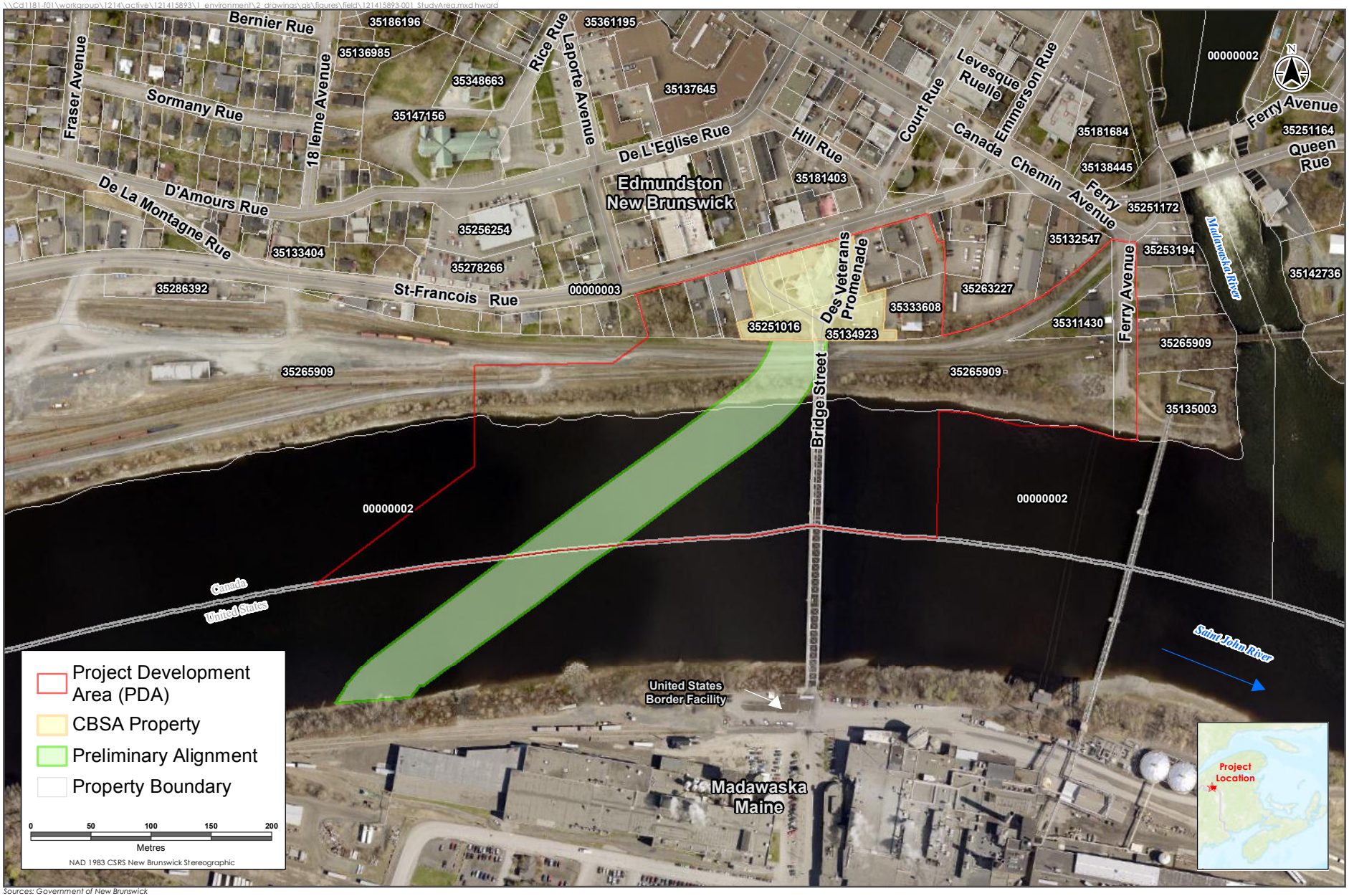

Sources: Government of New Brunswick

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap

Study Area

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121415893 - NBDTI - MADAWASKA-EDMUNDSTON BRIDGE

Figure 2

1.5 REGULATORY FRAMEWORK

An overview of the anticipated major regulatory processes that could be applicable to the Project, including federal and provincial environmental assessment requirements and the roles of regulatory authorities is provided below.

1.5.1 Provincial Legislation

The primary provincial environmental legislation potentially relevant to the Project includes the New Brunswick *Environmental Impact Assessment Regulation–Clean Environment Act*, New Brunswick *Species at Risk Act,* New Brunswick *Watercourse and Wetland Alteration Regulation–Clean Water Act*, and the New Brunswick *Fish and Wildlife Act.* Further details are provided below.

1.5.1.1 New Brunswick Environmental Impact Assessment Regulation–Clean Environment Act

The New Brunswick *Environmental Impact Assessment Regulation 87-83* under the *Clean Environment Act* (EIA Regulation) governs the environmental impact assessment (EIA) process in the province. The EIA Regulation requires that all "undertakings" listed in Schedule "A" of the Regulation require registration with the New Brunswick Department of Environment and Local Government (NBDELG).

The Project meets the requirement of an "undertaking" pursuant to Schedule "A" of the EIA Regulation as follows:

> *"(i) all causeways and multiple-span bridges".*

Following registration, NBDELG will form a Technical Review Committee (TRC) to undertake a determination review of the submitted EIA documentation. During this review, the TRC may require additional information and pose questions for NBDTI to address. At the conclusion of the determination review, the TRC will make a recommendation to the Minister of Environment and Local Government who will decide if the Project can proceed under certain conditions ("determination review"), or if a more detailed EIA ("comprehensive review") is required. At minimum, the determination review led by NBDELG will be required to review the Project's information and potential environmental interactions. Should a comprehensive review be required, a more extensive review and assessment process would follow.

1.5.1.2 New Brunswick Species at Risk Act

The New Brunswick *Species at Risk Act* (NB *SARA*) is administered by NBDERD and is intended to protect species from extirpation and extinction. Species that are included in the *Prohibitions Regulation* of NB *SARA* currently have some regulatory protection. Schedule A of NB *SARA* lists species in New Brunswick that are classified as being extirpated, endangered, threatened, or of special concern. The NB *SARA*, by way of Section 28(2), prohibits the killing, harming, harassing, or taking of any species listed in Schedule A.

1.5.1.3 New Brunswick Watercourse and Wetland Alteration Regulation–Clean Water Act

The New Brunswick *Watercourse and Wetland Alteration Regulation–Clean Water Act*, administered by NBDELG, requires a watercourse and wetland alteration (WAWA) permit to be issued for any activity carried out within 30 m of a watercourse or wetland.

1.5.1.4 New Brunswick Fish and Wildlife Act

The New Brunswick *Fish and Wildlife Act*, administered by NBDERD, protects all fish and wildlife species from angling, hunting, trapping, and other forms of intentional take except under the authority of permits or licenses.

1.5.1.5 Heritage Conservation Act

Heritage resources in New Brunswick are regulated under the *Heritage Conservation Act* (2010). The regulatory management of heritage resources falls under the New Brunswick Department of Tourism, Heritage, and Culture, and is administered by its Archaeological Services Branch (for archaeological resources), Historic Places Section (for built heritage resources), and Natural Sciences Section (for palaeontological resources).

The Province of New Brunswick provides guidance for conducting heritage assessments, such as the *Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick* (the "Archaeological Guidelines"; Archaeological Services 2012).

An Archaeological Field Research Permit and Site Alteration Permit both issued by Archaeological Services, Heritage Branch of the New Brunswick Department of Tourism, Heritage, and Culture are required for this Project under the *Heritage Conservation Act*.

1.5.2 Federal Legislation (Canada)

The primary federal environmental legislation of potential relevance to the Project includes the *Canadian Environmental Assessment Act, 2012*, the *Fisheries Act*, the *Explosives Act*, the *Navigation Protection Act*, the *Migratory Birds Convention Act* (*MBCA*), and the *Species at Risk Act*. Further details are provided below.

1.5.2.1 Canadian Environmental Assessment Act, 2012

The *Canadian Environmental Assessment Act, 2012* (*CEAA 2012*) defines the requirements for federal environmental assessments (EA) in Canada. *CEAA 2012* applies mainly to "designated projects", which are the physical activities listed under the *Regulations Designating Physical Activities* under *CEAA 2012*, as well as physical activities carried out on federal land. The *Regulations Designating Physical Activities* identify 48 physical activities that are considered to be designated projects, thereby requiring an EA under

CEAA 2012. Item 28 of the Schedule to the Regulations includes:

- *"28. The construction, operation, decommissioning and abandonment of a new*
  (a) international or interprovincial bridge or tunnel;"

NBDTI submitted a description of the project to the Canadian Environmental Assessment Agency. After review, the Agency determined that a federal environmental assessment is not required for the Project.

1.5.2.2 Fisheries Act

The federal *Fisheries Act* defines the requirements for protecting fish and fish habitat in Canada. Specifically, Section 35(2) of the Act specifies that any activity that may cause "serious harm to fish that are part of a commercial, recreational, or Aboriginal (CRA) fishery, or to fish that support such a fishery" requires an authorization to be issued, with appropriate offsetting for residual environmental effects of the activity. Authorization must be provided under Section 35(2) of the Act for activities that cause serious harm to fish that support a CRA fishery, including appropriate fish habitat offsetting. This applies to physical harm that may be caused to fish by physical activities associated with a project and to impeding passage of fish through physical obstruction or by lowering of water levels in such a manner that serious harm may occur. Additionally, Section 36(3) of the *Fisheries Act* states that it is illegal to release deleterious substances into a fish-bearing watercourse or waterbody without an authorization. A deleterious substance is considered any substance that has the ability to degrade water quality such that it becomes harmful to fish or fish habitat.

Amendments to the *Fisheries Act* are scheduled to come into force in 2019. NBDTI will comply with any changes to regulatory requirements under the *Act* related to these amendments.

1.5.2.3 Navigation Protection Act

The federal *Navigation Protection Act* (*NPA*) came into effect in 2014, replacing the former *Navigable Waters Protection Act* (*NWPA*). Section 5(1) of the *NPA* requires that "*an owner who proposes to construct, place, alter, repair, rebuild, remove or decommission a work – other than a designated work – in, on, over, under, through or across any navigable water that is listed in the schedule shall give notice of the proposal to the Minister.*"

Portions of the Saint John River upstream of the Mactaquac Dam, while navigable, are not listed on the schedule and thus activities upstream of Mactaquac do not require the Minister's authorization. Therefore, under current legislation, activities associated with the new bridge would not require an approval from Transport Canada. However, new legislation (the *Canadian Navigable Waters Protection Act*) is scheduled to come into force in early 2019, which is applicable to all new projects proposed in, on, over, under or through any navigable water (not just Scheduled Waters). Bridge design will likely be finalized in 2019, and NBDTI anticipates that activities related to the new bridge will likely require approval under the new legislation.

Transport Canada considers the existing bridge a "lawful" work under the *NPA* as is it a "crown work" (C. Ripley, personal communication, February 27, 2018). As such, demolition and removal of the existing

bridge could require the Minister's authorization. However, as the existing bridge is not located on a scheduled waterway, NBDTI can and intends to "opt-out" and remove the existing bridge from the *NPA* regime in early 2019, such that the Minister of Transport's authorization will not be required for this component of the project.

1.5.2.4 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (*MBCA*), administered by the Canadian Wildlife Service, contains provisions for the protection and conservation of migratory bird populations, individuals, and their nests within all lands in Canada. The *MBCA* prohibits the killing, harming, or other harassment of migratory birds and their nests. An estimated 450 native species of migratory birds (including their nests and eggs) are protected under the *MBCA*.

1.5.2.5 Species at Risk Act

The federal *Species at Risk Act* (*SARA*) is administered by Environment and Climate Change Canada with the intent to protect species from extirpation or extinction as a result of human activity. The purpose of these provisions under *SARA* is to prevent species at risk from becoming threatened or endangered and to allow for recovery of species that are considered threatened, endangered or extirpated. Section 32(1) affords protection to individuals of species that are listed under *SARA* as extirpated, endangered, or threatened, while Section 33 protects the habitat of these species.

Schedule 1 of *SARA* lists species in Canada that are classified as being extirpated, endangered, threatened, or of special concern. The more than 300 wild plant and animal species listed in Schedule 1 are afforded special measures to protect them and assist in their recovery. These measures include, amongst other things, prohibitions against:

- The killing, harming, or harassment of these species;
- The damage or destruction of their residences; and
- The destruction of any part of their critical habitat.

1.5.3 United States Regulatory Approvals

An updated Environmental Impact Statement (EIS) report was prepared by the US General Services Administration, regarding a proposed new Madawaska Border Station in November 2018 (Maine DOT 2018). Although outside the scope of the present EIA determination, the Project will also need the review and approval of the Maine Department of Environmental Protection under Section 401 of the *Clean Water Act - Water Quality Certification*. Other US-based permit requirements may include and are not limited to a Natural Resources Protection Act Permit. The Maine DOT is responsible for obtaining the required regulatory approvals and permits for the elements of the Project which fall under US jurisdiction, and within the US border.

2.0 PROJECT DESCRIPTION

2.1 PURPOSE/RATIONALE/NEED FOR THE UNDERTAKING

The purpose of the Project is to provide a bridge structure that allows for the long-term, safe, and efficient flow of current and projected traffic volumes, including the movement of goods and people between Edmundston, New Brunswick and Madawaska, Maine. The Project will address safety concerns associated with the current bridge structure, which is at an advanced age, is showing signs of deterioration, and is narrow compared with current bridge design standards. As a result of the deteriorated state of the existing bridge, weight restrictions have been implemented, resulting in a detour to alternative border crossings for large vehicles including emergency services.

The replacement bridge will be designed according to American Association of State Highway and Transportation Officials Bridge Design Specifications and will be verified by NBDTI against the CSA S6-14 Canadian Highway Bridge Design Code CL-625-ONT design vehicle for the required gross vehicle weight of 64,000 kg, to confirm that the bridge has sufficient capacity to handle legal commercial vehicles originating in Canada and the US.

2.1.1 Overview of the Existing Bridge Structure and Load Restrictions

The proposed Project is needed because the existing international bridge is nearing the end of its useful life. The existing 287 m long bridge is 97 years old, having been opened to traffic in 1921. The bridge now has many deficiencies including the following.

- Substandard geometry – roadway width & clearance
- Foundations susceptible to undermining
- Piers cracked and deteriorated
- Significant steel corrosion
- Insufficient bridge capacity

Due to the condition of the bridge, weight restrictions were applied on October 27, 2017, reducing the maximum allowable vehicle weight from 43.5 tons to 5 tons. Large trucks and even certain emergency vehicles are now prohibited from crossing the bridge.

Heavier vehicles currently must use the Clair/Fort Kent international bridge 32 km upstream, or the Saint-Leonard/Van Buren international bridge 43 km downstream. Despite targeted structural repairs (i.e., replacement of critical rusted stringers) carried out in the fall of 2017 on the Canadian side of the bridge deck, the load rating was kept at a maximum of 5 tons. Due to the extent of the steel deterioration on the bridge and the amount of time and money it would take to repair the defects, it is anticipated that the current load restrictions will remain in effect until the bridge is replaced.

In addition, for the existing bridge, only the north abutment, two spans, and two piers are within Canadian jurisdiction. The balance of the existing bridge is in US territory. The CBSA Facility (Edmundston LPOE) was built in 1992 and is still adequate for current and future needs.

2.1.2 Siting Considerations

A Feasibility and Planning Study was carried out that considered over twelve potential crossing locations and configurations, including several out-of-town and greenfield options upstream and downstream of the existing bridge (Maine DOT et al., 2018). Rehabilitating the existing bridge was also considered, but this option was not retained due to the extent of steel deterioration on the existing structure.

The location and alignment eventually identified as the Project, is preferred by both US and Canadian Federal entities as well as State and Provincial partners. This location is in downtown Edmundston and Madawaska and will span directly from the existing CBSA Facility to the proposed new Madawaska LPOE, located approximately 350 m to the west of the existing facility. Several factors led to the selection of this option:

- The current CBSA facility was built in 1992 and is still adequate to meet the demand at this border crossing, there are no current plans or funds in place to build a new facility elsewhere, thus the new bridge needed to be placed to utilize this existing facility.
- The bridge replacement is needed as soon as possible, due to the load restrictions in place for the existing bridge.
- Overall costs for the Project are lower for the downtown location than the other locations that were considered.

The urban nature of the Project location also means that there will be limited greenfield development in Canada, avoiding sensitive features in less disturbed areas.

2.2 DESCRIPTION OF PROJECT COMPONENTS AND INFRASTRUCTURE

2.2.1 Overview

The Project will involve the construction of a new international bridge spanning across the Saint John River between Edmundston, New Brunswick, and Madawaska, Maine. The new bridge is being constructed as a replacement for the existing international bridge which is anticipated to be demolished upon completion of the proposed bridge. The Project will link the existing CBSA facility in Edmundston and a new US LPOE to be constructed approximately 350 m upstream of the existing US LPOE. In addition to spanning the Saint John River, the new bridge will cross over railways tracks on both sides of the river. The construction of the proposed US LPOE will take place entirely within the state of Maine and is not included in this assessment. No modifications to the existing CBSA building are proposed as part of the Project. The existing bridge access roads at the facility will be adjusted to connect the proposed bridge to the existing facility.

The proposed new bridge will have an overall length of approximately 560 m to 570 m . The configuration of the proposed bridge, including the number and location of the piers, has not been finalized. Based on a planning study completed for the project, the conceptual bridge alignment includes as few as four to as many as six piers. The final bridge alignment, geometry, and the number of piers required, will be established during preliminary design of the project. The roadway width of the proposed bridge is anticipated to be approximately 10 m and consist of two 3.66 m travel lanes and two 1.5 m shoulders. In

addition, the proposed bridge will likely feature a 1.7 m-wide pedestrian sidewalk. Concrete abutments on each end of the bridge will support it and facilitate traffic movement onto existing roadways. All legal truck loads (i.e., up to 64,000 kg gross vehicle weight) will be accommodated by the proposed new bridge.

Ancillary structures that may be required by the Project include material storage areas, temporary access roads and structures, and borrow areas. The locations of these ancillary structures will be identified as part of the contractors' bid proposals and have not yet been established. The locations and operations of these facilities will be subject to approval by NBDTI and applicable regulations.

The existing Madawaska-Edmundston International Bridge will remain in use during construction of the proposed new bridge. Once the proposed new bridge is operational, the existing bridge will be decommissioned and removed. Decommissioning activities include the demolition of the existing structure and removal of associated debris. The timeline for the decommissioning of the existing bridge has not yet been determined.

According to available data from Transport Canada, the Madawaska-Edmundston border crossing processed approximately 1,484,000 vehicles in 2016 (3,993 passenger cars per day and 73 commercial trucks per day on average). While the proportion of passenger vehicle traffic to commercial vehicle traffic is expected to remain roughly the same to the year 2030, traffic volumes in general are predicted to increase by up to 10% by 2030. The capacity of the bridge will be designed to accommodate the anticipated increase in traffic.

The Canada-US international boundary line in this area is located in the approximate centre of the Saint John River channel at the new bridge crossing location (Figure 1). Only the north abutment, up to four spans, and up to three piers (two in water) to be constructed as part of the Project are on the Canadian side of the border—and thus within Canadian jurisdiction.

2.3 PROJECT PHASES AND ACTIVITIES

2.3.1 Construction

Construction of the Project will include the construction of temporary access roads and structures and construction of the proposed bridge, followed by decommissioning and removal of the existing bridge.

2.3.1.1 Bridge Construction

The proposed bridge consists of the following major components:

- Bridge approaches– including connections from the existing roadways to the bridge abutments, and modifications to the layout of roadways at the existing CBSA facility.
- Bridge substructure - including the abutment on the northern bank of the Saint John River, connecting to the bridge approach and piers located in the Saint John River.
- Bridge superstructure - including the support structure, concrete decking, railings, light standards and other miscellaneous infrastructure.

Temporary access roads will be constructed within the CN Railway property to provide access to the work area on the Canadian side of the river. The location and design of the access roads will be determined by the contractor with approval from NBDTI and CN Rail; work in the vicinity of the railway tracks will be restricted due to railway operations. Temporary construction laydown and staging areas will also be required to accommodate construction activities and delivery of materials. The location and size of these temporary construction laydown areas will be determined by the contractor, with approval of NBDTI, CBSA, and CN Rail, and are anticipated to be near the approaches to the proposed and existing bridges, within the PDA.

Access for construction of piers and spans has not yet been determined; however, it is anticipated that access will be provided via temporary trestle constructed either upstream or downstream from the proposed bridge, or via barges.

An Environmental Management Plan (EMP) will be developed for the Project, and construction activities will be carried out in accordance with this EMP, the NBDTI Environmental Management Manual (EMM), and applicable environmental management documents developed by the Maine DOT.

Construction of Bridge Approaches

Work on the north bank of the Saint John River will include construction of the north bridge approach and a realignment of the existing access roads on the bridge from the CBSA facility. Site preparation activities for the new bridge will include clearing, grubbing, and the removal of overburden soils as necessary for the new abutment and access road(s). Construction activities will include ground preparation to the required grades for the bridge approach using granular fill, compacting the fill, and installing asphalt pavement. Road excavation and fills will be accomplished using earth moving machinery such as bulldozers, excavators, graders, loaders and articulated haulers. Compaction will be accomplished using rollers, soil compactors or both.

The realignment of the existing access roads on and off the bridge will include the removal of existing pavement, sidewalks and curbing, placement and compaction of granular fill, and installation of new pavement, curbing and sidewalks, as well as the relocation of a small storage shed owned by the CBSA.

Installation of the Bridge Substructure

For the purpose of this EIA, the bridge substructure will consist of a north abutment, and up to three bridge piers, with two in the water. Construction of these structures will consist of excavation of existing material, installation and subsequent removal of concrete formwork, installation of reinforcing steel, placement of concrete, placement of prefabricated wall components, and backfilling. This work will be conducted using heavy equipment.

Heavy equipment used for the construction of the north abutment foundations will be situated on land in the immediate vicinity of the abutment. Drilled concrete caissons may be used to support the abutment. The abutment will be constructed on the shore, above the normal water elevation. Construction of the north abutment will likely require the installation of sheet piling (or a similar earth retention strategy)

between the proposed abutment and the existing bridge and CBSA facility, in order to keep the existing bridge open during construction.

Heavy equipment used to construct other elements of the bridge substructure in the river will likely supported by a trestle, access platform, or barge. Cofferdams may be installed around the pier locations to allow for construction of the bridge piers in isolation of streamflow. These coffer dams will be removed following construction. Alternatively, piers may be constructed using cased drilled shafts or caissons without separate cofferdams, or other similar construction methods may be implemented. The caissons will end below the riverbed and will be extended with concrete columns and a concrete pier cap beam will be constructed above the caissons. Steel cofferdams will then be placed, and the area within the cofferdam will be excavated to expose the caissons. Tremie concrete will be poured under water to create a seal. Water will then be removed from inside the cofferdam and a structural concrete footing will be built. Concrete columns will be poured on the footings to support a concrete pier cap beam.

Installation of the Bridge Superstructure

The steel superstructure of the bridge will be installed on the bridge abutments and piers. This work is anticipated to be conducted using cranes placed on trestles, access platforms, or barges. There is also potential for superstructure construction to be conducted using launching or balanced cantilever construction approaches.

Construction of the superstructure may also require the installation and use of temporary bents or shoring towers to support girder sections during construction. Installation of these structures may require installation of driven piles using pile driving equipment on barges. Turbidity curtains will be installed to surround the pile driving activities to limit the escape of sediments from the work area into the river water.

Once the steel superstructure has been installed, a concrete deck will be constructed. This work will include installation and subsequent removal of formwork, placement of reinforcing steel, and installation of concrete. Bridge railings, barriers, light standards, and other miscellaneous infrastructure will be installed from the finished deck once it has cured.

Ancillary Facilities

Fill materials required will be obtained from nearby approved borrow sources. If borrow pits need to be developed, this development will be conducted in accordance with applicable laws and regulations. Borrow material will be free of contaminants and approved for suitability for the Project, prior to use. Potential borrow pits will be considered unsuitable if the rock/gravel material has potential to be sulphide-bearing. Erosion control measures will be used at borrow areas, where required, to reduce the potential for siltation of watercourses and wetlands, and adjacent properties in accordance with the EMP and the NBDTI EMM.

Conventional asphalt-concrete will be used in the construction of this Project. This material is made by mixing petroleum-based liquid asphalt with sand and crushed stone in an asphalt plant. The hot mix is easily transported, spread and rolled to provide a smooth surface that can be used almost immediately.

Existing approved asphalt paving companies will be used for finishing applications at existing asphalt plant locations.

2.3.1.2 Decommissioning of the Existing Bridge

Once the proposed new bridge has been constructed and is operational, the existing bridge will be decommissioned and removed. Decommissioning is anticipated to take approximately one year. Demolition of the existing structure may require the installation of temporary bents or shoring towers. Installation of these structures may require installation of driven piles using pile driving equipment on barges with turbidity curtains.

The existing steel structure will be dismantled and will become the property of the contractor once removed. There is the potential for parts of the existing superstructure to contain lead paint. Provisions will be included in the Project contract documents and the EMP to address requirements for management and disposal of materials containing lead.

The existing bridge trusses may be removed from the piers and transported to staging areas on land for demolition, if feasible. If this is not feasible they will be demolished in place using cranes placed on trestles, access platforms or barges. Removal of the existing piers may be conducted from barges or temporary work trestles. Details on demolition method for the removal of the piers have not yet been determined and will be developed during future design phases of the Project. It is anticipated that demolition activities will be carried out using cofferdams and/or turbidity curtains. The concrete abutments will likely be removed using air tools such as pneumatic hammers and blunted chisel tools. Concrete debris resulting from the demolition of the existing bridge will be disposed of at an approved landfill facility.

2.3.2 Operation

2.3.2.1 General Bridge Maintenance

Periodic bridge maintenance activities will be conducted throughout the operational life of the new bridge in order to maintain the safe operation of the structure. Maintenance activities include inspection of the bridge superstructure and substructure, bridge deck drainage, cleaning, the application, removal and reapplication of protective coatings including asphalt paving, and grouting. These activities are anticipated to take place from the late spring to early fall and may result in periodic temporary disruption of service to the public.

2.3.2.2 Winter Bridge Maintenance

Winter operation activities generally involve snow removal and ice control on the bridge superstructure to reduce traffic disruptions and safety hazards. Snow removal involves plowing services provided by, or contracted out and supervised by, local NBDTI Maintenance Depot employees. Snow removal and ice control activities including the application of road salt will be conducted in accordance with the NBDTI EMM.

2.3.2.3 Roadway Approach Maintenance

Periodic roadway maintenance activities will be conducted at the new bridge approaches to maintain the safe operation of these roadways. The condition of pavement in these areas will be monitored, and repainting, localized repairs, and resurfacing will be conducted when required. These repairs may involve excavation or removal of the existing pavement and sub-grade, patching and levelling, grading and graveling, surface treatment, and asphalt-concrete overlays. These activities are anticipated to take place from the late spring to early fall and may result in periodic temporary disruption of service to the public. These activities will be conducted in accordance with the NBDTI EMM.

2.3.3 Decommissioning and Abandonment of Proposed New Bridge

It is anticipated that there will always be a need for a bridge crossing at this location, and as such decommissioning is not envisioned. The new bridge will be designed for an anticipated life-span of 75 years. Environmental assessment or permitting requirements for the decommissioning of the proposed new bridge will be conducted in accordance with the regulations and requirements in place at that time.

2.4 PROJECT SCHEDULE

The bridge design work and the regulatory approval processes (in the US and in Canada) are taking place concurrently, in 2019 and possibly in 2020, depending on the level of federal review required.

A three-year construction period is anticipated for the Project, plus an additional year to demolish the existing bridge once construction of the new bridge is complete. The bridge opening will have to coincide with the opening of the new LPOE in Madawaska, Maine, which will be built simultaneously (but is not part of the international bridge project).

A refined project schedule will be prepared during the preliminary bridge design phase.

2.5 EMISSIONS AND WASTE

2.5.1 Airborne Emissions

Emissions associated with fuel combustion in heavy equipment and vehicles, and fugitive dust associated vehicle movement are anticipated to occur during the construction, and operation phases of the Project. Construction of the Project is not anticipated to result in substantive emissions of air contaminants, and greenhouse gases (GHG) are estimated to be low (see Appendix B). Air contaminant emissions are expected to be generally confined to the PDA and are not expected to result in measurable increases in the air quality conditions in Edmundston, or to exceed provincial air quality standards.

The Operational phase of the Project is anticipated to result in a net reduction of GHG emissions, as heavy-duty commercial trucks truck traffic will no longer be diverted to the border crossing at Clair/Fort Kent or Saint-Leonard/Van Buren.

2.5.2 Sound Emissions

Sound emissions and vibration will result from operation of heavy equipment, from transportation vehicles on Project access roads, pile driving (if used) during construction, and from vehicle traffic during operation.

2.5.3 Surface Runoff

The project may include the construction of closed drainage systems. Bridge drains will also be installed on the proposed bridge, which will direct surface water runoff during operation. The number and location of drainage outlets and bridge drains will be established as part of preliminary design.

2.5.4 Hazardous Materials

Potentially hazardous materials used during the construction may include, and are not limited to, propane, diesel, gasoline, hydraulic fluids, motor oil, and grease and lubricants for heavy equipment and vehicle use.

2.5.5 Waste Disposal

There will be disposal of some general construction and demolition wastes such as wood, steel, concrete, cardboard or other packaging, and other construction wastes. These materials will be disposed of at approved construction and demolition disposal sites. No burning of waste will be carried out during construction. NBDTI and its contractors will re-use or recycle waste materials where possible and dispose of other wastes at approved facilities.

2.6 ACCIDENTS, MALFUNCTIONS, AND UNPLANNED EVENTS

Accidents, malfunctions, and unplanned events are occurrences or upset events or conditions that are not planned as part of routine Project activities during any Project phase. Even with the best planning and application of mitigation, accidents, malfunctions and unplanned events could occur during any phase of the Project. They could occur because of abnormal conditions, wear and tear, human error, equipment failure, and other possible causes. Many of these are, however, preventable and can be addressed or prevented with good planning and design, vehicle and equipment maintenance, hazards analysis and corrective action, and emergency response planning and mitigation.

Given the adherence of Project-related activities to the mitigation measures in the NBDTI EMM, adverse environmental interactions related to accidents, malfunctions, and unplanned events are not likely to occur during any phase of the Project. This assessment includes the potential accidents, malfunctions and unplanned events that have a probability of occurrence. The potential accidents, malfunctions and unplanned events include:

- hazardous material spill;
- Project-caused fire;
- vehicle collision; and

- erosion and sediment control failure.

The potential effects of these scenarios on the environment are included in the assessment of each valued component (see Section 3.2).

3.0 ENVIRONMENTAL ASSESSMENT METHODS AND SCOPE

3.1 ENVIRONMENTAL ASSESSMENT METHODS AND VALUED COMPONENTS

The EIA methods used in this document are based on a structured and focused approach that considers factors under the NBDELG "Guide to Environmental Impact Assessment in New Brunswick" (NBDELG 2018) and linear facilities' sector guidelines (NBDELG 2008). The method focuses on issues of greatest concern; considers the issues raised by the public and other stakeholders; and integrates engineering design, mitigation, and monitoring into a comprehensive environmental planning process.

The Project-related environmental effects are assessed using a standard framework for each valued component (VC; see section 3.2). The environmental effects assessment methodology for each VC involves the following generalized steps, as shown graphically in Figure 2.

- Scope of Assessment – This involves the scoping of the VC, including: the rationale for selection of the VC; the applicable regulatory and policy setting; selection of environmental effects and measurable parameters; description of temporal and spatial boundaries; definition of the parameters that are used to characterize the Project-related environmental effects; and identification of the standards or thresholds that are used to determine the significance of environmental effects. This step relies upon the scoping undertaken by the study team based on its professional judgment and experience with past EIAs of a similar nature; preliminary discussions with regulatory authorities; and consideration of the early input (as applicable) of the public, stakeholders, and First Nations.
- Existing Conditions – This involves the establishment of existing (baseline) environmental conditions for the VC. In many cases existing conditions expressly and/or implicitly include those environmental effects that may be or may have been caused by other past or present projects or activities that have been or are being carried out.
- Assessment of Project-Related Environmental Effects – This includes the assessment of Project-related environmental effects. The assessment includes descriptions of how an environmental effect will occur (pathways), the mitigation and environmental protection measures proposed to reduce or eliminate the environmental effect, and the characterization of the residual environmental effects of the Project. The focus is on residual environmental effects (i.e., the environmental effects that remain after planned mitigation has been applied). All applicable phases of the Project are assessed, as are accidents, malfunctions, and unplanned events. The evaluation also considers the Effects of the Environment on the Project. Follow-up measures that are proposed to verify the environmental effects predictions or the effectiveness of mitigation are identified as appropriate.

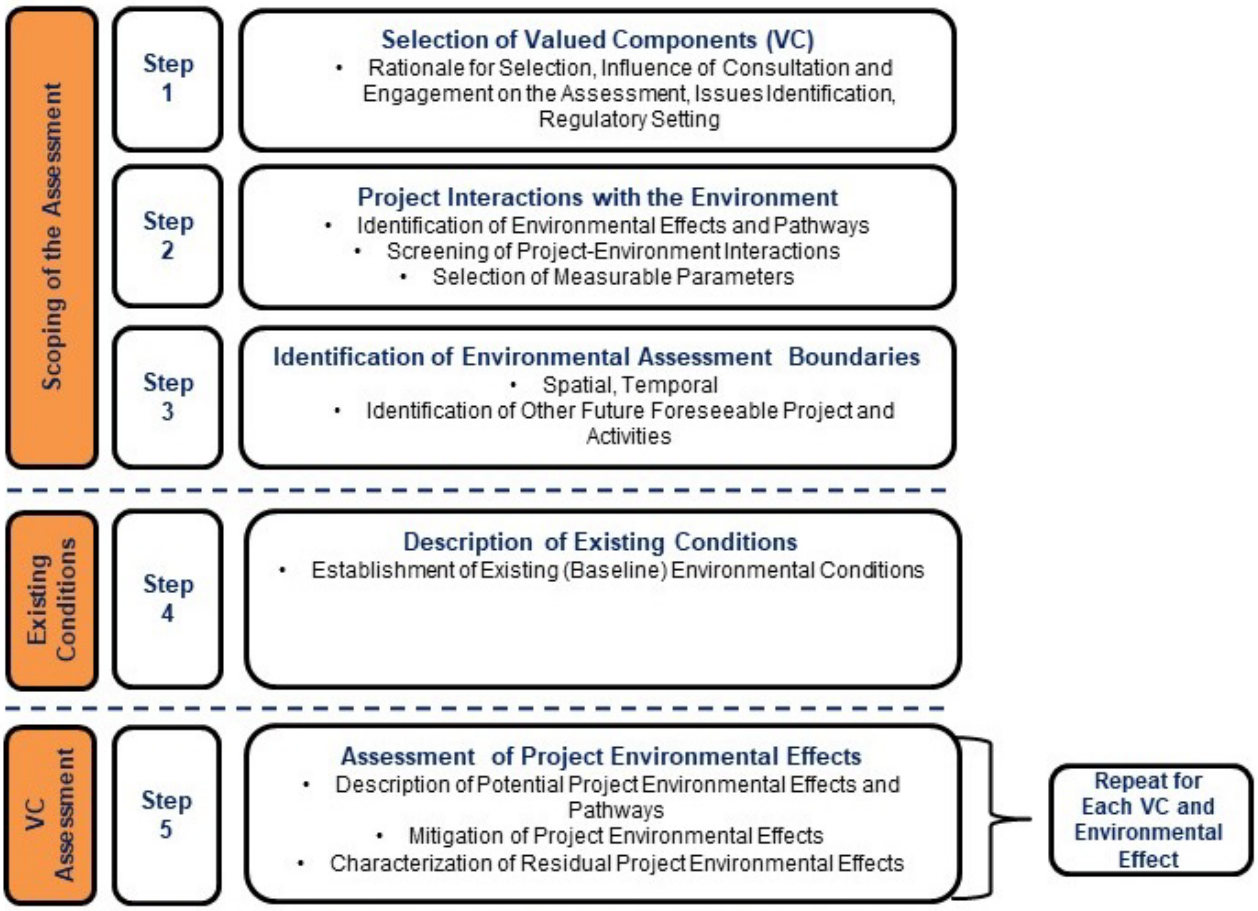


Figure 3 Environmental Impact Assessment Methodology

3.2 VALUED COMPONENTS

The scope of factors to be considered in the EIA is described below as it relates to valued components (VCs). VCs are defined as broad components of the biophysical and human environments that, if altered by the Project, would be of concern to regulatory agencies, Indigenous persons, resource managers, scientists, stakeholders, and/or the general public. VCs are typically selected on the basis of: regulatory issues, guidelines, and requirements; consultation with regulatory agencies, the public, stakeholder groups, and First Nations; field reconnaissance; and the professional judgment of the study team.

The following valued components (VCs) have been selected for the Project:

- Atmospheric Environment;
- Groundwater Resources;
- Aquatic Environment;
- Wildlife and Wildlife Habitat (completed by NBDTI);
- Vegetation and Wetlands (completed by NBDTI);
- Heritage Resources;

- Land Use and Economy; and
- Effects of the Environment on the Project.

The individual VC assessments are present as appendices, with the following sections:

- Introduction;
- Rationale for Selection as a Valued Component;
- Boundaries;
- Existing Conditions;
- Assessment of Potential Project Interactions;
- Summary and Recommendations; and
- References.

The scope of factors that will be included in each VC assessment is provided in Table 1 below:

Table 1 Scope of Assessment for Each Valued Component

Valued Component (VC)	Key Issues of Concern	Scope of Factors to be Considered
Atmospheric Environment	Project-related emissions of particulate matter, combustion gases, and sound may affect the atmospheric environment and/or be perceptible to nearby receptors.	• Air quality • Sound quality • Greenhouse gas emissions
Groundwater Resources	Project-related activities such as blasting and pile driving, as well as construction of the abutments could cause a temporary or permanent change in groundwater flow, quantity or quality of groundwater resources and disturb existing wells.	• Physiography and drainage • Bedrock and surficial geology • Hydrogeology • Groundwater resource use within 500 m of the Project • Groundwater quality and quantity
Aquatic Environment	Project-related activities have the potential to change fish and fish habitat within the Saint John River and its watershed near the Project. Potential changes include: • fish habitat (including surface water and sediment quantity and quality) • fish populations due to a change in water quality • species at risk (SAR) or species of conservation concern (SOCC) due to change in habitat	• Fish and fish habitat • Species at risk (SAR) and critical habitat • Species of conservation concern (SOCC) and their habitat • Environmentally significant areas • A summary of previous records occurring in and around the project from the Atlantic Canada Conservation Data Centre (AC CDC) • Fisheries including sport or subsistence fisheries • Fish migration routes/movement corridors • Surface water quality • River flow variations • Water level variations • Navigable waters

Table 1 Scope of Assessment for Each Valued Component

Valued Component (VC)	Key Issues of Concern	Scope of Factors to be Considered
Wildlife and Wildlife Habitat	Project-related activities have the potential to change wildlife use and/or wildlife habitat within and around the Project. Potential changes include: • Use and potential for use of the Project area by migratory birds; • Disturbance of or loss of Critical or important habitat areas or features for wildlife species (birds or other species) of conservation concern (SOCC) and Species at Risk (SAR); Compliance with the *Migratory Bird Convention Act* (MBCA) will be of primary concern in all stages of the Project.	• Known or suspected use of the area by various wildlife species including observations and a summary of previous records occurring in and around the project from the Atlantic Canada Conservation Data Centre (AC CDC) • Species at Risk (SAR) and Critical Habitat • Environmentally significant areas • Observed use and potential for use of the Project area by wildlife species with a focus on SAR and migratory birds.
Wetlands and Vegetation	Project-related activities have the potential to change wetland habitat and vegetation within and near the Project. Potential changes include: • the extent and type of wetland and any associated valued functions; • The composition and integrity of native vegetation communities; and • A potential loss of vascular plant species of conservation concern (SOCC) and Species at Risk (SAR)\	• Amount and type of wetland • Valued functions of any wetland present • Species at risk (SAR) and critical habitat • Environmentally significant areas • Species of conservation concern (SOCC) and their habitat • A summary of previous records occurring in and around the project from the Atlantic Canada Conservation Data Centre (AC CDC)
Heritage Resources	Ground disturbance associated with Project-related activities could adversely affect archaeological or other heritage resources (e.g., fossils) that may be present if mitigation is not implemented prior to the activities.	• Structures, sites, and things of historical, archaeological, paleontological, or architectural significance

Table 1 Scope of Assessment for Each Valued Component

Valued Component (VC)	Key Issues of Concern	Scope of Factors to be Considered
Land Use and Economy	Construction of the replacement of Madawaska-Edmundston International Bridge may result in a change in Land and Resource Use within the PDA. Project-related activities have the potential to affect employment and the economy within and surrounding the City of Edmundston. Project-related activities could interact with Current Use activities in proximity to the bridge by Indigenous persons.	• Residential land use • Commercial and industrial land use • Recreational land use • Resource land use • Road transportation network • Local economy • Current use of land and resources for traditional purposes by Indigenous persons
Effects of the Environment on the Project	Potentially harsh environmental conditions during Project-related activities could negatively affect infrastructure or operational performance of the activities	• Changes or potential effects on the Project caused by: • Current climate conditions • Climate change • Sea level rise and flooding • Erosion and mass wasting • Seismic activity • Natural forest fires • Contaminated sites • Sulphide-bearing rock

4.0 PUBLIC, STAKEHOLDER, AND INDIGENOUS PEOPLE'S ENGAGEMENT

This section provides a summary of the public, stakeholder, and Indigenous people's engagement that NBDTI has conducted for the Project, as of November 30, 2018. A more detailed public engagement report will be prepared and submitted by NBDTI under separate cover, following registration of the EIA.

4.1 PUBLIC AND STAKEHOLDER ENGAGEMENT

A public and stakeholder engagement program has been initiated by NBDTI to allow elected officials, landowners, stakeholders, and the general public to be informed and offered opportunities to provide feedback on the Project. A Feasibility and Planning Study (Maine DOT et al., 2018) was conducted from January 2017 to April 2018. As part of the study, various potential locations for the new bridge and associated border crossing facilities were considered. Stakeholders of the proposed project were informed of the plans and have been providing feedback to help guide the study design and decision-making process. Consultation as part of the Feasibility and Planning Study occurred with the following:

- Canada – federal level, provincial level, and municipal level (the City of Edmundston)
- U.S.A. – federal and state level

- industry, including
  - Canadian National Railway Company (CN Rail)
  - Maine Northern Railways
  - Twin Rivers Paper Company
- business organizations, including
  - Edmundston Chamber of Commerce
  - Edmundston Downtown Business Group
- the public, at public information sessions

A study-specific website (https://www1.maine.gov/mdot/planning/studies/meib) has been created and updated as materials are developed. In addition to the materials about the study, the website provides an opportunity to submit comments directly to the Maine DOT and NBDTI.

The public and stakeholder engagement program during the EIA review period for the Project will follow guidance from the document entitled "A Guide to Environmental Impact Assessment in New Brunswick" (NBDELG 2018).

4.2 INDIGENOUS PEOPLE'S ENGAGEMENT

NBDTI has initiated an engagement program with Indigenous communities and groups about the Project. A notification letter was sent by the NBDTI on May 4, 2017 to the Chiefs and the Consultation Coordinators of the following Wolastoqey communities and organizations, located near the project:

- Madawaska First Nation (adjacent to City of Edmundston);
- Tobique First Nation;
- Woodstock First Nation;
- Kingsclear First Nation;
- St. Mary's First Nation ;
- Oromocto First Nation; and
- Saint John River Tribal Council.

This letter advised of the need for the project and offered to meet and discuss concerns or questions that the Wolastoqey Communities may have. A follow up letter was also sent on September 26, 2018 providing a link to view the recently finalized Feasibility and Planning Study (Maine DOT et al. 2018) and explaining the status of the project. The Wolastoqey Nation in New Brunswick (WNNB), New Brunswick Aboriginal Affairs Secretariat (NBAAS) and Infrastructure Canada were also sent a copy of this letter. A response letter was received, and the conversation is ongoing between NBDTI and First Nations. The Maine DoT has advised Indigenous communities in north-eastern Maine about the project as well.

After submission of the EIA Registration, NBAAS will carry out an initial assessment containing details on the project, potential environmental impacts, and of potential impacts on Indigenous communities/rights which will be sent to Indigenous communities. NBDTI will meet with interested Indigenous communities and groups to provide the latest project plans and gather feedback. Potential concerns raised during such meetings will be either answered right away, or addressed through design changes when possible, and/or mitigation measures.

5.0 REFERENCES

Archaeological Services. 2012. Guidelines and Procedures for Conducting Professional Archaeological Impact Assessments in New Brunswick. Archaeological Services, Heritage Branch, Department of Tourism, Heritage and Culture, Fredericton.

NBDELG. 2008. Additional Information Requirements for Linear Facilities. Available at https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/SectorGuidelines/LinearFacilities.pdf

NBDELG. 2018. A Guide to Environmental Impact Assessment in New Brunswick. Environmental Assessment Section, New Brunswick Department of Environment and Local Government, Fredericton, NB. January 2018. Available at https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/GuideEnvironmentalImpactAssessment.pdf.

NBDTI. 2018. Project Description Summary, Madawaska/Edmundston International Bridge New Brunswick Department of Transportation and Infrastructure. November 2018.

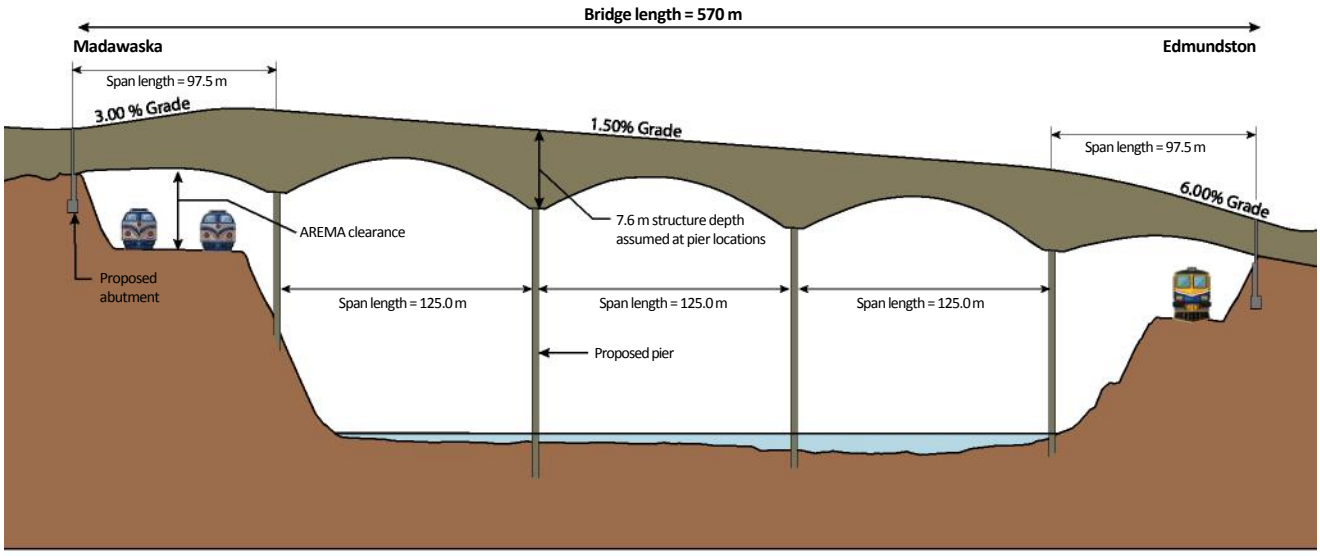
Maine DOT. 2018. Maine Department of Transportation, U.S. General Services Administration, Federal Highway Administration. New Madawaska Land Port of Entry and International Bridge Project - Draft Supplemental Environmental Impact Statement and Draft Programmatic Section 4(f) Evaluation. November 2018.

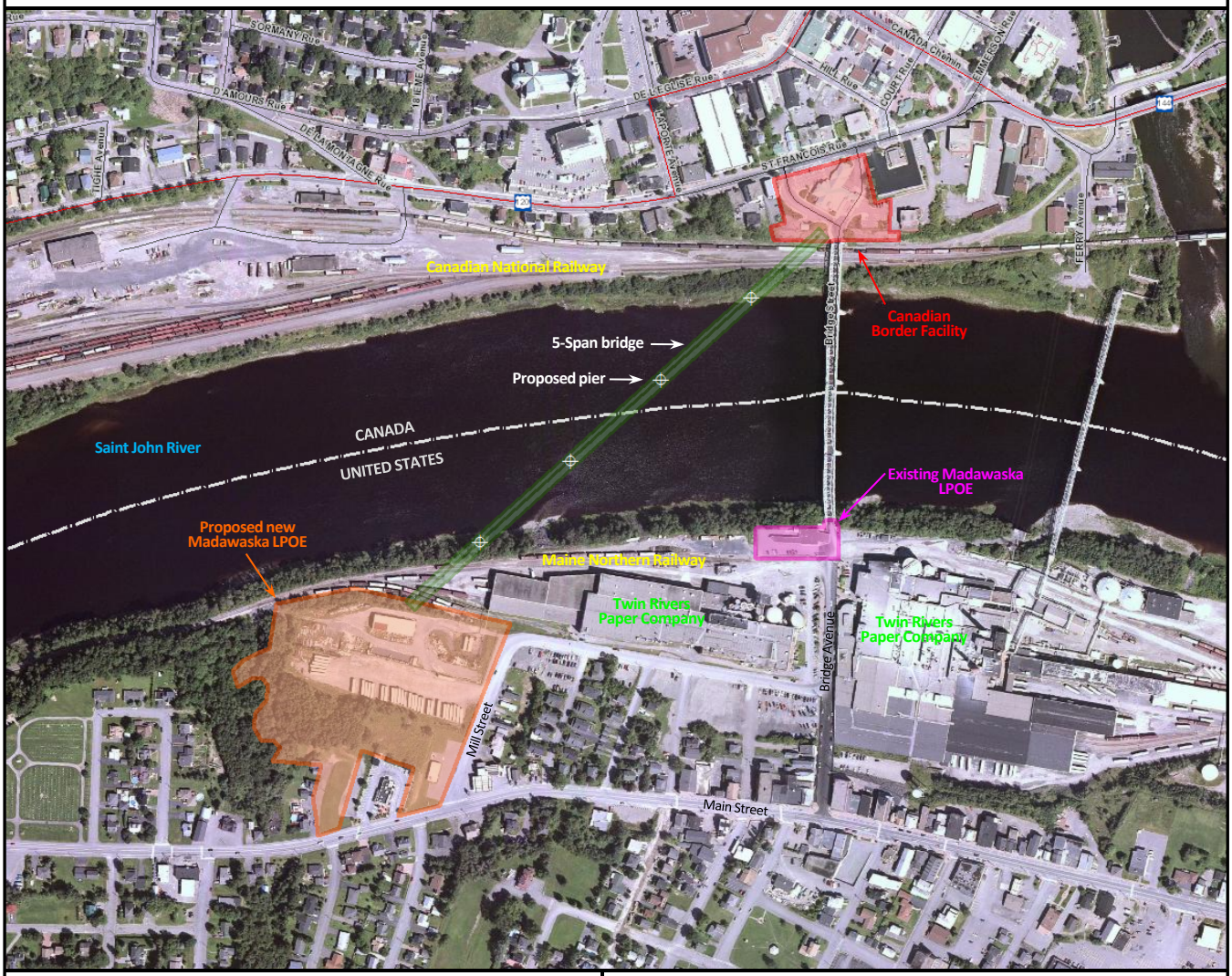
Maine Department of Transportation, U.S. General Services Administration, U.S. Customs and Border Protection, New Brunswick Department of Transportation and Infrastructure, Public Works and Government Services Canada, and Canada Border Services Agency. 2018. Madawaska/Edmundston International Bridge and Border Crossing – Feasibility and Planning Study. May 2018. Available online at: https://www1.maine.gov/mdot/planning/studies/meib/

Appendix A PRELIMINARY DESIGN DRAWINGS

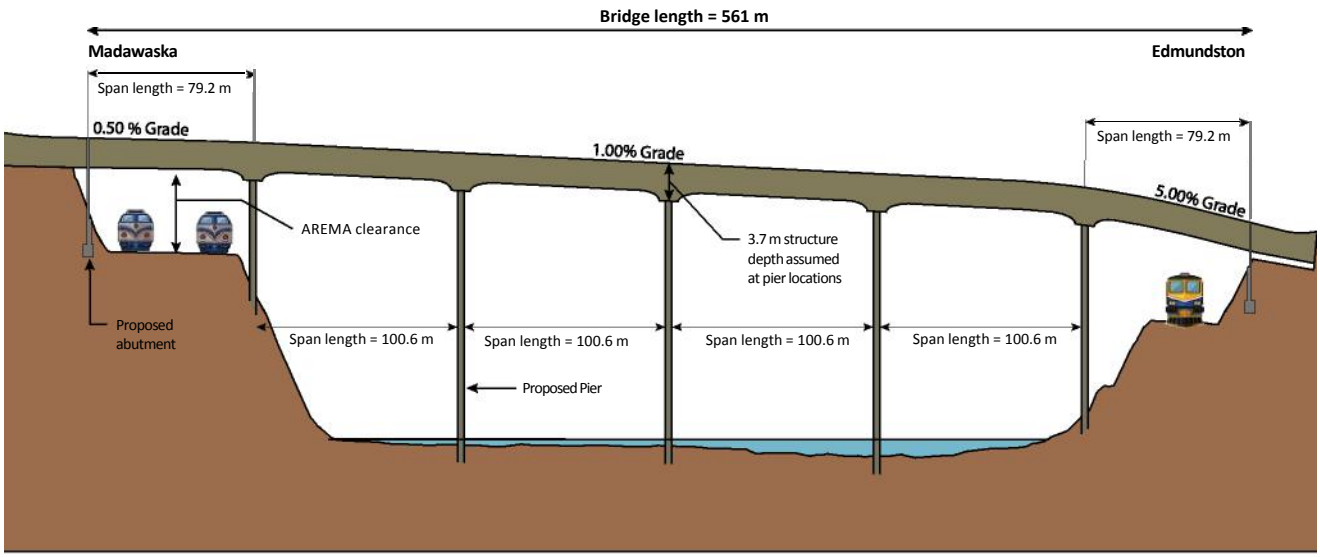
ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320)

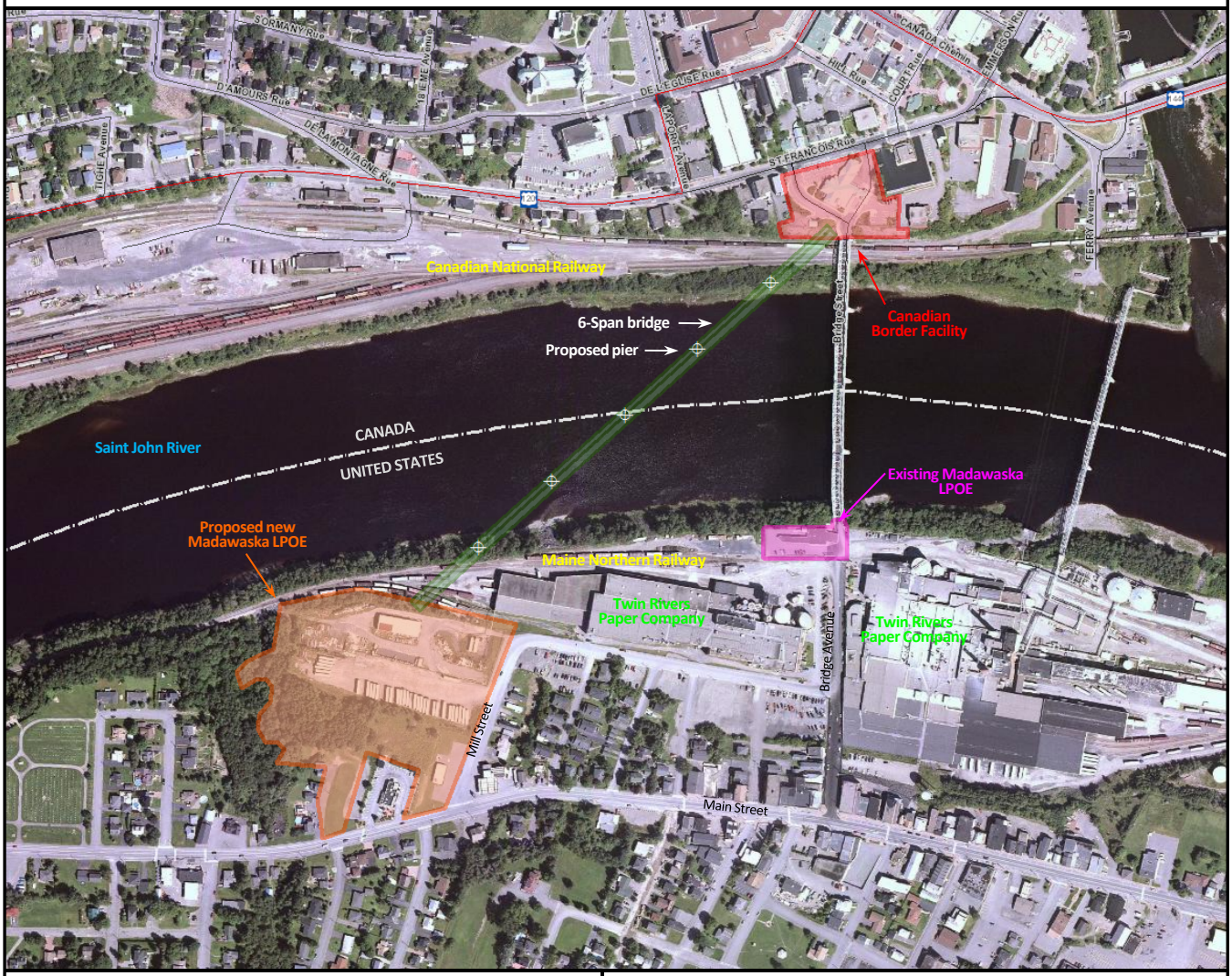
Appendix A Preliminary Design drawings
February 2019





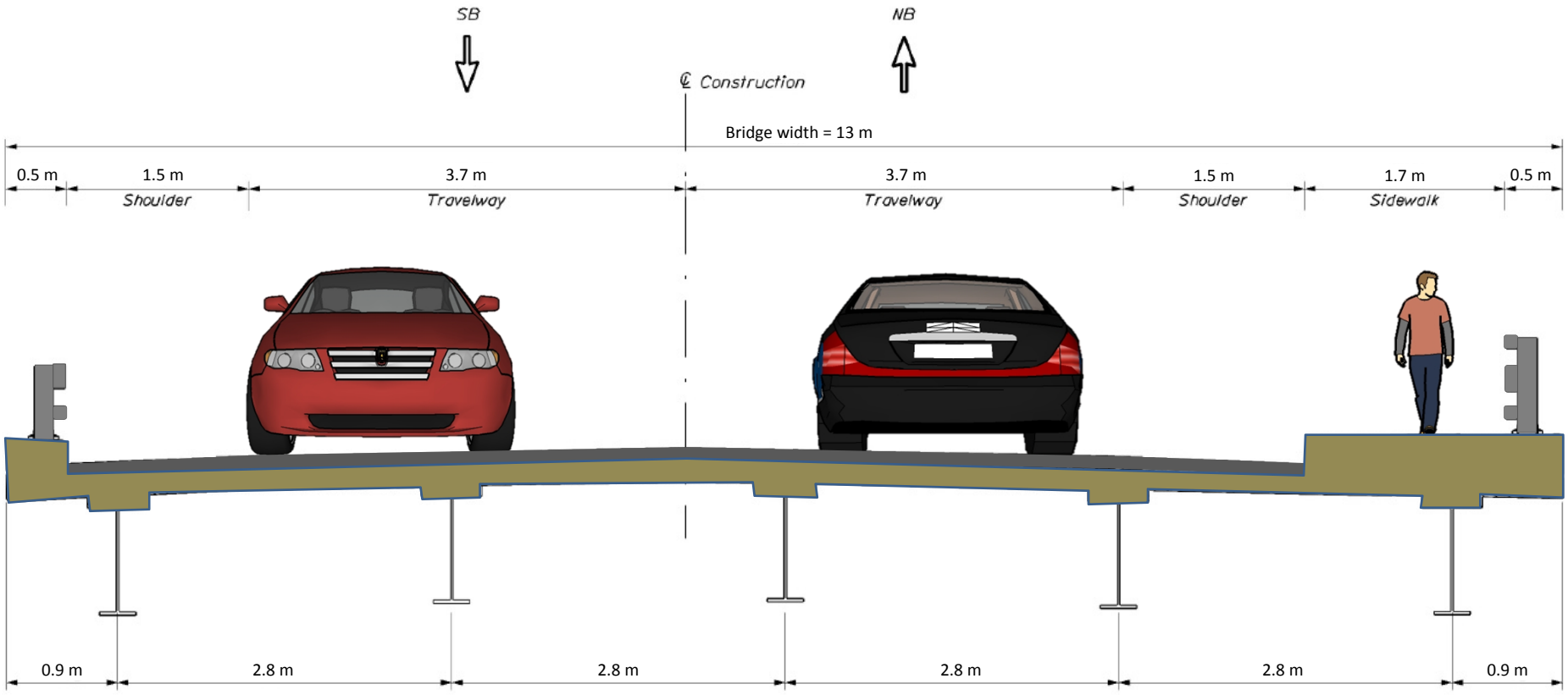
EIA Registration **Bridge Alternative No. 1 (5 spans)** **Plan and Profile**	Project: **Madawaska/Edmundston International Bridge**	
	Date: **2018/11/20**	Figure: **1**





EIA Registration **Bridge Alternative No. 2 (6 spans)** **Plan and Profile**	Project: **Madawaska/Edmundston International Bridge**	
	Date: **2018/11/20**	Figure: **2**

Conceptual Bridge Cross Section



Typical Section
(Bridge Section)
Not to Scale

Appendix B ATMOSPHERIC ENVIRONMENT

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320)

Appendix B Atmospheric Environment
February 2019

Appendix B – Atmospheric Environment

Environmental Impact Assessment Registration for the Replacement of the Madawaska-Edmundston International Bridge (E320)

February 2019

Prepared for:

Province of New Brunswick
Department of Transportation and Infrastructure

Prepared by:

Stantec Consulting Ltd.
845 Prospect Street
Fredericton, NB E3B 2T7

Statement of Limitations

This document entitled Appendix B – Atmospheric Environment is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project and was prepared by Stantec Consulting Ltd. ("Stantec") for the account of the New Brunswick Department of Transportation and Infrastructure and the Maine Department of Transportation (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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1.0 INTRODUCTION

This document is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project (the Project). The Project is being proposed by the New Brunswick Department of Transportation and Infrastructure (NBDTI) and the Maine Department of Transportation (Maine DOT) and consists of the construction, operation, and maintenance of a new international bridge as well as the demolition of the existing international bridge over the Saint John River. The bridge spans between the City of Edmundston, New Brunswick and the Town of Madawaska, Maine.

This document includes an analysis of the potential interactions between Project activities and the atmospheric environment Valued Component (VC) of the EIA for the Project.

2.0 RATIONALE FOR SELECTION AS A VALUED COMPONENT

The atmospheric environment has been selected as a VC because changes in air quality, greenhouse gas (GHG) emissions, and sound quality may be caused by Project activities.

Air quality is defined by the presence or absence of contaminants in ambient air that may have adverse effects on vegetation, wildlife, or human health. Whether air quality is good or bad is defined by comparing levels of contaminants in the ambient air to established air quality criteria, which are set to be protective of human health or the environment. The principle contaminants of concern related to this Project are those generated by the combustion of heavy equipment and on-road vehicles, primarily nitrogen oxides (NO_X), sulphur dioxide (SO_2), carbon monoxide (CO), total particular matter (TPM), and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). These contaminants were identified because guidelines exist for their concentrations in ambient air and because these contaminants are likely to be generated during the construction and operation and maintenance phases of the Project.

GHGs are chemical species that have the potential to contribute to global climate change when released into the atmosphere by preventing heat from escaping the atmosphere. GHGs can be released from both man-made sources, such as fossil fuel combustion, and natural sources, such as biomass decomposition or forest fires. The GHG species of concern that are released from combustion sources are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Combined, emissions of GHGs are reported as carbon dioxide equivalent (CO_2e), using the global warming potentials (GWPs) adopted by Environment and Climate Change Canada (ECCC) and as set by the Intergovernmental Plant on Climate Change IPCC (IPCC 2014). GHG emissions are reported as tonnes of CO_2e.

Sound quality is characterized by the sound pressure level in the ambient air due to both anthropogenic sources (e.g., vehicles) and natural sources (e.g., bird song), as well as by the frequency (i.e., tone) of the sound and the effect the sound has on humans (e.g., enjoyment or disruption). While the sound pressure level and frequency of a sound source can be quantified, the effect of unwanted sound (noise) is not easily quantified. Sound pressure levels are measured in decibels (dB), which is a logarithmic scale.

For example, a change from 40 dB to 50 dB represents a doubling in the perceived sound level for the human ear. For environmental assessments where humans are the focus, an A-weighted dB scale (dB_A) is used to report sound pressure levels as that scale is weighted to most closely mirror the perception of various frequencies of the human ear.

In this assessment, the potential changes to the Atmospheric Environment as a result of the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

2.1 REGULATORY CONTEXT

2.1.1 Air Quality

Air quality in New Brunswick is regulated by the *Air Quality Regulation* under the New Brunswick *Clean Air Act*. The regulation and act provide measures to regulate the emissions of air contaminants to the atmosphere from stationary or fugitive sources, provide testing and monitoring provisions, and establish permissible ground-level concentrations of specified air contaminants in ambient air, among other requirements.

At the federal level, the main instruments for managing air quality are the *Canadian Environmental Protection Act* (CEPA) and the Canadian Ambient Air Quality Standards (CAAQS) (CCME 2018) developed by the Canadian Council of Ministers of the Environment (CCME). The CAAQS include objectives, standards, or guidelines for protecting the environment and human health. Many of these exist to protect air quality.

There are no City of Edmundston by-laws with respect to air quality.

2.1.2 GHG Emissions

New Brunswick does not have provincial legislation limiting emissions of GHGs. Federally, industrial facilities that emit more than 10,000 t CO_2e per year are required to quantify and report GHG emissions to ECCC (ECCC 2018a).

Beginning on January 1, 2019, the federal government will implement an output-based pricing system (OBPS) for industrial facilities across Canada (ECCC 2018b) for the provinces of New Brunswick, Ontario, Manitoba, Saskatchewan, Yukon, Nunavut, and Prince Edward Island (Bennett Jones LLP 2018). The other provinces have their own systems that have been accepted by ECCC. The federal OBPS is designed to encourage industrial facilities releasing 50,000 t CO_2e or more to reduce their GHG emissions. Industrial facilities that have higher GHG emissions than the limit imposed by the OBPS will pay a carbon price on the emissions over the limit. If industrial facilities are below the OBPS limit, the facility will receive credits that can be traded. The OBPS does not apply to the Project activities directly.

In conjunction with the OBPS, a monetary charge on fossil fuels (e.g., gasoline) will also be put into place, which will be paid by fuel producers and distributors. This may cause fuel prices to increase to

compensate. In New Brunswick's "Update on New Brunswick Climate Change Actions" (Government of New Brunswick 2017), the Province is not planning to increase fossil fuel taxes for consumers as part of its Climate Change Action Plan.

There are no City of Edmundston by-laws with respect to GHG emissions.

2.1.3 Sound Quality

There are no overarching sound guideline levels, regulations, or standards currently established by the Province of New Brunswick for limiting acceptable sound levels from industrial facilities; however, a Certificate of Approval issued under the *Clean Air Act* for an industrial facility are sometimes used to regulate noise levels for individual facilities. In such cases, the New Brunswick Department of Environment and Local Government (NBDELG) generally requires that sound emissions from any activity be controlled so as not to cause substantial loss of enjoyment of the normal use of any property, or substantial interference with the normal conduct of business. Absolute limits are sometimes included in NBDELG's approvals and typically range from 50 to 55 decibels on an A-weighted scale (dB_A).

Edmundston has a bylaw regarding noise that restricts noise generating activities between 11:00 PM and 7:00 AM (City of Edmundston 2005). There are some approved sources that are exempt from this restriction, including activities engaged in by the Province of New Brunswick (i.e., DTI).

Health Canada produced the document "Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise" (Health Canada 2016), which provides guidance on sound levels at the most exposed façade of a noise sensitive receptor for both construction and operation of sound emission sources. The recommended assessment method for long term construction (greater than 1 year), as well as operational noise, is to establish the baseline, construction, and operation day-night sound pressure levels (L_{DN}) and the percent of the population that is highly annoyed (% HA) by the increase in sound pressure levels. Sensitive receptors are residences, churches, nursing homes, schools, daycares, and hospitals.

3.0 BOUNDARIES

3.1 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and atmospheric environment is focused on a Project Development Area (PDA) and a Local Assessment Area (LAA).

The PDA for the Project is defined as the area of physical disturbance associated with the construction and operation and maintenance phases of the Project, as well as the decommissioning of the existing bridge. For the purposes of this assessment, the PDA comprises a physical footprint of the Project and includes portions of the Canada Border Services Agency properties and adjacent private properties east and west of the proposed new bridge location, a portion of land owned by the Canadian National Railway

(CN), and a portion of the Saint John River (from 250 metres (m) upstream of the new bridge to 250 m downstream of the existing bridge to the east, and up to the international border to the south).

The LAA for Atmospheric Environment is defined as the area within which the environmental effects of the Project can be measured or predicted. With respect to air quality and sound quality, the LAA is defined as 2 km extending from the PDA. With respect to GHG emissions, an LAA is not defined, as climate change is a global affect.

The PDA and the LAA are shown on Figure 1.

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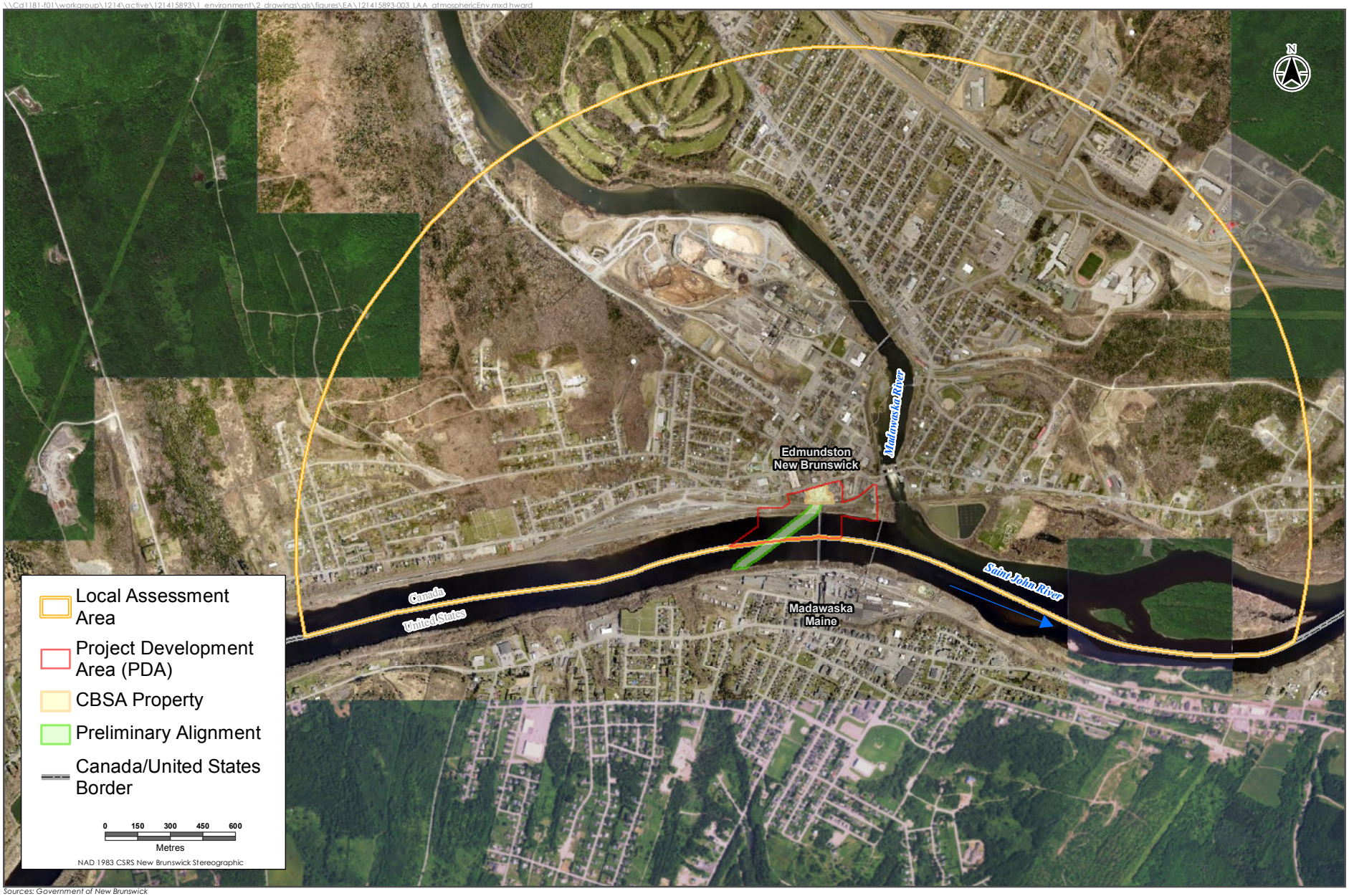

Sources: Government of New Brunswick
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Local Assessment Area for Atmospheric Environment

Stantec

121415893 - NBDTI - MADAWASKA-EDMUNDSTON BRIDGE

Figure 1

Boundaries
February 2019

3.2 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental interactions between the Project and atmospheric environment include the following phases.

- Construction - including construction of the new bridge (anticipated to last three years) and demolition of the existing bridge (anticipated to last one additional year);
- Operation and maintenance – in perpetuity; and,
- Decommissioning and abandonment of the new bridge – not anticipated.

It is anticipated that construction of the new bridge will last three years. Decommissioning of the existing bridge, considered as part of the construction phase, will commence after the opening of the new bridge. A project schedule will be prepared during the preliminary design of the bridge.

There are potential environmental interactions with the atmospheric environment that will occur during the construction and operation and maintenance phases of the Project. The new bridge will be designed for an anticipated life-span of 75 years. Environmental assessment or permitting requirements for the decommissioning of the proposed new bridge would be conducted in accordance with the regulations and requirements in place at that time and are not included in this assessment.

4.0 EXISTING CONDITIONS FOR ATMOSPHERIC ENVIRONMENT

The sections below describe the existing conditions for air quality, GHG emissions, and sound quality.

The provincial government operates a number of air monitoring stations located throughout New Brunswick. Annually, a report entitled “New Brunswick Air Quality Monitoring Results” is released. Stantec used the information in the most recently published air quality report (NBDELG 2017), which is for 2015, to inform the assessment on air quality in Edmundston.

Provincial and national GHG emissions are reported by ECCC in a National Inventory Report (NIR) to the United Nations Framework Convention on Climate Change (UNFCCC) annually as part of Canada’s commitment to the Kyoto Protocol (ECCC 2018c). The most recently published NIR contains GHG emissions information for 2016 and was used as the source of New Brunswick’s and Canada’s existing GHG emissions (ECCC 2018c).

Information on the existing sound quality in Edmundston is not available in the literature. Stantec considered the Alberta Energy Regulator’s (AER) Directive 038 for Noise Control to inform the likely existing conditions with respect to sound quality. This Directive provides typical ambient sound pressure levels in consideration of proximity to roadways, existing sound sources, and density of dwellings in the area. Stantec considers this approach appropriate, given that there are no special features, immediately adjacent or with the PDA that would cause the sound quality to be substantively different from a typical urban setting. The Madawaska Maine operations for Twin Rivers Paper Company, located near the US

side of the bridge, may contribute to baseline sound quality on both sides of the river; however, on the Canadian side it is not expected to be noticeable most of the time over noise from local traffic.

Stantec also used the acoustic software model CADNAA to estimate existing day and night sound pressure levels at the nearest receptor due to pre-project bridge vehicle traffic both with historical truck traffic and without (as restrictions are now in place). The estimated sound pressure levels using CADNAA were used to validate the existing conditions as determined using the AER Directive 038.

4.1 AIR QUALITY

Air quality is highly dependent on local air contaminant sources, such as industrial facilities or heavy vehicle traffic. The movement of air contaminants from Québec and/or Maine also has a small effect on air quality. Terrain and weather can affect how quickly air contaminants are dispersed.

The Twin Rivers Paper facility is the largest industrial facility in Edmundston and Twin Rivers also operates a facility across the river in Maine. These facilities release SO_2, NO_X, CO, total particulate matter, PM_{10}, $PM_{2.5}$ into the atmosphere, among other contaminants, which contribute along with other smaller local sources to ambient air contaminant concentrations. The NBDELG, in cooperation with ECCC and a number of industrial partners, operates a network of ambient air quality monitoring stations in various areas of the province. The NBDELG documents the results of this monitoring annually in a report for public distribution. The most recent publication was for the 2015 calendar year (NBDELG 2017).

Based on the most recent available data from the NBDELG, ambient air quality in New Brunswick is characterized as very good most of the time, with few exceedances of the provincial ambient air quality objectives or Canada-wide Standards. The majority of exceedances in New Brunswick in 2015 were related to odour (hydrogen sulphide) and these occurred principally due to weather conditions preventing timely dispersal of hydrogen sulphide (NBDELG 2017).

There are two ambient air quality monitoring stations in Edmundston, one at the Cormier School and the other at St. Mary's Academy. The monitors are operated by the Twin Rivers Paper Company industrial facility. Concentrations of SO_2 and $PM_{2.5}$ are measured at the Cormier station and SO_2 is measured at the St. Mary's station. In 2015, the daily and annual average concentrations of $PM_{2.5}$ were below the CAAQS at the Cormier station; it is noted that the CAAQS is compared to the average of two years of data, whereas only one year of data is available at the Cormier station. The daily average $PM_{2.5}$ concentration over the 2015 year was 19 µg/m^3, which can be compared to a CAAQS of 28 µg/m^3) The maximum daily $PM_{2.5}$ concentration was approximately 32 µg/m³ (this is not comparable to the CAAQS due to the different averaging period).

The average concentrations of SO_2 were below the provincial ambient air quality objectives for hourly, daily, and annual periods at St. Mary's station; however, there were two exceedances of the hourly SO_2 objective at the Cormier station due to upset conditions at the nearby Twin Rivers Paper facility.

The nearest station where NO_X is measured is in Belledune, which is 270 km from the PDA. There were no exceedances of NO_X at the station in Belledune in 2015. There were also no exceedances of NO_X at any other stations in New Brunswick, indicating good overall compliance with this parameter.

4.2 GHG EMISSIONS

A summary of GHG emissions from New Brunswick and Canada, as reported by ECCC to the UNFCCC, are presented in Table 1.

Table 1 GHG Emissions from New Brunswick and Canada for 2016

Boundary	CO_2 (ktonnes)	CH_4 (ktonnes CO_2e)	N_2O (ktonnes CO_2e)	Other GHGs (ktonnes CO_2e)	Total (ktonnes CO_2e)
New Brunswick	13,700	890	440	251	15,300
Canada	558,000	96,000	37,000	13,220	704,000
New Brunswick Percent of Canada	2.4%	0.9%	1.2%	1.9%	2.2%

Notes: ktonnes are 1000 tonnes. Other GHGs include perfluorocarbons, hydrocarbons, nitrogen trifluoride, and sulphur hexafluoride. Totals may not add up due to rounding.
Reference: ECCC NIR (2018) for New Brunswick and Canada, ECCC GHG (2018d)

New Brunswick's GHG emissions accounted for approximately 2.2% of Canada's emissions in 2016. According to ECCC, Canada's contribution to global GHG emissions in 2013 was 1.6% (ECCC 2018e).

In 2016, seventeen industrial facilities in New Brunswick reported GHG emissions to the ECCC GHG reporting program, representing a total of 7,793 ktonnes CO_2e or approximately 51% of GHG emissions from New Brunswick.

4.3 SOUND QUALITY

The existing sound quality in the vicinity of the PDA is expected to be dominated by vehicle traffic. Considering that large vehicles are currently restricted from using the existing international bridge, sound pressure levels in the PDA are currently slightly lower than if the restrictions were not in place.

In addition to on-road vehicle traffic, CN tracks run along the Saint John River, and the CN Edmundston Yard is located west of the existing bridge. An estimated six to ten trains a day operate under the existing bridge.

Health Canada's guidance on evaluating human health effects due to noise includes the calculation of the day-night average sound pressure level (L_{DN}) and establishment of the corresponding percent of individuals who may be "highly annoyed" at that L_{DN}. The percent "highly annoyed" has been

approximated based on community studies. To take into account the expectation of quiet during nighttime, the nighttime sound pressure level used in the calculation of L_{DN} is increased by 10 dB_A.

Based on the basic sound levels for nighttime found in the AER Directive 038 (AER 2007), the sound pressure levels in the vicinity of the Project are expected to be approximately 53 dB_A at night for a city of Edmundston's size and in proximity to heavily travelled roads and the rail line. To estimate daytime sound pressure levels, the AER recommends adding 10 dB_A to the nighttime level to account for increased sound-generating activities. Therefore, the expected daytime sound pressure level is approximately 63 dB_A. For reference, a sound pressure level of 66 dB_A is comparable to sound levels in a restaurant setting (AER 2007). Stantec estimated the day-night equivalent sound pressure level (L_{DN}) to be 63 dB_A. Note that the L_{DN} is not a straight average of day and night levels; it is a logarithmic equation and 10 dB_A is added to nighttime levels to account for the increased sensitivity to noise during that time.

Stantec estimated the existing sound pressure levels due to bridge traffic at the nearest receptor using the acoustic modelling software CADNAA. The CADNAA model allows us to estimate the specific effect of bridge traffic on sound pressure level at the nearest receptor. The traffic count data from 2016, when the bridge did not have vehicle weight restrictions in place was used in the model and in addition, the model was run with heavy trucks removed to represent the current restrictions (Transport Canada 2017). Stantec assumed that three-quarters of the bridge traffic occurred during the daytime (125 crossings per hour in 2016) and that one-quarter occurred at night (41 crossings per hour in 2016). The results show a daytime sound pressure level of 49 dB_A and a nighttime sound pressure level of 44 dB_A without heavy trucks (restrictions in place) and 51 dB_A and 46 dB_A for day and night with no restrictions to heavy trucks. Combined, this represents a day-night average sound level of 55 dB_A pre-restriction and 53 dB_A with restrictions to heavy trucks. This corresponds to a percent "highly annoyed" of 4% pre-restriction and 3% with restrictions to heavy trucks. The CADNAA model predicted existing sound pressure levels are lower than AER Directive 038 estimate because the CADNAA model did not contain information on sound sources other than bridge traffic. As such the model-predicted sound pressure levels are expected to be lower than those estimated using the AER Directive 038. The AER based estimate accounts for all expected noise sources in a similar environment. Because the change in the bridge traffic numbers and their location relative to the nearest receptor now versus with the Project is most relevant to the assessment, the model-predicted existing sound levels have been used for comparison to the model-predicted future sound levels.

5.0 ASSESSMENT OF POTENTIAL PROJECT INTERACTIONS WITH ATMOSPHERIC ENVIRONMENT

5.1 PROJECT-ENVIRONMENT INTERACTIONS FOR ATMOSPHERIC ENVIRONMENT

5.1.1 Potential Interactions with Atmospheric Environment During Construction

The construction of the new bridge and demolition of the existing bridge have the potential to interact with the Atmospheric Environment in the following ways:

- Air quality
  - air contaminants generated from the combustion of fossil fuels (e.g., diesel and gasoline) by heavy mobile equipment
  - fine particulate matter (dust) generated by earth moving activities
  - dust generated from demolition of concrete abutments
- GHG emissions
  - CO_2, CH_4, and N_2O emissions from the combustion of fossil fuels in heavy mobile equipment
- Sound quality
  - noise from use of heavy mobile equipment (e.g., engines, back-up beepers)
  - noise from material movements (e.g., scrapping, banging of equipment)
  - noise from pile driving (if used)
  - noise from use of chisels and pneumatic hammers for concrete demolition

A detailed description of these potential interactions and results of modelling is provided below. Burning of debris is not expected as part of the project and is not discussed further. No other substantive interactions are anticipated.

Fuel combustion in heavy mobile equipment will result in releases of air contaminants and GHGs into the atmosphere. Stantec estimated air contaminant and GHG emissions using typical heavy mobile equipment expected for the bridge replacement. Typical fuel consumption (McClung-Logan 2018) and engine load (Government of Australia 2008) for each construction equipment type was assumed. Air contaminant emission factors are taken from the Government of Australia (2008) and GHG emission factors were taken from the ECCC National Inventory Report (ECCC 2018c). A summary of the estimated air contaminant emissions released during construction (three-year period) is provided in Table 2.

Table 2 Air Contaminant Emissions from Construction Activities (Three Years Total)

Equipment	CO (tonnes)	NO_X (tonnes)	$PM_{2.5}$ (tonnes)	SO_2 (tonnes)
Construction Activities	88	217	15	0.1
Notes: SO_2 emissions assume 15 parts per million (ppm) sulphur by weight in diesel (Government of Canada 2002).				

The air contaminant emissions of CO, NO_X, and SO_2 from construction activities do not typically cause exceedances of ambient air quality criteria. However, dust (particulate matter) has the potential to cause elevated ambient concentrations that may locally exceed ambient air quality criteria. Fugitive dust will also be generated by earth moving activities, the movement of vehicles over unpaved roads such as access roads, and the demolition of concrete structures. Demolition and removal of the existing bridge structure will result in similar air contaminant emissions as the construction of the new bridge. Therefore, air contaminant emissions during demolition activities are not anticipated to be higher than the emissions associated with construction activities.

The estimated GHG emissions from construction activities are 5,900 t CO_2e for the entire construction period. This represents approximately 0.04% of New Brunswick's 2016 GHG emissions (15,300 kilotonnes CO_2e, ECCC 2018c). Because the heavy mobile equipment used for the demolition of the existing bridge are expected to be similar to the equipment used for the construction of the new bridge, GHG emissions from the demolition of the existing bridge are not expected to exceed the new bridge construction emissions estimated above. On this basis, demolition emissions are estimated to be less than 0.04% of New Brunswick's 2016 GHG emissions.

Construction activities such as land preparation have the potential to cause an undesirable decrease in sound quality for nearby receptors. Stantec used four heavy diesel engine noise sources, positioned where the bridge concrete work would be undertaken, to estimate the sound pressure levels at the nearest receptor. The estimated sound pressure level emissions from construction activities may approach 73 dB_A at the nearest residence during the daytime for peak construction. Construction noise is typically intermittent and fluctuates during the day. Noise from pile driving (if used) may be noticeable by nearby receptors given the relatively short distance to the nearest receptor (approximately 100 m).

The construction of the new bridge is anticipated to occur for three years and may be nearly continuous during this period. Construction activities will likely be noisiest during the summer months during peak activities. It is anticipated that construction activities will be limited to daytime hours; however, if unavoidable, there is potential for limited construction activities to occur at night. These activities are anticipated to be infrequent.

Sound emissions during demolition of the existing bridge may be more disruptive or annoying as pneumatic hammers or chisels are expected to be used and are planned to be used frequently during the daytime during some periods of demolition. Stantec modelled the contribution to sound pressure level at the nearest receptor from the use of a pneumatic hammer situated at the nearest concrete abutment (approximately 120 m away). It was assumed that of the 10-hour work day, the pneumatic hammer would be actively making noise for 5 hours (U.S. Federal Highway Administration 2006). The sound power level of the equipment was calculated based on the sound pressure level spectrum data from the U.K. (Department of Environment, Food, and Rural Affairs, 2005). The CADNA model results showed that the use of pneumatic hammer will not substantively contribute to the sound pressure level at the nearest receptor during the operation of the new bridge.

5.1.2 Potential Interactions with Atmospheric Environment During Operation and Maintenance

The following activities may interact with the Atmospheric Environment:

- Air quality
  - air contaminants generated from the combustion of fuels (e.g., diesel, gasoline) from heavy mobile equipment used for maintenance activities, as well as vehicles using the bridge
- GHG emissions
  - GHGs generated from the combustion from heavy mobile equipment used for maintenance activities, as well as vehicles using the bridge
- Sound quality
  - noise from mobile equipment (e.g., engines, back-up beepers, banging).
  - noise from vehicles using the bridge

A detailed description of these potential interactions is provided below.

Although the existing bridge currently has less truck vehicle traffic due to weight restrictions placed in 2017, the amount of vehicle traffic using the new bridge will return to the pre-weight restriction traffic volumes once initially open.

Stantec estimated the air contaminant and GHG emissions using the 2016 number of border crossings by commercial trucks and passenger cars. In addition, the bridge span distance of approximately 560 to 570m, as well as typical highway fuel economies for trucks and passenger vehicles were used. Air contaminant emission factors were taken from the Australian National Pollutant Inventory (Government of Australia 2008). GHG emission factors were taken from the Canada's National Inventory Report (ECCC 2018c).

The air contaminant emissions generated by vehicle traffic while travelling on the new bridge will be small in comparison to construction emissions described above. The estimated GHG emissions from truck and passenger car traffic on the new bridge are approximately 140 t CO_2e per year. Once the new bridge is in place, heavy trucks and other large vehicles will no longer be required to travel longer distances to cross the Canada-U.S. border (up to 143 km roundtrip). Therefore, an estimated 913 t CO_2e per year of GHG emissions may be avoided by using the new bridge instead of the other crossings (Stantec 2018).

The air contaminant and GHG emissions associated with maintenance activities are expected to be less in comparison to annual emissions from regular traffic on the bridge as maintenance activities involve fewer vehicles operating for fewer hours.

Day and nighttime sound pressure levels in the vicinity of the Project will increase due to the return of truck traffic that is currently being detoured to the Clair/Fort Kent and Saint-Leonard/Van Buren bridges. Using the 2016 average daily truck crossings and the sound modelling software CADNAA, as well as the new bridge alignment, Stantec estimated that sound pressure levels due to bridge traffic at the nearest receptor will be 53 dB_A during daytime and 48 dB_A during nighttime. The L_{DN} is estimated to be 56 dB_A during operation, which is an increase of approximately 3 dB_A from the sound pressure levels currently

experienced with the heavy truck restriction (as estimated using CADNAA). A change of this magnitude would be just noticeable to the human ear. The percent "highly annoyed" during operation is estimated to be 5%, which is an increase of 2% from the existing percent "highly annoyed" (3%). Health Canada recommends that if the change in percent highly annoyed is more than 6.5% (increased over existing levels), noise mitigation should be considered.

5.1.3 Accidents, Malfunctions, and Unplanned Events

Accidents, malfunctions, and unplanned events are occurrences that are not part of planned activities or normal operation of the Project and have the potential to result in adverse environmental interactions. Given the adherence of Project activities to mitigation measures (e.g., good planning and design, vehicle and equipment maintenance, worksite health, safety, and environmental training of personnel), including those in the NBDTI Environmental Management Manual (EMM; NBDOT 2010), accidents, malfunctions, and unplanned events of a serious nature are unlikely to occur during any phase of the Project.

The accidents, malfunctions, and unplanned events that have a potential to occur for this Project, and could potentially interact with Atmospheric Environment include:

- hazardous material spill; and
- Project-caused fire

The potential for a hazardous material spill is limited to the operation of vehicles and heavy construction equipment, especially the rupture of a hydraulic fluid line or the release of fuel. The release of a hazardous material such as a volatile organic compound (VOC) could temporarily decrease air quality in the LAA. The effect on Atmospheric Environment would depend on the amount of material spilled, as well as proximity of the spill to receptors.

The potential for a Project-caused fire includes the use of vehicles, equipment, or the improper discarding of cigarettes. A fire could result in smoke which contains particulate matter and result in a decrease in air quality in the LAA, especially for nearby receptors. The effect on receptors depends on the location, size, and fuel source of the fire. The Project location is not remote, and local emergency response services are available.

Mitigation for accidents, malfunctions, and unplanned events is described in Section 5.2.

5.2 MITIGATION FOR ATMOSPHERIC ENVIRONMENT

Interaction of the Project activities with the Atmospheric Environment will be managed through the use of mitigation measures, including adherence to NBDTI's EMM. Measures which will be employed to mitigate interactions with the Atmospheric Environment are presented in Table 2.

Table 3 Mitigation Measures Applicable to the Atmospheric Environment

Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation in NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
Construction including: • substructure • approaches and Canadian Port of Entry Modification • superstructure including bridge deck • removal of existing bridge	• Increased ambient air contaminant concentrations	• 5.5 Detouring • 5.6 Dust Control • 5.8 Excavation, Blasting and Aggregate Production • 5.15.3 Removal of structures • 5.17 Temporary Ancillary Facility Management • 5.19 Vehicle and Equipment Management • 5.20 Waste Management • 5.23 Working Near Environmentally Sensitive Areas	No additional mitigation recommended
	• Increased ambient GHG concentrations, contributing to global climate change	• 5.19 Vehicle and Equipment Management	No additional mitigation recommended
	• New, potentially disruptive sound sources that decrease sound quality	• 5.8 Excavation, Blasting and Aggregate Production • 5.23 Working Near Environmentally Sensitive Areas	No additional mitigation recommended
Operation and maintenance including: operation of infrastructure (including snow and ice removal), perseveration and maintenance of structures, traffic.	• Increased ambient air contaminant concentrations • Increased ambient GHG concentrations, contributing to global climate change	• 5.16 Summer Highway Maintenance • 5.21 Winter Highway Maintenance	No additional mitigation recommended

Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation in NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
	• Increase in traffic noise compared to when weight restrictions were in place		
Accidents, malfunctions, and unplanned events including: • Hazardous Material Spill • Project-caused Fire	• Increased ambient air contaminant concentrations	• 5.10 Fire Prevention and Contingency • 5.12 Spill Management • 5.13 Storage and Handling of Petroleum Products • 5.19 Vehicle and Equipment Management	No additional mitigation recommended

5.3 CHARACTERIZATION OF RESIDUAL PROJECT-ENVIRONMENTAL INTERACTIONS FOR ATMOSPHERIC ENVIRONMENT

5.3.1 Construction

DTI has experience with the appropriate mitigation for dust generating activities and has planned mitigation for the Project as outlined in Section 5.2. In consideration of this and the transient nature of emissions sources, the air contaminant emissions during the construction period are not expected to substantively increase the ambient concentration of air contaminants in the Edmundston region and are not anticipated to result in a substantive change in air quality.

In addition, GHG emissions during construction are low in comparison to annually reported GHG emissions in New Brunswick and are not anticipated to result in a substantive change in GHG emissions.

The anticipated estimated baseline day-night average sound pressure level in the vicinity of the project is 63 dB_A. Sound quality may decrease temporarily for nearby receptors during construction, especially during summer months or if pile driving is used. Pile driving is a short-term activity that will only be conducted during day time. Impact noise from pneumatic hammers or chisels during the demolition of the existing bridge may be noticeable by nearby receptors during the day. However, demolition is expected to take place for of a shorter time than bridge construction activities.

5.3.2 Operation and Maintenance

Although the existing bridge currently has less truck vehicle traffic due to weight restrictions placed in 2017, the amount of vehicle traffic using the new bridge will return to the pre-weight restriction traffic volumes once initially open. The air contaminant emissions generated by vehicle traffic while travelling on the new bridge will be small in comparison to construction emissions. Once the new bridge is in place, heavy trucks and other large vehicles will no longer be required to travel longer distances to cross the Canada-U.S. border, resulting in a decrease in GHG emissions compared to current conditions. The percent “highly annoyed” during operation is estimated to be 2% higher than the current percent “highly annoyed” (3%) due to the reintroduction of truck traffic once weight restrictions are lifted; however, this is below the Health Canada recommended threshold where noise mitigation should be considered. Therefore, the change in the sound pressure levels as a result of operation of the Project is not expected to be noticeable at the nearest receptor.

6.0 SUMMARY AND RECOMMENDATIONS

With the implementation of mitigation and environmental protection measures as described in the EMM and in this assessment, it is not anticipated that there will be substantial interaction between the Project and the Atmospheric Environment during the Project. Concentrations of air contaminants are not expected to exceed the provincial or federal objectives, guidelines, or standards during construction or operation. GHG emissions from construction activities and during operation are low in comparison to annually reported GHG emissions in New Brunswick and operation will result in a decrease in GHG emissions in comparison to current conditions.

Sound quality may decrease for nearby receptors during the construction of the new bridge and the demolition of the existing bridge due to an increase in sound pressure levels, however DTI will investigate noise complaints during construction/demolition and consider employing additional mitigation if warranted.

Sound pressure levels during operation and maintenance of the Project are anticipated to be similar to the sound pressure levels experienced in the vicinity of the existing bridge both prior to the weight restrictions as well as with the weight restrictions in place.

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Appendix C GROUNDWATER RESOURCES

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320)

Appendix C Groundwater Resources
February 2019

Appendix C – Groundwater Resources

Environmental Impact Assessment Registration for the Replacement of the Madawaska-Edmundston International Bridge (E320)

February 2019

Prepared for:

Province of New Brunswick
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Statement of Limitations

This document entitled Appendix C – Groundwater Resources is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project and was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of the New Brunswick Department of Transportation and Infrastructure and the Maine Department of Transportation (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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February 2019

1.0 INTRODUCTION

This document is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project (the Project). The Project is being proposed by the New Brunswick Department of Transportation and Infrastructure (NBDTI) and the Maine Department of Transportation (Maine DOT) and consists of the construction, operation, and maintenance of a new international bridge as well as the demolition of the existing bridge over the Saint John River. The bridge spans between the City of Edmundston, New Brunswick and the Town of Madawaska, Maine.

This document includes an analysis of the potential interactions between Project activities and the Groundwater Resources Valued Component (VC) of the EIA for the Project.

2.0 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Groundwater resources has been selected as a VC due to its importance as a potable water resource. More than 75% of the population of New Brunswick relies on groundwater as a source of drinking water (Statistics Canada 2010), including the municipal supply for the City of Edmundston. Groundwater from drilled or screened wells is used for domestic, agricultural, municipal, commercial, institutional, and industrial purposes.

In this assessment, the potential changes to groundwater resources as a result of the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

2.1 REGULATORY CONTEXT

The Province of New Brunswick has legislation in place to manage and protect water resources (both surface water and groundwater), including the Clean Water Act and the Clean Environment Act. Specific regulations under these acts that relate to the protection of groundwater include the Wellfield Protected Areas Designation Order–Clean Water Act, the Water Well Regulation–Clean Water Act, and the Potable Water Regulation–Clean Water Act.

The Wellfield Protected Areas Designation Order defines restrictions in areas around production wells that are used for public water supply systems. The Designation Order restricts the types of activities that can be carried out within the Wellfield Protected Area, thereby reducing the risk of contaminants (e.g., bacteria and viruses, petroleum products, and chlorinated solvents) possibly reaching the wells.

The Water Well Regulation defines how water wells are to be constructed in New Brunswick so that water quality is not compromised by local runoff or land use activities. The Potable Water Regulation requires water quality testing for all new water wells installed in the province, and for regulated water supply systems. These regulations apply to all water wells in the Local Assessment Area (LAA, defined later), including future water wells.

Although groundwater resources in Canada are generally managed by provincial regulatory bodies as described above, the Guidelines for Canadian Drinking Water Quality (GCDWQ) published by Health Canada are also applicable to groundwater across Canada; however, these have no force of law unless adopted through a regulatory instrument. The GCDWQ are "established based on current published scientific research related to health effects, aesthetic effects and operational considerations" (Health Canada 2017). The New Brunswick Department of Health has adopted many of the GCDWQ that are applicable to municipally and provincially owned and operated water systems (NB OCMOH 2017).

3.0 BOUNDARIES

3.1 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and groundwater resources is focused on a Project Development Area (PDA) and a Local Assessment Area (LAA).

The PDA for the Project is defined as the area of physical disturbance associated with the construction and operation and maintenance phases of the Project, as well as the decommissioning of the existing bridge. For the purposes of this assessment, the PDA comprises a physical footprint of the Project and includes portions of the Canada Border Services Agency properties and adjacent private properties, east and west of the proposed new bridge location, a portion of land owned by the Canadian National Railways (CN), and a portion of the Saint John River (from 250 metres (m) upstream of the new bridge to 250 m downstream of the existing bridge to the east, and up to the international border to the south).

The LAA for groundwater resources is defined as the area within which the environmental effects of the Project can be measured or predicted. For considering a potential change in groundwater as a result of the Project, the LAA includes the PDA and a 500 m area surrounding the PDA.

The PDA and the LAA are shown on Figure 1.

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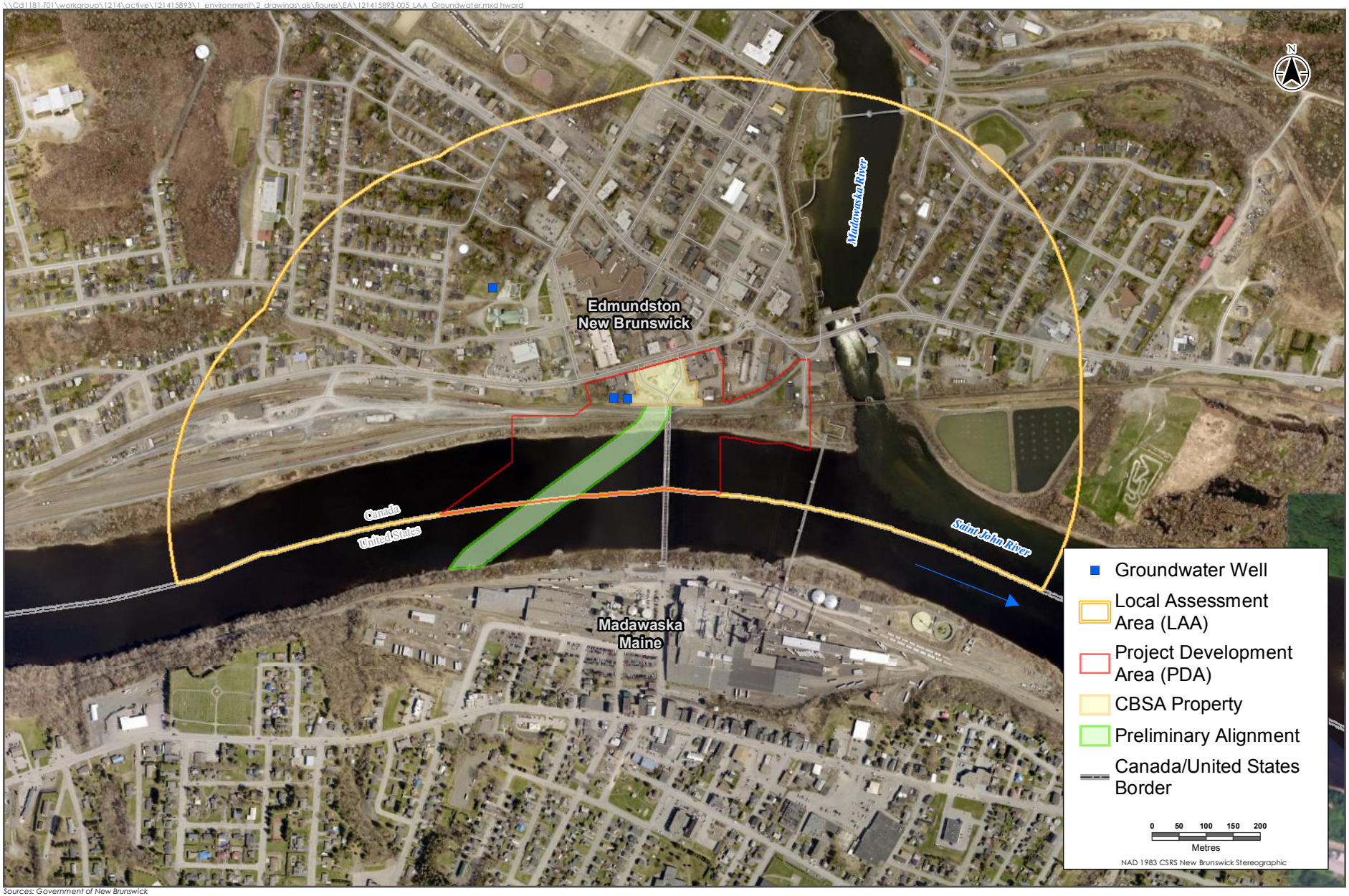

Sources: Government of New Brunswick
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Local Assessment Area for Groundwater

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APPENDIX C – GROUNDWATER RESOURCES
ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

Boundaries
February 2019

3.2 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental interactions between the Project and groundwater resources include the following phases.

- Construction - including construction of the new bridge (anticipated to last three year) and demolition of the existing bridge (anticipated to last one additional year);
- Operation and maintenance – in perpetuity; and
- Decommissioning and abandonment of the new bridge – not anticipated.

It is anticipated that construction of the new bridge will last three to four years. Decommissioning of the existing bridge, considered as part of the construction phase, will commence after the opening of the new bridge. A project schedule will be prepared during the preliminary design of the bridge.

There are potential environmental interactions with groundwater resources that will occur during both the construction, and operation and maintenance phases of the Project. The new bridge will be designed for an anticipated life-span of 75 years. Any environmental assessment or permitting requirements for the decommissioning of the proposed new bridge would be conducted in accordance with the regulations and requirements in place at that time and are not included in this assessment.

4.0 EXISTING CONDITIONS FOR GROUNDWATER RESOURCES

Baseline conditions for Groundwater Resources were determined by reviewing regional and local geology and publicly available information on water wells and water chemistry in the LAA. Sources of information included:

- New Brunswick Online Well Log System (NB OWLS) water well database, maintained by the New Brunswick Department of Environment and Local Government (NBDELG 2018);
- Natural Resources Canada Atlas of Canada - Toporama (NRCan 2018);
- surficial geology map of New Brunswick (Rampton 1984);
- bedrock geology map of New Brunswick (NBDNRE 2000); and
- Wellfield Protected Areas (NBDELG 2018b).

4.1 PHYSIOGRAPHY AND DRAINAGE

The Project area slopes south/southeast towards the Saint John River and the Madawaska River. The elevation of the Project area ranges from 180 m above mean sea level at the highest point to approximately 136 m above mean sea level at the edge of the Saint John River. There is approximately a 10 m difference in elevation between the Saint John River and the CN Rail line which runs parallel and adjacent to the river.

The Project is located in the Saint John River Valley, approximately 350 m upstream of its confluence with the Madawaska River. Groundwater flow is anticipated to be generally to the southeast, toward these

rivers. More information on the Saint John River is provided in the assessment of the Aquatic Environment VC (Appendix D).

The surficial geology within the LAA is covered in pre-quarternary rock with an area of alluvial sediment along the Saint John River (Rampton et al. 1984). This alluvial sediment generally consists of sand, gravel, some silt and minor clay and organic sediment, generally more than 2 m thick deposited as channel, overbank, and flood basin. The bedrock geology underlying the LAA is characterized as Early Devonian sedimentary rocks consisting of fine grained, deep marine, siliciclastic rocks of the Fortin Group (NBDNRE 2000).

4.2 GROUNDWATER

Groundwater typically occurs in soil deposits (referred to as overburden) or in cracks or crevices in the underlying rock (i.e., fractured bedrock). As groundwater moves through soil and rock, minerals in the soil and rock can be dissolved into the groundwater, resulting in a change in the water quality. As a result, the quantity and quality of groundwater that can be extracted using water wells depends on the geology of an area. Overburden and fractured bedrock formations that can produce useable amounts of groundwater are called aquifers.

Municipal water for the City of Edmundston is supplied from groundwater (City of Edmundston 2018a). The closest designated Wellfield Protected Area is located approximately 4 km from the PDA (NBDELG 2009). It is anticipated that many of the businesses and residences in the area receive water from the municipal supply. The City of Edmundston reported the presence of groundwater wells at two properties immediately to the west of the Canada Border Services Agency facility but noted that these wells may no longer be in service as the properties were also serviced by the municipal system (City of Edmundston 2018b). A query of the NB OWLS also identified one non-drinking water well located within the LAA. As the NB OWLS only contains water well records for wells drilled since 1994, there is also the potential for other water wells to exist within the LAA.

In order to obtain a large enough dataset of potential wells in the area to characterize the water quality in the LAA, groundwater samples reported by the NB OWLS for water well records located within 5 km of the PDA were obtained. This included sample results from 26 groundwater wells. Summary statistics for the analyzed water quality parameters were prepared and are presented on Figure 2. Overall, the water quality in the area is good, and all analyzed parameters meet the maximum acceptable concentrations developed for the GCDWQ (Health Canada 2017), although the aesthetic objectives developed for the GDCWQ were exceeded for iron in two of the samples, and manganese in seven of the samples. Total coliform was also detected in eight of the samples; however, no samples indicated the presence of E. coli.

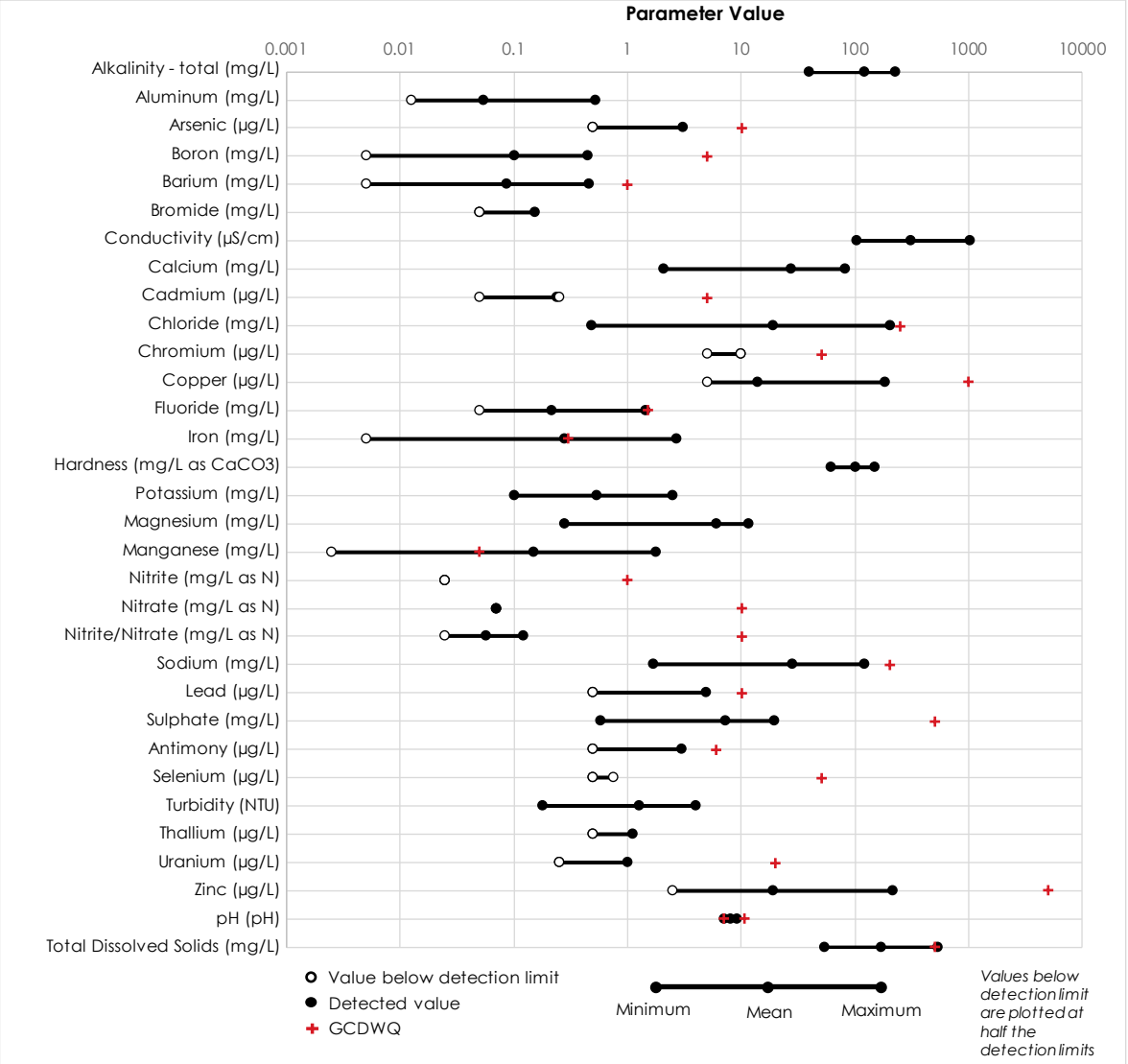

Figure 2 Summary of Groundwater Quality Data within 5 km of PDA

5.0 ASSESSMENT OF POTENTIAL PROJECT INTERACTIONS WITH GROUNDWATER RESOURCES

5.1 PROJECT-ENVIRONMENT INTERACTIONS FOR GROUNDWATER RESOURCES

This section describes how the Project activities could interact with groundwater resources.

5.1.1 Potential Interactions with Groundwater Resources During Construction

During construction, the Project has the potential to interact with groundwater resources, resulting in a change in groundwater quality or quantity. Construction activities that may result in these changes include dewatering of excavations and driving piles to support construction activities within the river. No blasting activities are anticipated as part of the Project.

Pile driving activities may be required for the installation of cofferdams, construction of bridge piers, or the construction of temporary work platforms. Vibrations generated from pile driving activities are unlikely to result in a change in groundwater quantity as the magnitude of the vibrations is unlikely to be sufficient to create new fractures in bedrock or close or partially infill or close existing fractures.

Vibrations from pile driving activities (if required) may have the potential to temporarily increase turbidity in nearby wells, resulting in a temporary change in water quality. Vibration in the bedrock caused by the pile driving may dislodge or move sediments present in the fractures in bedrock wells, cause sediment to enter the screens of overburden wells, or loosen well casings thereby allowing entry of surface water to a well bore. This may temporarily decrease the clarity of the groundwater (i.e., increase the turbidity) in a well connected to these fractures or unconsolidated formations; however, the turbidity would return to pre-construction conditions shortly after a pile driving event as dislodged sediment settles in the fractures.

Vibrations in bedrock are typically characterized by the peak particle velocity (PPV) that is observed at various distances from the source. The establishment of most guidelines for “safe” vibration levels in the literature are tied to data on damages to buildings, and generally cite a safe peak particle velocity of 50 mm/s based on the likelihood of damage to buildings (Siskind et al. 1980). These guidelines have also been applied to groundwater wells, focused on the effects of turbidity. The maximum distance at which a PPV of 50 mm/s would be observed as a result of pile driving activities is less than 10 m (Dowding 1996).

Given the magnitude of vibrations generated by pile driving activities and that pile driving activities would be limited to the river, at a distance greater than 10 m from the closest groundwater well, this activity is not anticipated to have an effect on nearby groundwater wells, and therefore is not anticipated to result in changes in groundwater quantity or quality or interact with groundwater resources.

Changes in groundwater quality are not anticipated as a result of dewatering activities. Dewatering of excavations required for construction of the bridge abutment and piers (e.g., within the cofferdam) is

unlikely to lower the water table or decrease the availability of water in nearby wells, resulting in a change in groundwater quantity. The groundwater level at the location of the bridge abutment is dictated by the water level in the Saint John River, approximately 10 m below the location of the bridge abutment. It is unlikely that the depth of excavation will be sufficient to require dewatering and will not result in a substantive change in groundwater levels. Piers will be constructed in the Saint John River; therefore, it is unlikely that dewatering activities at these locations would result in a change to groundwater levels as the hydraulic head in the river would be sufficient to counteract the effect of dewatering on groundwater. As such these activities are unlikely to have an effect on groundwater wells within the LAA or interact with groundwater resources.

Although there will be some grade changes in the PDA to accommodate the bridge abutments and piers through the excavation and placement of fill, the overall drainage patterns, surficial and bedrock geology are not expected to change substantively. Excavation and filling activities are not anticipated to interact with groundwater resources and are not discussed further in this assessment.

Although unlikely, there is the potential for land-based spills of hazardous materials to result in a change in groundwater quality. This is discussed further in Section 5.1.3.

5.1.2 Potential Interactions with Groundwater Resources During Operation and Maintenance

The operation and maintenance phase of the Project may require salting and sanding during the winter months to allow the passage of vehicles during icy conditions. De-icing will be conducted in accordance with government regulations. Use of road salt has the potential to increase the sodium, chloride total dissolved solids and hardness concentrations in existing water wells. However, salt application on the new bridge will be limited to the PDA and is not likely to extend close enough to interact with potential wells in the LAA. As a result, no interaction with groundwater resources is anticipated during operation.

As with construction, during operation and maintenance there is the potential for land-based spills of hazardous materials or vehicle collisions to result in a change in groundwater quality. This is discussed further in Section 5.1.3.

5.1.3 Accidents, Malfunctions, and Unplanned Events

Accidents, malfunctions, and unplanned events are occurrences that are not part of planned activities or normal operation of the Project and have the potential to result in adverse environmental interactions. Given the adherence of Project activities to mitigation measures (e.g., good planning and design, vehicle and equipment maintenance, worksite health, safety, and environmental training of personnel), including those in the NBDTI Environmental Management Manual (EMM; NBDOT 2010), accidents, malfunctions, and unplanned events of a serious nature are unlikely to occur during any phase of the Project.

The accidents, malfunctions, and unplanned events that have the potential to occur for this Project, and could potentially interact with groundwater resources include:

- vehicle collision; and
- hazardous material spill.

There is potential for a Project vehicle to collide with another vehicle, Project infrastructure, other infrastructure or people. A vehicle collision could result in damage to property or the release of a hazardous material. There is also potential for a hazardous material spill through the operation of vehicles and heavy construction equipment, especially the rupture of a hydraulic fluid line or the release of fuel. Release of a hazardous material on the bridge approaches, or on the bridge which reaches the Saint John River through stormwater drains could result in the contamination of groundwater, including wells on private property. This could result in a human health hazard and decrease in property value.

Mitigation for accidents, malfunctions, and unplanned events is described in Section 5.2.

5.2 MITIGATION FOR GROUNDWATER RESOURCES

Interaction of the Project activities with groundwater resources will be managed through the use of mitigation measures, including adherence to the NBDTI EMM. Measures which will be employed to mitigate interactions with groundwater resources are presented in Table 1.

Table 1 Mitigation Measures Applicable to Groundwater Resources

Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation in NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
Construction including: • substructure • removal of existing bridge	• Drawdown of groundwater	• 5.17 Temporary Ancillary Facility Management • 5.20 Waste Management • 5.23 Working Near Environmentally Sensitive Areas	No additional mitigation recommended
	• Increased turbidity in groundwater wells due to vibrations from pile driving activities	• 5.8 Excavation, Blasting and Aggregate Production • 5.17 Temporary Ancillary Facility Management • 5.20 Waste Management • 5.23 Working Near Environmentally Sensitive Areas	No additional mitigation recommended
Operation and maintenance including: operation of infrastructure (including snow and ice removal), preservation and maintenance of structures.	• No interaction anticipated	• 5.16 Summer Highway Maintenance • 5.21 Winter Highway Maintenance	No additional mitigation recommended
Accidents, malfunctions, and unplanned events including: • Hazardous Material Spill • Vehicle Collision	• Contamination of groundwater and private wells	• 5.12 Spill Management • 5.13 Storage and Handling of Petroleum Products • 5.19 Vehicle and Equipment Management	• In the unlikely event that a hazardous material spill reaches the Saint John River, measures will be taken to isolate the affected area as soon as possible. An assessment of the affected area will be conducted, and remediation will be completed as required.

5.3 CHARACTERIZATION OF RESIDUAL PROJECT-ENVIRONMENTAL INTERACTIONS FOR GROUNDWATER RESOURCES

There are a limited number of groundwater wells in the LAA, and the area is serviced by a municipal water supply. Given the proximity of potential dewatering to the Saint John River, and the magnitude of excavation and pile driving, any interactions with groundwater resources during construction are anticipated to be localized and not affect groundwater receptors within the LAA. During operation and maintenance, the application of road salt will also be localized and unlikely to interact with groundwater wells within the LAA. As such, no substantive residual effects to groundwater resources are anticipated as a result of Project-related activities during the construction or operation and maintenance phases of the project.

6.0 SUMMARY AND RECOMMENDATIONS

With the implementation of mitigation and environmental protection measures as described in the EMM and in this assessment, it is not anticipated that there will be any substantial interaction between the Project and groundwater resources during any phase of the Project.

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Appendix D AQUATIC ENVIRONMENT

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320)

Appendix D Aquatic Environment
February 2019

Appendix D – Aquatic Environment

Environmental Impact Assessment Registration for the Replacement of the Madawaska-Edmundston International Bridge (E320)

February 2019

Prepared for:

Province of New Brunswick
Department of Transportation and Infrastructure

Prepared by:

Stantec Consulting Ltd.
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Statement of Limitations

This document entitled Appendix D – Aquatic Environment is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project and was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of the New Brunswick Department of Transportation and Infrastructure and the Maine Department of Transportation (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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1.0 INTRODUCTION

This document is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project (the Project). The Project is being proposed by the New Brunswick Department of Transportation and Infrastructure (NBDTI) and consists of the construction, operation and maintenance of a new international bridge as well as the demolition of the existing international bridge over the Saint John River. The bridge spans between the city of Edmundston, New Brunswick and the town of Madawaska, Maine.

This document includes an analysis of the potential interactions between Project activities and the aquatic environment Valued Component (VC) of the EIA for the Project.

2.0 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Aquatic environment has been selected as a VC because of the potential for this Project to interact with a number of elements of the aquatic environment including:

- Surface water quantity which includes river flow and water level;
- Fish habitat which includes surface water quality, physical habitat and environmentally significant areas;
- Fish species which includes fish species presence and their potential for migration;
- Commercial, recreational and Aboriginal fisheries;
- Species at risk (SAR) and species of conservation concern (SOCC) including their habitat preferences and critical habitat; and
- Navigable waters.

In this assessment, the potential changes to aquatic environment as a result of the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

2.1 REGULATORY CONTEXT

The environmental effects of the Project on the aquatic environment is largely focused on matters related to fish populations and fish habitat, such as water quality and quantity, species at risk and species of conservation concern, and the navigability of the Saint John River. These are regulated either through federal and provincial legislation or both.

The *New Brunswick Clean Environment Act* regulates water quality within the province through the *Water Quality Regulation*. The Minister of the Environment and Local Government may grant approvals under the Water Quality Regulation for activities that will result in releases of pollutants to the waters of the province.

The *Fisheries Act* regulates water quality federally through Section 36, which prohibits the "deposit of deleterious substances into waters frequented by fish", unless Authorized. A deleterious substance is considered any substance that, when added to water, degrades or alters its quality such that it is harmful to fish, fish habitat or the use of fish by people.

The Canadian Council of Ministers of the Environment (CCME) has established environmental quality guidelines for chemical-specific concentrations in various environmental media (CWQG 2018). For the aquatic environment, the Canadian Environmental Quality Guidelines (CEQG) include the Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life (Freshwater) (PFAL) and the Canadian Sediment Quality Guidelines (CSQG) for the Protection of Aquatic Life (Freshwater). As the CEQG environmental quality values are guidelines they do not have force of law.

The *New Brunswick Clean Water Act* (90-80) indirectly protects the aquatic environment through the Watercourse and Wetland Alteration Regulation (WAWA). The WAWA regulation requires a permit for any activity that will result in a temporary or permanent change to a watercourse or wetland or changes within 30 m of a watercourse or wetland.

Section 35 of the *Fisheries Act* protects productivity of CRA fisheries and fish that support those fisheries, through the prevention of "serious harm", where "serious harm" is defined as the death of fish, or a permanent alteration or destruction of fish habitat. Under the *Fisheries Act*, the Governor General in Council, on the recommendation of the Minister of Fisheries and Oceans can authorize, and require measures to offset, serious harm to fish and fish habitat. However, changes to the *Fisheries Act* is scheduled to come into force in early 2019 which will expand protections to include all fish and fish habitat. Bridge design will likely be finalized in 2019, and the new bridge be reviewed under the legislation current at the time.

The federal *Fisheries Act* defines fish habitat as spawning, nursery, rearing or feeding grounds, food supplies, and areas used for migration by fish and other organisms that fish depend on to carry out their life processes. Freshwater fish are defined as fish that live in freshwater for a least a portion of their lifecycle and include parts of a fish, shellfish, crustaceans, and any parts of a shellfish or crustacean, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish and crustaceans.

The *New Brunswick Fish and Wildlife Act* regulates the recreational capture of fish (angling) within the province of New Brunswick. The Act is administered and enforced by the New Brunswick Department of Energy and Resource Development (NBDERD) through the General Angling Regulation.

The federal *Species at Risk Act* (SARA) governs the aquatic environment for species at risk (SAR) within Canada.

The provincial *New Brunswick Species at Risk Act* (NB SARA) also governs the aquatic environment within the Province of New Brunswick. Species at risk (SAR), are species listed as extirpated, endangered, threatened, or special concern by the NB SARA.

The *Navigation Protection Act* (NPA) is administered by Transport Canada under the Navigation Protection Program. The NPA regulates works which may affect navigation on waters in Canada.

Currently under existing legislation, the NPA regulation requires an authorization for any activity taking place on a Scheduled water (i.e., a water body on the Schedule list in the NPA). However, new legislation (*the Canadian Navigable Waters Protection Act*) is scheduled to come into force in early 2019, which is applicable to all new projects proposed in, on, over, under or through any navigable water (not just Scheduled Waters). Infilling or dewatering of any navigable waterway (not just scheduled waters) is prohibited under the *Navigation Protection Act* (NPA) and requires an Exemption by Order of the Governor in Council (GIC) pursuant to Section 24 of the NPA. Bridge design will likely be finalized in 2019, and NBDTI anticipates that activities related to the new bridge will likely require approval under the new legislation.

For the purposes of this VC the following definitions will apply:

- SAR are species listed as extirpated, endangered, threatened, or special concern by the federal SARA, or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).
- Freshwater SOCC, which are species that have been identified by federal and/or provincial species at risk agencies as being rare in New Brunswick, or their populations may not be considered sustainable. SOCC are here defined to include species that are not SAR, but are ranked S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable) in New Brunswick by the Atlantic Canada Conservation Data Centre (AC CDC).

3.0 BOUNDARIES

3.1 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and the aquatic environment is focused on a Project Development Area (PDA) and a Local Assessment Area (LAA).

The PDA for the Project is defined as the area of physical disturbance associated with the construction and operation and maintenance phases of the Project, as well as the decommissioning of the existing bridge. For the purposes of this assessment, the PDA comprises a physical footprint of the Project and includes portions of the Canada Border Services Agency properties and adjacent private properties, east and west of the proposed new bridge location, a portion of land owned by the Canadian National Railways (CN), and a portion of the Saint John River (from 250 metres (m) upstream of the new bridge to 250 m downstream of the existing bridge to the east, and up to the international border to the south).

The LAA for the aquatic environment is defined as the area within which the environmental effects of the Project can be measured or predicted. For the aquatic environment, the LAA includes the PDA and generally extends from 1 km upstream to 1 km downstream of the proposed crossing location on the Saint John River. The LAA also includes the area that extends 30 m from the observed high-water mark of the banks into the riparian area of the Saint John River.

The PDA and the LAA are shown on Figure 1.

APPENDIX D – AQUATIC ENVIRONMENT
ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

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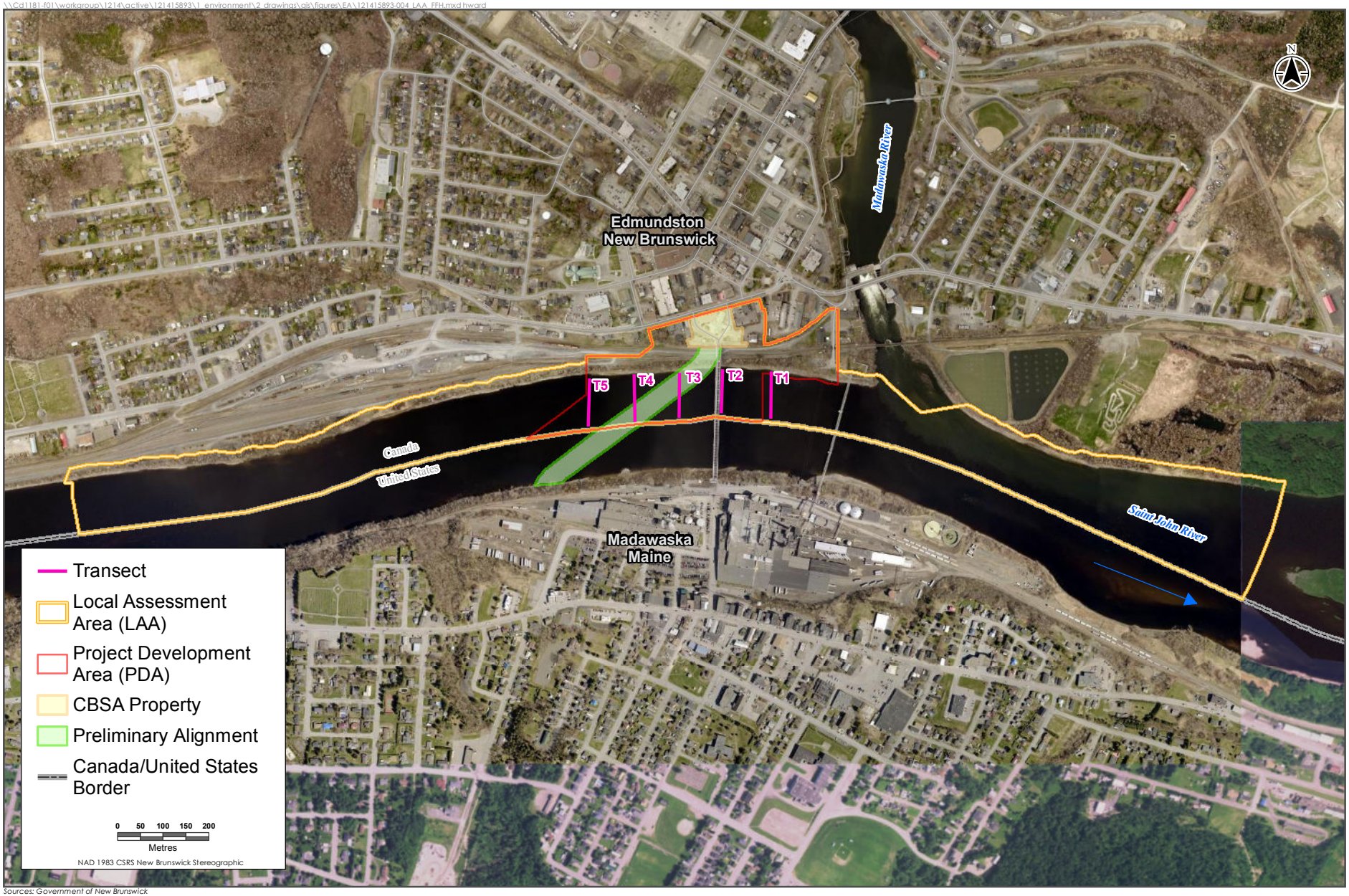

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Local Assessment Area for Aquatic Environment

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121415893 - NBDTI - MADAWASKA-EDMUNDSTON BRIDGE

Figure 1

APPENDIX D – AQUATIC ENVIRONMENT
ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

3.2 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental interactions between the Project and the aquatic environment include the following phases.

- Construction - including construction of the new bridge (anticipated to last three years) and demolition of the existing bridge (anticipated to last one additional year);
- Operation and maintenance – in perpetuity; and,
- Decommissioning and abandonment of the new bridge – not anticipated.

It is anticipated that construction of the new bridge will last three years. Decommissioning of the existing bridge, considered as part of the construction phase, will commence after the opening of the new bridge. A project schedule will be prepared during the preliminary design of the bridge.

There are potential environmental interactions with the aquatic environment that will occur during the construction and operation and maintenance phases of the Project. The new bridge will be designed for an anticipated life-span of 75 years. Any environmental assessment or permitting requirements for the decommissioning of the proposed new bridge would be conducted in accordance with the regulations and requirements in place at that time and are not included in this assessment.

4.0 EXISTING CONDITIONS FOR AQUATIC ENVIRONMENT

4.1 SOURCES OF INFORMATION AND METHODOLOGY

To characterize the existing conditions for the aquatic environment to support the EA, existing literature and information were reviewed, and field data was collected in 2018.

The review of existing literature included:

- The Saint John River: A State of the Environment Report (Kidd et al. 2011);
- Government publications and websites (DFO 2018a and 2018b; ECCC 2016 and 2018; NBDELG 2018; GNB 2018)
- Atlantic Canada Conservation Data Centre data (AC CDC 2018)
- University theses (Arciszewski 2007)
- Unpublished data (Stantec Consulting Ltd. 2012, 2015)

The following provides a description of the methods used in the field data collection and analysis.

The contribution of the watershed area was used to calculate the river flow as no flow information was available at the Saint John River at Edmundston station (01AF004) (ECCC 2018). A watershed area of 15,500 km² was delineated for the Project location on the Saint John River using the ArcGIS Hydro Tool based on the New Brunswick hydrographic watercourse network, the United States Geological Services Hydrography dataset, and the New Brunswick Digital Topographic Database (SNB 1998). Historic flow data for the Saint John River were obtained for the nearest downstream hydrometric station (01AF002) on the mainstem of the Saint John River maintained by Environment and Climate Change Canada,

located at Grand Falls, approximately 60 km downstream of the PDA. The watershed area at Station 01AF002 is approximately 21,900 km² (ECCC 2016). Historical flow data from the Grand Falls hydrometric station were prorated based on the ratio of the watershed areas upstream of the PDA divided by the watershed area upstream of the hydrometric station to represent flows at the PDA. Mean, minimum and maximum daily flow between 2006 and 2015 were calculated.

On September 27, 2018 a field survey was conducted in the Saint John River within the Canadian side of the in-water PDA. Approximately 400 m of river length of habitat was surveyed. The habitat survey was conducted as per New Brunswick Department of Natural Resources (NBDNR) and Fisheries and Oceans Canada (DFO) guidelines, using modified stream habitat methodology and forms (Hooper et al.1995) (Attachment B). Fish habitat information collected included habitat type (i.e., riffle, run, pool), substrate type as well as other habitat characteristics (i.e., cover, bank stability). In situ water quality parameters measured included water temperature, dissolved oxygen, and conductivity (all measured using YSI2030 meter); pH (measured using a Hanna Instruments 98127 pH meter) and turbidity (measured using a Hach 2100Q turbidimeter). Water quality meters were calibrated prior to use.

A water and a sediment sample were collected at the proposed crossing location for laboratory analysis by the Research and Productivity Council (RPC) in Fredericton, New Brunswick. The water sample was analyzed for general chemistry, trace metals, total suspended solids (mg/L) and the sediment sample was analyzed for trace metals. Water samples were compared to the CWQG PFAL guidelines. These guidelines are intended to provide protection to all forms of freshwater aquatic life from anthropogenic stressors (i.e., chemical inputs). Trace metal concentrations in sediment were compared to the CSQG probable effects level (PEL), which indicates the level at which adverse biological effects are frequently expected to occur.

A fish survey was not conducted as it was deemed there was sufficient fish community information available from the existing literature. A mussel survey was undertaken on September 27, 2018 using an underwater viewer at five transects in the Saint John River through the Project area (Figure 1). Any empty mussel shells that were observed along the shoreline were also collected for identification.

4.2 SURFACE WATER QUANTITY

Discharge on the Saint John River at Edmundston, New Brunswick is estimated to vary between 102 and 1,673 m³/s in an average year between 1996 and 2015 (Figure 2) (ECCC 2018). Between 1996 and 2015 the minimum discharge estimated was 14 m³/s and the maximum discharge estimated was 5308 m³/s. Discharge is typically highest during the spring freshet in April and June and lowest in January to March and in July and September.

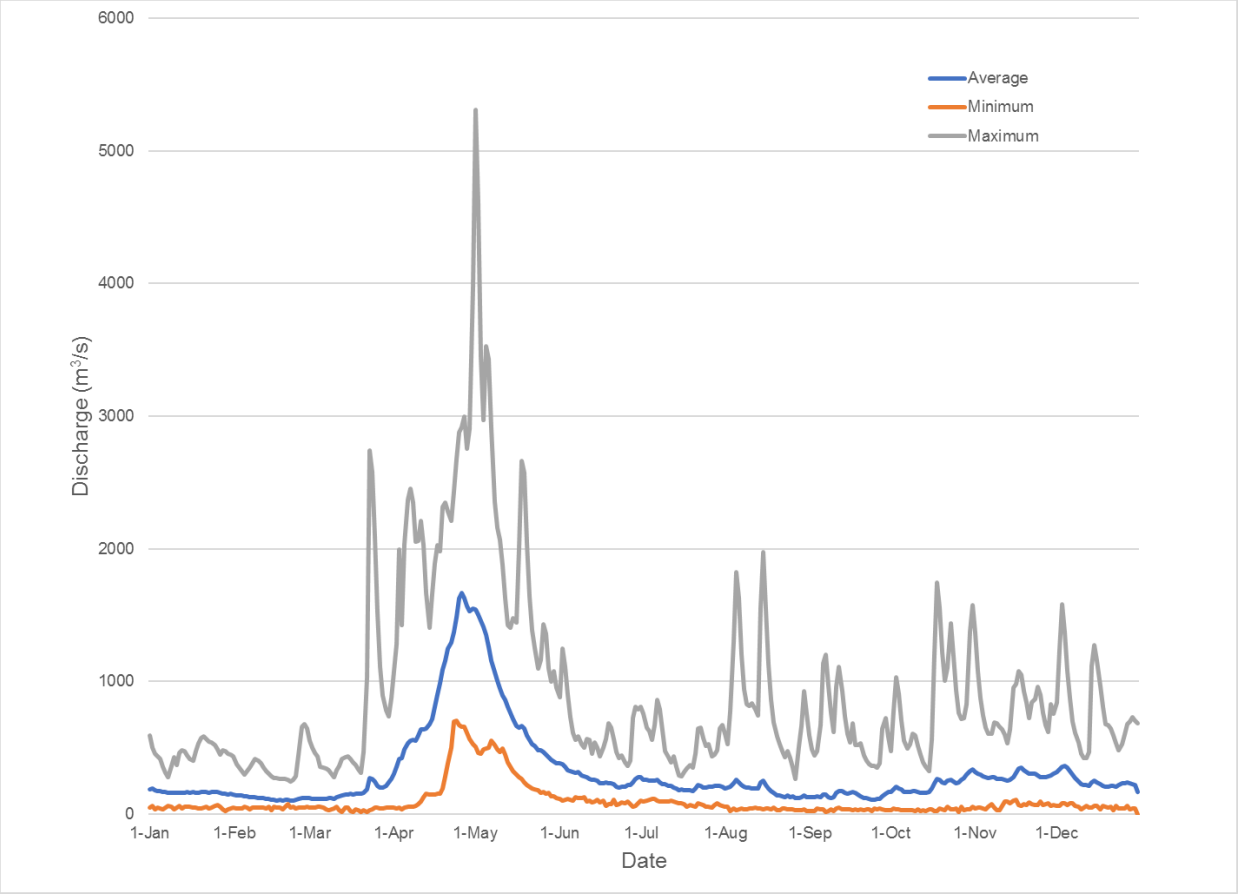

Figure 2 Mean Daily Discharge (m³/s) at the Saint John River PDA, Edmundston, NB (1996 to 2015)

In an average year between 2003 and 2016 water levels on the Saint John River at Edmundston, NB, varied by 3.2 m (Figure 3) (ECCC 2018). However, water levels have the potential to vary by 8.5 m between highest and lowest average daily water levels recorded in this time period. For this timeframe, water levels were highest during the spring freshet in April and June and lowest between July 1 and October 1.

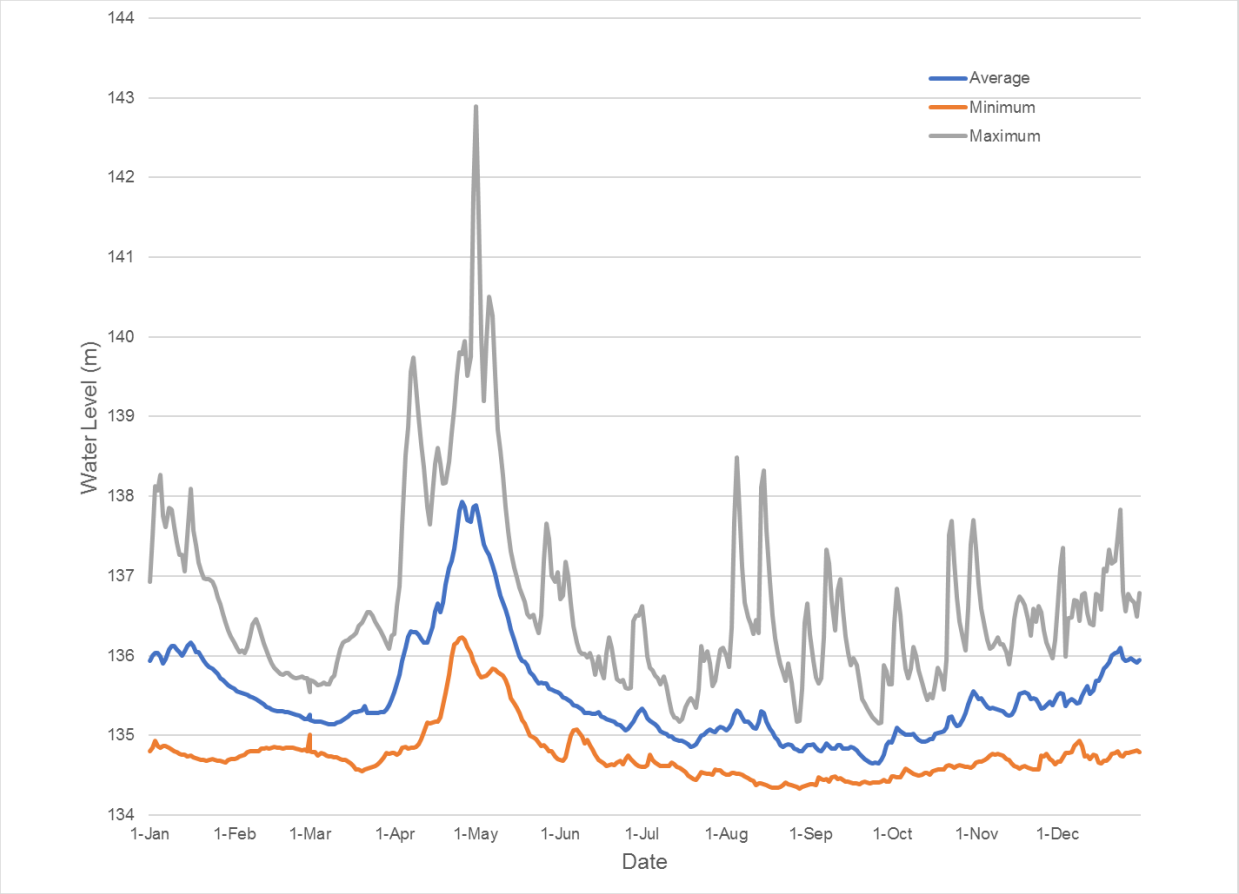

Figure 3 Daily Water Level (m) at the Saint John River PDA, at Edmundston, NB (2003 to 2016)

4.3 FISH HABITAT

Within the PDA, the Saint John River is a large river approximately 200 m wide. Fish habitat within the Project area consists of a riffle, pool and run habitat. The upstream portion of the PDA is riffle and the downstream portion is run. During the site visit in September 2018, a 2.3 m deep pool was found beneath the existing bridge structure; average water depth was 1.1 m and ranged from 0.3 to 2.4 m; and substrate consisted of fines (6%) small gravel (14%), large gravel (16%), cobble (42%) and boulder (22%). Banks were stable and riparian vegetation was primarily grasses and trees. There was no overhead cover and little instream cover for fish with the exception of some boulders. Photos 1 to 6 (below) show representative habitat encountered during the site visit in September 2018.

Photo 1 Representative Shoreline Habitat in the Saint John River at the Project Area Looking Downstream Approximately 260 m Upstream of Existing Bridge on the Left-Hand Bank on the Canadian Side (September 27, 2018)

Photo 2 Representative Habitat in the Saint John River at the Project Area Looking Downstream Approximately 100 m Downstream of the Existing Bridge on the Left-Hand Bank on the Canadian Side (September 27, 2018)

Photo 3 View South Across the Saint John River to US Side at the Proposed Crossing Location

Photo 4 View Downstream of the Saint John River Showing Representative Substrate at the Proposed Crossing Location

Photo 5 Representative Riparian Vegetation within the PDA on the Canadian Side Facing North Approximately 200m Upstream of the Existing Bridge

Photo 6 Fish Habitat within the Project Footprint Approximately 125 m Upstream of the Existing Bridge Crossing

During the September 2018 site visit, the dissolved oxygen concentration in river water in the PDA was 10.1 mg/L, and above the recommended minimum value of 9.5 mg/L for early life stages of fish (CWQG 2018). The pH was 6.7 and within the recommended CWQG PFAL range of 6.5 – 9.0 (CWQG 2018). Both pH (6.1 to 7.9) and dissolved oxygen (3.0 to 14.0 mg/L) were within the range of values previously observed on the Saint John River at Edmundston, NB (Kidd et al. 2011). Water temperature at the time of sampling was 14.0°C. Maximum water temperature on the Saint John River downstream of the Project was 27°C in 2017 and 2018 (NBDELG 2018).

The analytical result of the water sampling indicated that surface water is soft, and contains low concentrations of dissolved minerals (i.e., hardness) and has low pH. Nutrient concentrations in surface water was generally low. Water was clear, as indicated by generally low total suspended solids (<5) and low turbidity (<1.3 NTU). Trace metal concentrations were generally low. None off the fourteen parameters with CWQG PFAL guidelines exceeded their associated CWQG PFAL guideline (CWQG 2018) (Attachment A).

There is a municipal effluent discharge located approximately 700 m downstream of the PDA within the LAA (Arciszewski 2007), as well as municipal effluent discharges located in the lower Madawaska River upstream of the confluence with the Saint John River (Arciszewski 2007). There is also an industrial effluent outfall (i.e., pulp and paper) approximately 550 m downstream of the existing bridge crossing on the US side of the Saint John River. Water quality within the LAA downstream of the confluence of the Madawaska River likely differs from the PDA as a result of these inputs.

Of the six trace metal parameters in sediment with CSQG PEL guidelines, none exceeded the guidelines (CSQG 2014) (Attachment A).

There are no environmentally significant areas identified within the LAA as defined by the Nature Trust of New Brunswick (Tims and Craig 1995).

4.4 FISH SPECIES

The Saint John River originates in Quebec and Maine and flows through New Brunswick to empty into the Bay of Fundy at Saint John. The distribution and abundance of fish species in the Saint John River watershed is influenced by the presence of Mactaquac Dam and Grand Falls/Grand Falls Dam. Grand Falls Dam is located on Grand Falls, a natural barrier to upstream and downstream fish passage. The Project is located in the uppermost reach between the headwaters of the Saint John River and Grand Falls downstream.

A total of 53 species of fish have been identified within the watershed of the Saint John River (Kidd et al. 2011). Of those, 31 are known to occur upstream of Grand Falls (Kidd et al. 2011) (Table 1). Of these 31 species, there are two species (i.e., American eel (*Anguilla rostrata*) and Arctic charr (*Salvelinus alpinus*)) that are no longer known to be present within that reach and are not included in this VC. Of the species known to be present, nine have been confirmed present within the LAA (Table 1). All life stages of these species have the potential to be present within the LAA.

Of the fish species confirmed to be present in the LAA, longnose and white sucker, lake chub and smallmouth bass have been shown to make migratory movements in rivers often prior to spawning in spring (May -June) (Scott and Crossman 1998; Doherty et al. 2010; Reebs et al. 2008).

Field crews identified a shell of the eastern pearlshell (*Margaritifera margaritifera*) along the shoreline of the Project Area. Only one other mussel was observed during the survey; however, the water was too deep and swift to safely retrieve the organism for identification.

Table 1 Fish Species Known to be Present in the Saint John River Upstream of Grand Falls Dam and Confirmed to be Present in the LAA

Species	Saint John River Upstream of Grand Falls[1]	Confirmed Present in LAA[2]	Species	Saint John River Upstream of Grand Falls[1]	Confirmed Present in LAA[2]
Atlantic salmon (*Salmo salar*) (landlocked)	✓	×	Lake trout (*Salvelinus namaycush*)	✓	×
Banded killifish (*Fundulus diaphanus*)	✓	×	Lake whitefish (*Coregonus clupeaformis*)	✓	×
Blacknose dace (*Rhinichthys atratulus*)	✓	✓	Longnose sucker (*Catostomus catostomus*)	✓	✓

Table 1 Fish Species Known to be Present in the Saint John River Upstream of Grand Falls Dam and Confirmed to be Present in the LAA

Species	Saint John River Upstream of Grand Falls[1]	Confirmed Present in LAA[2]	Species	Saint John River Upstream of Grand Falls[1]	Confirmed Present in LAA[2]
Blacknose shiner (*Notropis heterolepis*)	✓	✓	Muskellunge (*Esox masquinongy*) (I)	✓	×
Brook trout (*Salvelinus fontinalis*)	✓	×	Ninespine stickleback (*Pungitius pungitius*)	✓	×
Brown bullhead (*Ictalurus nebulosus*)	✓	×	Northern redbelly dace (*Chrosomus eos*)	✓	×
Burbot (*Lota lota*)	✓	×	Pearl dace (*Semotilus margarita*)	✓	×
Central mudminnow (*Umbra limi*) (I)	✓	×	Rainbow smelt (landlocked) (*Osmerus mordax*)	✓	×
Common shiner (*Notropis cornutus*)	✓	×	Rainbow trout (*Salmo gairdneri*) (I)	✓	×
Creek chub (*Semotilus atromaculatus*)	✓	×	Round whitefish (*Prosopium cylindraceum*)	✓	×
Fallfish (*Semotilus corporalis*)	✓	×	Slimy sculpin (*Cottus cognatus*)	✓	✓
Fathead minnow (*Pimephales promelas*)	✓	×	Smallmouth bass (*Micropterus dolomieui*)	✓	✓
Finescale dace (*Chrosomus neogaeus*)	✓	×	Threespine stickleback (*Gasterosteus aculeatus*)	✓	✓
Golden shiner (*Notemigonus crysoleucas*)	✓	×	White sucker (*Catostomus commersoni*)	✓	✓

Table 1 Fish Species Known to be Present in the Saint John River Upstream of Grand Falls Dam and Confirmed to be Present in the LAA

Species	Saint John River Upstream of Grand Falls[1]	Confirmed Present in LAA[2]	Species	Saint John River Upstream of Grand Falls[1]	Confirmed Present in LAA[2]
Lake chub (*Couesius plumbeus*)	✓	✓	Yellow perch (*Perca flavescens*)	✓	✓

NOTE:
✓ – Present Record
I – non-native
× Presence unconfirmed
[1] Kidd et al. 2011
[2] Stantec Consulting Ltd. Unpublished Data (2012 and 2015)

4.5 COMMERCIAL, RECREATIONAL AND ABORIGINAL FISHERIES

There are no known commercial fisheries within the LAA.

The Project is located in Recreational Fishing Area (RFA) #8 (Upper Saint John) which includes all lakes, rivers, and streams of the Saint John River drainage, upstream from the Covered Bridge at Hartland, NB. Species that may be fished recreationally in boundary waters between New Brunswick and Maine include trout, landlocked salmon, smallmouth bass, rainbow smelt, whitefish and white perch where they reside (GNB 2018).

Aboriginal fisheries have the potential to occur within the vicinity of the Project. The Madawaska Maliseet First Nation has food, social and ceremonial fisheries agreements in place for brook trout in the Saint John River within the vicinity of the Project. Other Aboriginal groups in New Brunswick have fishing agreements in the Saint John River and its tributaries which could include the Project Area. The species that make up these Aboriginal fisheries include brook trout, burbot, brown bullhead (i.e., catfish), chub, muskellunge, yellow perch, white sucker, and whitefish near the Project (DFO 2018a).

4.6 SPECIES AT RISK AND SPECIES OF CONSERVATION CONCERN

An AC CDC data request and DFO species at risk maps within 5 km of the Project location did not identify any aquatic SAR or SOCC (AC CDC 2018; DFO 2018b), although two dragonfly and one mussel SAR have the potential to be present within the Project Area (Table 2). The pygmy snaketail dragonfly (*Ophiogomphus howei*) has the potential to occur in the Project area as it has been observed at Baker Brook on the Saint John River upstream of Grand Falls (COSEWIC 2008). The skillet clubtail dragonfly (*Gomphus ventricosus*) and yellow lampmussel (*Lampsilis cariosa*) have been observed in the lower Saint John River (COSEWIC 2010; 2004). Brook floater (*Alasmidonta varicosa*) has only been recorded once on the Saint John River downstream of Grand Falls dam. Critical habitat has not been defined for any of these species.

The presence of pygmy snaketail dragonfly is unlikely as it prefers large clean flowing rivers, with sand or pea gravel substrates (COSEWIC 2008). This type of habitat was not abundant within the Project Area and it is unlikely they reside in this area. The presence of the skillet clubtail dragonfly is unlikely as it prefers habitats in medium to slow-running rivers with fine substrates (i.e., silt and/or clay) (COSEWIC 2010). This type of habitat was not abundant within the Project Area and it is unlikely they reside in this area. The yellow lampmussel (*Lampsilis cariosa*) is found in the lower portion of the Saint John River below the Mactaquac Dam and has not been observed upstream of Grand Falls Dam (COSEWIC 2004); therefore, it is unlikely to exist within the Project Area. Brook floater (*Alasmidonta varicosa*) has only been recorded once historically on the Saint John River downstream of Grand Falls dam; therefore, it is unlikely to exist within the Project Area.

Table 2 Conservation Status for SAR That May Inhabit the LAA

Species	Conservation Status			Potential to Occur within Project Area
	SARA1	COSEWIC2	NB SARA3	
Invertebrates				
Yellow lampmussel	Special Concern, Schedule 1	Special Concern (2013)	Special Concern	Low
Brook Floater	Special Concern, Schedule 1	Special Concern	Special Concern	Low
Arthropods				
Pygmy Snaketail Dragonfly	special concern, Schedule 1	Special concern (2008)	Special concern	Low
Skillet Clubtail Dragonfly	Endangered, Schedule 1	Endangered (2010)	Endangered	Low

NOTES:
1. Government of Canada (2017a)
2. Government of Canada (2017b)
3. New Brunswick Department of Natural Resources, No date

4.7 NAVIGABLE WATERS

The river is navigable within the LAA with the exception of the two bridge piers associated with the Bridge Avenue crossing between the Canadian and the United States Border and the pier associated with a pipeline crossing between Canada and the United States approximately 250 m downstream.

5.0 ASSESSMENT OF POTENTIAL PROJECT INTERACTIONS WITH AQUATIC ENVIRONMENT

5.1 PROJECT-ENVIRONMENT INTERACTIONS FOR AQUATIC ENVIRONMENT

This section describes how the Project activities could interact with the aquatic environment.

5.1.1 Potential Interactions with Aquatic Environment During Construction

There are no construction activities associated with the connections from the existing roadways to the bridge approaches that are anticipated to interact with the aquatic environment.

Construction activities associated with the Project may result in a change in river flow or water level. A change in water level from the historical range of flows is not anticipated during the open water season as a result of construction activities. During ice-break up the use of temporary works (i.e., rock roads, trestles) has the potential to increase ice jams through changes in break-up and movement of winter ice, though given the history of the site this is unlikely to occur (Hilcon 2018).

Construction activities including clearing, grubbing, removing overburden soils, and construction of a temporary access road have the potential to interact with water quality through the erosion or transport of soils within the PDA. The erosion and transportation of soils within the PDA could result in a change in surface water quality (i.e., increase in turbidity or total suspended solids).

In-water construction activities (e.g., new pier construction, decommissioning of the existing bridge, temporary access road construction) have the potential to interact with surface water quality. In-water construction activities have the potential to result in increases in sedimentation in the in-water areas of the Project footprint which could result in a temporary change in surface water quality (i.e., increase in turbidity or total suspended solids). It is anticipated that the bridge or temporary work structure (trestle) piers will be constructed using sheet pile cofferdams or caissons, which will allow the in-water work area to be isolated from the stream flow.

The timing of construction can increase the potential environmental effects of the Project on the aquatic environment. Conducting instream work during periods of high flow or increased rainfall can increase the potential for runoff and sedimentation of watercourses and result in a change in surface water quality (i.e., increase in turbidity or total suspended solids).

A change in water quality (i.e., turbidity or total suspended solids) as a result of the removal of riparian vegetation or the deposition of sediments downstream could result in a change in fish habitat (i.e., substrate composition or infilling of spaces between the substrate). Increases in fines or embeddedness can affect the quality of spawning or rearing habitat as well as food sources for fish (i.e., benthic invertebrate community).

Construction activities have the potential to interact with fish habitat through the use of heavy equipment (e.g., excavators, clearing equipment) near the watercourse. A potential interaction could occur between the aquatic environment as a result of heavy equipment entering a watercourse. Equipment entering a watercourse could result in changes in fish habitat through alterations to in-water habitats.

In-water construction activities (e.g., new pier construction, decommissioning of the existing bridge, temporary access road construction) have the potential to interact with fish habitat. The in-water footprints of the new piers will result in a permanent loss of fish habitat within the footprint of the pier. The in-water footprints of temporary in-water works (e.g., temporary access road or trestle piers) may result in a temporary alteration to fish habitat quantity during the construction phase of the Project. The decommissioning of the existing bridge will allow the area formerly beneath the bridge piers to return to fish habitat.

The timing of construction can increase the potential for environmental effects of the Project on the aquatic environment. Conducting instream work outside of the DFO/NBDELG timing windows (June 1 to September 30) may result in the direct mortality of fish larvae or eggs that are present.

In-water construction activities and the use of heavy equipment (e.g., excavators, clearing equipment) have the potential to interact with fish populations, CRA fisheries, species at risk and species of conservation concern. The in-water footprints have the potential to result in the direct mortality of fish or aquatic SAR or SOCC and result in a change in fish populations, CRA fisheries and populations of aquatic SAR and SOCC. A potential interaction could occur as a result of heavy equipment entering a watercourse. Equipment entering a watercourse could result in mortality or injury to fish or aquatic SAR or SOCC through physical contact.

The noise and/or vibration from bridge pier construction (e.g., pile driving) may result in behavioral changes (i.e., movements) or mortality to fish or aquatic SAR or SOCC if the pressure waves are of sufficient magnitude. Noise and vibration may deter fish from migrating through the construction area, whereas mortality may occur as a result of physical injuries as sound or pressure waves pass through the swim bladder. The distance which could result in an injury depends on a variety of factors such as depth and water temperature which diminish sound and the sensitivity of the organism. Sound levels from pile driving depend on the type of pile, its diameter, method of installation and the size of the hammer (Illingworth and Rodkin 2007). As the type of pier installation has not been determined, the distance at which injury could potentially occur cannot be determined at this time. It is anticipated that sound levels capable of causing injury or mortality would occur in close proximity to the pile.

Construction activities have the potential to interact with navigation in the Saint John River within the PDA. In-water construction activities (e.g., pier construction) have the potential to temporarily result in a change to navigation within the Project Area.

5.1.2 Potential Interactions with The Aquatic Environment During Operation and Maintenance

The application of road salt and sand during winter has the potential to affect water quality and result in a change in fish habitat. The application of salt has the potential to result in a change in water quality (i.e.,

salinity) which could affect the ability of fish to osmoregulate and result in a change to fish populations. The application of sand has the potential to result in an increase in sedimentation in the area of the Project.

Maintenance of the Project may create dust and other sediments that have the potential to enter the Saint John River and affect fish habitat (i.e., water quality).

The presence of the piers during the operational phase of the Project will affect navigation in the River.

5.1.3 Accidents, Malfunctions, and Unplanned Events

Accidents, malfunctions, and unplanned events are occurrences that are not part of planned activities or normal operation of the Project and have the potential to result in adverse environmental interactions. Given the adherence of Project activities to mitigation measures (e.g., good planning and design, vehicle and equipment maintenance, worksite health, safety, and environmental training of personnel), including those in the NBDTI Environmental Management Manual (EMM; NBDOT 2010), accidents, malfunctions, and unplanned events of a serious nature are unlikely to occur during any phase of the Project.

The accidents, malfunctions, and unplanned events that have potential to occur for this Project, and could potentially interact with the aquatic environment include:

- vehicle collision;
- hazardous material spill; and
- erosion and sediment control failure.

Runoff of fire suppressants or other hazardous materials as a result of an accidental fire, are considered as part of a hazardous material spill. There is potential for a Project vehicle to be involved in a collision on the bridge which could result in the release of a hazardous material to the aquatic environment. There is also potential for a hazardous material spill through the operation of vehicles and heavy construction equipment, especially the rupture of a hydraulic fluid line or the release of fuel. The release of a hazardous material could result in a change in fish habitat (i.e., water quality) which could result in in sublethal effects or direct mortality to fish populations as a result of exposure to deleterious substances. The release of a hazardous material may also result in change in navigation during spill clean-up.

There is the potential for a Project related erosion or sediment control failure which could result in the release sediment into watercourses following a heavy rainfall event and result in a temporary change in surface water quality (i.e., increase in turbidity or total suspended solids) or a change in fish habitat (i.e., substrate composition or infilling of spaces between the substrate).

Mitigation for accidents, malfunctions, and unplanned events is described in Section 5.2.

5.2 MITIGATION FOR AQUATIC ENVIRONMENT

Interaction of the Project activities with the aquatic environment will be managed through the use of mitigation measures, including adherence to NBDTI EMM. Measures which will be employed to mitigate interactions with the aquatic environment are presented in Table 3.

Table 3 Mitigation Measures Applicable to the Aquatic Environment

Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation in NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
Construction including: • substructure • approaches and Canadian Port of Entry Modification • temporary laydown areas or access roads • superstructure including bridge deck • removal of existing bridge	• Reduction in riparian vegetation • Reduction in overhead cover • Increase in erosion • Increase in turbidity and TSS in surface waters • Increase in composition of fine sediments in substrate • Increase in embeddedness • Sublethal effects to fish • Behavioural changes to fish • Mortality of fish • Reduction in fish populations	• 5.3 Clearing • 5.5 Detouring • 5.6 Dust Control • 5.7 Erosion and Sediment Management • 5.8 Excavation, Blasting and Aggregate Production • 5.11 Grubbing • 5.15 Structures • 5.17 Temporary Ancillary Facility Management • 5.19 Vehicle and Equipment Management • 5.20 Waste Management • 5.21 Winter Highway Maintenance • 5.22 Work Progression • 5.23 Working Near Environmentally Sensitive Areas • 5.25 Sulphide Bearing Rock & Acid Rock Drainage Management	• Machinery and materials will not be stored in flood-prone zones when it is reasonable to expect high water levels. • If instream work outside of the June 1 to Sept 30 window is required, appropriate approvals will be obtained from regulatory agencies
Operation and maintenance including: operation of infrastructure (including snow and ice removal), preservation and maintenance of structures.	• Increase in salinity or conductivity of surface water • Reduction in fish populations • Introduction of deleterious substances • Sublethal effects to fish • Mortality of fish • Change in navigation	• 5.10 Fire Prevention and Contingency • 5.15 Structures • 5.16 Summer Highway Maintenance • 5.21 Winter Highway Maintenance	No additional mitigation recommended

Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation in NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
Accidents, malfunctions, and unplanned events including: • Hazardous Material Spill • Erosion and Sediment Control Failure	• Increase in turbidity and TSS in surface waters • Physical changes to fish habitat • Change in riparian vegetation • Introduction of deleterious substances • Sublethal effects to fish • Mortality of fish • Reduction in fish populations	• 5.10 Fire Prevention and Contingency • 5.12 Spill Management • 5.13 Storage and Handling of Petroleum Products • 5.15 Structures • 5.19 Vehicle and Equipment Management	In the event of an erosion or sediment control failure water quality monitoring may be conducted to assess the extent and magnitude of the effects. If turbidity or total suspended solids are found to exceed the CWQG PFAL guidelines, DFO will be contacted to assess if serious harm has resulted and additional offsetting is warranted.

5.3 CHARACTERIZATION OF RESIDUAL PROJECT-ENVIRONMENTAL INTERACTIONS FOR THE AQUATIC ENVIRONMENT

5.3.1 Construction

Mitigation measures as outlined in Section 5.2 and the NBDTI EMM will reduce the likelihood and magnitude of potential releases of suspended sediments into the aquatic environment.

In-water construction activities and the use of heavy equipment have the potential result in direct mortality to, CRA fisheries species, SAR and SOCC. If feasible in-water construction activities may include a fish/SAR/SOCC rescue within the area of the Project footprint. If a fish/SAR/SOCC rescue is not feasible, and serious harm cannot be avoided, it will be mitigated by offsetting through a *Fisheries Act* Authorization in consultation with DFO.

The effects to fish from noise and/or vibration are anticipated to be minor and of short-term duration. As the in-water work area is relatively small relative to the river area, and not all in-water work will occur at the same time, it is anticipated that fish will move away from residual disruptive noise and/or vibrations.

Where serious harm from in-water construction activities cannot be avoided, the loss of the aquatic environment will be mitigated by offsetting through a *Fisheries Act* Authorization in consultation with DFO. It is estimated that up to approximately 400 m² of fish habitat may be permanently lost or altered at the location of each new pier. The removal of the existing bridge piers will allow fish habitat within the pier footprint to return to productive fish habitat (approximately 80 m^2 per pier).

Alteration or destruction of fish habitat and disturbance or direct mortality is not anticipated to result in changes to CRA fisheries species, SAR, or SOCC at a population level.

In-water construction activities may result in minor temporary disturbances in navigability, however navigability will be maintained within the LAA for the duration of the Project, and residual effects to navigability are not anticipated to be substantive.

In summary, no substantive residual effects are anticipated.

5.3.2 Operation and Maintenance

Substantive changes to water quality during operation and maintenance activities due to dust, sediment, or road salt, are not anticipated as the area of the bridge is small relative to the overall river size and discharge, and activities will be limited and conducted in accordance with the NBDTI EMM. There will be one or more additional pier(s) in the River as a result of the Project; however, given the width of the river relative to the size of the piers, it is not anticipated that there will be any substantive change to current navigation conditions in the river. As such, no substantive residual effects to the aquatic environment are anticipated as a result of Project-related activities during the construction or operation and maintenance phases of the project.

6.0 SUMMARY AND RECOMMENDATIONS

With the implementation of mitigation and environmental protection measures as described in the EMM and in this assessment, it is not anticipated that there will be any substantial interaction between the Project and the aquatic environment during the construction or operation and maintenance phases of the Project. The potential effects to the aquatic environment can be mitigated through standard environmental protection practices (e.g., sediment and erosion control structures, avoiding sensitive periods, minimizing clearing), as described in NBDTI 's EMM (2010) and the EMP that will be prepared for the project.

The potentially adverse effects resulting from the temporary or permanent loss in fish habitat are a single event of short-term duration during the construction phase of the Project. Any serious harm resulting from the Project will be mitigated through offsetting and a *Fisheries Act* Authorization. The fish species and fish habitat within the PDA are common throughout New Brunswick. The loss/alteration of fish habitat is anticipated to be small (e.g., approximately 400 m² per pier) and is not anticipated to affect CRA fisheries, fish that support those populations, or aquatic SAR, at the population level.

7.0 REFERENCES

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APPENDIX D – AQUATIC ENVIRONMENT
ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

Attachment A LABORATORY CERTIFICATES

APPENDIX D – AQUATIC ENVIRONMENT
ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

Report ID: 291140-IAS
Report Date: 15-Oct-18
Date Received: 28-Sep-18

CERTIFICATE OF ANALYSIS

for
Stantec Consulting Ltd
845 Prospect Street
Fredericton, NB E3B 2T7

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Jenny Reid
Project #: 121415893
Location: Saint John River

Analysis of Metals in Soil

RPC Sample ID:			291140-2
Client Sample ID:			SJR-001
Date Sampled:			27-Sep-18
Analytes	**Units**	**RL**	
Aluminum	mg/kg	1	14900
Antimony	mg/kg	0.1	< 0.1
Arsenic	mg/kg	1	4
Barium	mg/kg	1	19
Beryllium	mg/kg	0.1	0.3
Bismuth	mg/kg	1	< 1
Boron	mg/kg	1	2
Cadmium	mg/kg	0.01	0.05
Calcium	mg/kg	50	2060
Chromium	mg/kg	1	34
Cobalt	mg/kg	0.1	10.6
Copper	mg/kg	1	12
Iron	mg/kg	20	29600
Lead	mg/kg	0.1	11.2
Lithium	mg/kg	0.1	30.6
Magnesium	mg/kg	10	8290
Manganese	mg/kg	1	314
Molybdenum	mg/kg	0.1	< 0.1
Nickel	mg/kg	1	43
Potassium	mg/kg	20	620
Rubidium	mg/kg	0.1	4.1
Selenium	mg/kg	1	< 1
Silver	mg/kg	0.1	< 0.1
Sodium	mg/kg	50	< 50
Strontium	mg/kg	1	17
Tellurium	mg/kg	0.1	< 0.1
Thallium	mg/kg	0.1	< 0.1
Tin	mg/kg	1	< 1
Uranium	mg/kg	0.1	0.5
Vanadium	mg/kg	1	20
Zinc	mg/kg	1	69

This report relates only to the sample(s) and information provided to the laboratory.

RL = Reporting Limit

Ross Kean
Department Head
Inorganic Analytical Chemistry

Brannen Burhoe
Chemical Technician
Inorganic Analytical Services

Report ID: 291140-IAS
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Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Jenny Reid
Project #: 121415893
Location: Saint John River

Analysis of Water

RPC Sample ID:			291140-1
Client Sample ID:			SJR-001
Date Sampled:			27-Sep-18
Analytes	**Units**	**RL**	
Sodium	mg/L	0.05	2.95
Potassium	mg/L	0.02	0.48
Calcium	mg/L	0.05	12.7
Magnesium	mg/L	0.01	1.63
Iron	mg/L	0.02	0.08
Manganese	mg/L	0.001	0.013
Copper	mg/L	0.001	< 0.001
Zinc	mg/L	0.001	0.002
Ammonia (as N)	mg/L	0.05	< 0.05
pH	units	-	7.6
Alkalinity (as $CaCO_3$)	mg/L	2	38
Chloride	mg/L	0.5	3.7
Sulfate	mg/L	1	< 1
Nitrate + Nitrite (as N)	mg/L	0.05	0.06
o-Phosphate (as P)	mg/L	0.01	< 0.01
r-Silica (as SiO_2)	mg/L	0.1	3.1
Carbon - Total Organic	mg/L	0.5	5.8
Turbidity	NTU	0.1	1.3
Solids - Total Suspended	mg/L	5	< 5
Conductivity	µS/cm	1	96
Calculated Parameters			
Bicarbonate (as $CaCO_3$)	mg/L	-	37.8
Carbonate (as $CaCO_3$)	mg/L	-	0.141
Hydroxide (as $CaCO_3$)	mg/L	-	0.020
Cation Sum	meq/L	-	0.913
Anion Sum	meq/L	-	0.868
Percent Difference	%	-	2.53
Theoretical Conductivity	µS/cm	-	87
Hardness (as $CaCO_3$)	mg/L	0.2	38.4
Ion Sum	mg/L	-	48
Saturation pH (5°C)	units	-	8.9
Langelier Index (5°C)	-	-	-1.26

Report ID: 291140-IAS
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www.rpc.ca

Attention: Jenny Reid
Project #: 121415893
Location: Saint John River

Analysis of Metals in Water

RPC Sample ID:			291140-1
Client Sample ID:			SJR-001
Date Sampled:			27-Sep-18
Analytes	**Units**	**RL**	
Aluminum	µg/L	1	36
Antimony	µg/L	0.1	< 0.1
Arsenic	µg/L	1	< 1
Barium	µg/L	1	5
Beryllium	µg/L	0.1	< 0.1
Bismuth	µg/L	1	< 1
Boron	µg/L	1	5
Cadmium	µg/L	0.01	< 0.01
Calcium	µg/L	50	12700
Chromium	µg/L	1	< 1
Cobalt	µg/L	0.1	< 0.1
Copper	µg/L	1	< 1
Iron	µg/L	20	80
Lead	µg/L	0.1	0.1
Lithium	µg/L	0.1	0.4
Magnesium	µg/L	10	1630
Manganese	µg/L	1	13
Molybdenum	µg/L	0.1	0.1
Nickel	µg/L	1	< 1
Potassium	µg/L	20	480
Rubidium	µg/L	0.1	0.5
Selenium	µg/L	1	< 1
Silver	µg/L	0.1	< 0.1
Sodium	µg/L	50	2950
Strontium	µg/L	1	97
Tellurium	µg/L	0.1	< 0.1
Thallium	µg/L	0.1	< 0.1
Tin	µg/L	0.1	< 0.1
Uranium	µg/L	0.1	< 0.1
Vanadium	µg/L	1	< 1
Zinc	µg/L	1	2

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Tel: 506.452.1212
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www.rpc.ca

General Report Comments

291140-2
The sample was air dried and sieved at 2 mm. Portions were digested according to EPA Method 3050B.
The resulting solutions were analyzed for trace elements by ICP-MS.

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Fax: 506.452.0594
www.rpc.ca

Methods

Analyte	RPC SOP #	Method Reference	Method Principle
EPA 3050B Digestion	4.M19	EPA 3050B	Nitric Acid/Hydrogen Peroxide Digestion
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

Report ID: 291140-IAS
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Methods

Analyte	RPC SOP #	Method Reference	Method Principle
Ammonia	4.M47	APHA 4500-NH_3 G	Phenate Colourimetry
pH	4.M03	APHA 4500-H^+ B	pH Electrode - Electrometric
Alkalinity (as $CaCO_3$)	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Sulfate	4.M45	APHA 4500-SO_4 E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO_3 H	Hydrazine Red., Derivitization, Colourimetry
o-Phosphate (as P)	4.M50	APHA 4500-P F	Molybdate/Ascorbic Acid Colourimetry
r-Silica (as SiO_2)	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Solids - Total Suspended	4.M05	APHA 2540 D	Filtration, Gravimetry

Attachment B HABITAT ASSESSMENT FORMS

APPENDIX D – AQUATIC ENVIRONMENT
ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

Table B.1. Raw Fish Habitat Data Collected at Transects

Channel Measurements					
	T1	T2	T3	T4	T5
Depth at LDB 25%	0.8	1.5	1	0.8	1.1
Depth at LDB 50%	1.3	2.3	1	0.9	0.9
Depth at LDB 75%	1.3	1	1.1	1.1	0.3
Maximum Depth (m)	1.3	2.4	1.1	1.1	1.1
Gradient	1	1	1	1	1
Dominant Habitat	Deep Run	Deep Pool	Riffle	Riffle	Riffle
Stream Bed (% Composition)					
Organics	0	0	0	0	0
Fines	0	15	5	5	5
Small Gravel	25	30	5	5	5
Large Gravel	15	15	20	15	15
Cobble	50	30	30	45	55
Boulder	10	10	40	30	20
Bedrock	0	0	0	0	0
Embeddedness	Low	Low	Low	Low	Low
Stream Banks					
	LDB/RDB	LDB/RDB	LDB/RDB	LDB/RDB	LDB/RDB
Bank Slope (°)	30/45	30/45	30/45	30/45	30/45
Bank Height (m)	1	1	1	1	1
Bank Stability	Stable	Stable	Stable	Stable	Stable
Bank Materials - Dominant	Cobble	Cobble	Cobble	Cobble	Cobble
Bank Materials - Sub-dominant	Fines	Fines	Fines	Fines	Fines
Riparian Vegetation - Dominant	Grass	Grass	Grass	Grass	Grass
Riparian Vegetation - Sub-dominant	Deciduous	Deciduous	Deciduous	Deciduous	Deciduous

Water Quality	
Time	12:02
Temperature (°C)	14
Dissolved Oxygen (%)	99
Dissolved Oxygen (mg/L)	10.1
Specific Conductivity (µS/cm)	90.9
pH	6.7
Turbidity (NTU)	2.32
Flow Stage	Low

Table B.2. Raw Fish Habitat Data

Site ID: SJR-001 Stream Name: Saint John River Crew: JR, VB Date: September 27, 2018 Project: 121415893

Habitat Number	Habitat Unit Type	Unit Length (m)	Maximum Depth	Average Width (m)		Bank Stability	
				Wetted	Channel	Left Bank	Right Bank
1	Riffle	270	1.1	191	215	Stable	Stable
2	Deep Pool	70	2.4	200	215	Stable	Stable
3	Deep Run	70	1.3	210	230	Stable	Stable

Habitat Number	Substrate Composition (% of Area Assessed)						
	Organic	Fines (<2 mm)	Small Gravel (2-16 mm)	Large Gravel (17-64 mm)	Cobble (65-256 mm)	Boulder (>256 mm)	Bedrock
1	0	5	5	15	45	30	0
2	0	10	40	20	20	10	0
3	0	0	25	15	50	10	0

Habitat Number	Overhead Cover < 1m (% of Assessed Area)			
	Woody Debris	Undercut Bank	Grasses	Trees/Shrubs
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0

Habitat Number	Instream Cover (% of Assessed Area)			
	Woody Debris	Boulders	Water Depth/Clarity	Aquatic Vegetation
1	0	0	0	1
2	0	0	0	0
3	0	0	0	0

Habitat Number	Aquatic Vegetation Composition (% of Total Aquatic Vegetation)					
	Emergent	Floating-leafed	Submergent	Free Floating	Filamentous Algae	Macrophytic Algae
1	0	0	0	0	100	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0

Habitat Number	Riparian Vegetation	
	Dominant	Subdominant
1	Grass	Trees
2	Grass	Trees
3	Grass	Trees

Appendix E WETLANDS AND VEGETATION

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320)

Appendix E Wetlands and Vegetation
February 2019

Appendix E – VC Wetlands and Vegetation

Environmental Impact Assessment Registration for the Replacement of the Madawaska-Edmundston International Bridge (E320) - NBDTI

February 2019

Prepared by:

Environmental Unit, Design Branch
New Brunswick Department of Transportation and Infrastructure

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

Table of Contents

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LIST OF ATTACHMENTS

1.0 INTRODUCTION

This document is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project (the Project). This document includes an analysis of the potential interactions between Project activities and the Wetlands and Vegetation Valued Component (VC) of the EIA for the Project.

2.0 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Wetlands are considered a valued component of the project environment because of the recognized importance of flood plain wetlands along the Saint John River, which are often categorized as Provincially Significant Wetlands by the New Brunswick Department of Environment and Local Government (NBDELG), and because of the potential for the project to interact with riparian wetlands that could occur within the Project Development Area. Wetlands, in general, are understood to fulfill a variety of valued functions including: shoreline stabilization, human health protection, biodiversity, and cultural and scientific opportunities. This value in combination with historic losses of wetlands in New Brunswick and across Canada have led to the development of both provincial and federal wetland policies that are designed to protect wetlands and their functions.

In New Brunswick, wetlands are most recognizable by their unique assemblages of vegetation and wildlife. Wetlands are typically more biodiverse than other natural communities in New Brunswick for both wildlife and vegetation and the most obvious expression of this is in the diversity of plant species that occur in wetlands and the large proportion of rare and endangered plant species that occur in wetlands. Nearly all the plant species listed as endangered in New Brunswick occur in wetlands. The upper Saint John River valley, is also the place that supports one of the rarest plant species in eastern North America, known as Furbish's lousewort, which is listed as Endangered under Schedule A of the Federal Species at Risk ACT (SARA).

2.1 REGULATORY CONTEXT

In New Brunswick, wetlands are regulated under the Clean Water Act - Watercourse and Wetland Alteration Regulation administered by the NBDELG. Vegetation is also included in this VC and is primarily focused on Species at Risk (SAR) and Species of Conservation Concern (SOCC).

To assess any influence of the Project on wetlands and vegetation, three components have been identified for the VC:

- Wetlands are lands where the water table is at, near, or above the land's surface, or lands which are saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophytic vegetation, and various kinds of biological activities adapted to the wet environment (NBDELG, 2002);

- Vegetation SAR include species that have a protective status under Schedule 1 of the federal Species at Risk Act (SARA) or are protected under the provincial New Brunswick Species At Risk Act (NBSARA); and
- Vegetation SOCC are species not protected by federal or provincial legislation but are:
    - Considered rare in New Brunswick with an Atlantic Canada Conservation Data Centre (ACCDC) rank of S1 to S3; and/or
    - Ranked ‘At Risk’, ‘May Be At Risk’ or ‘Sensitive’ by the Canadian Endangered Species Council (CESCC 2015)

3.0 BOUNDARIES

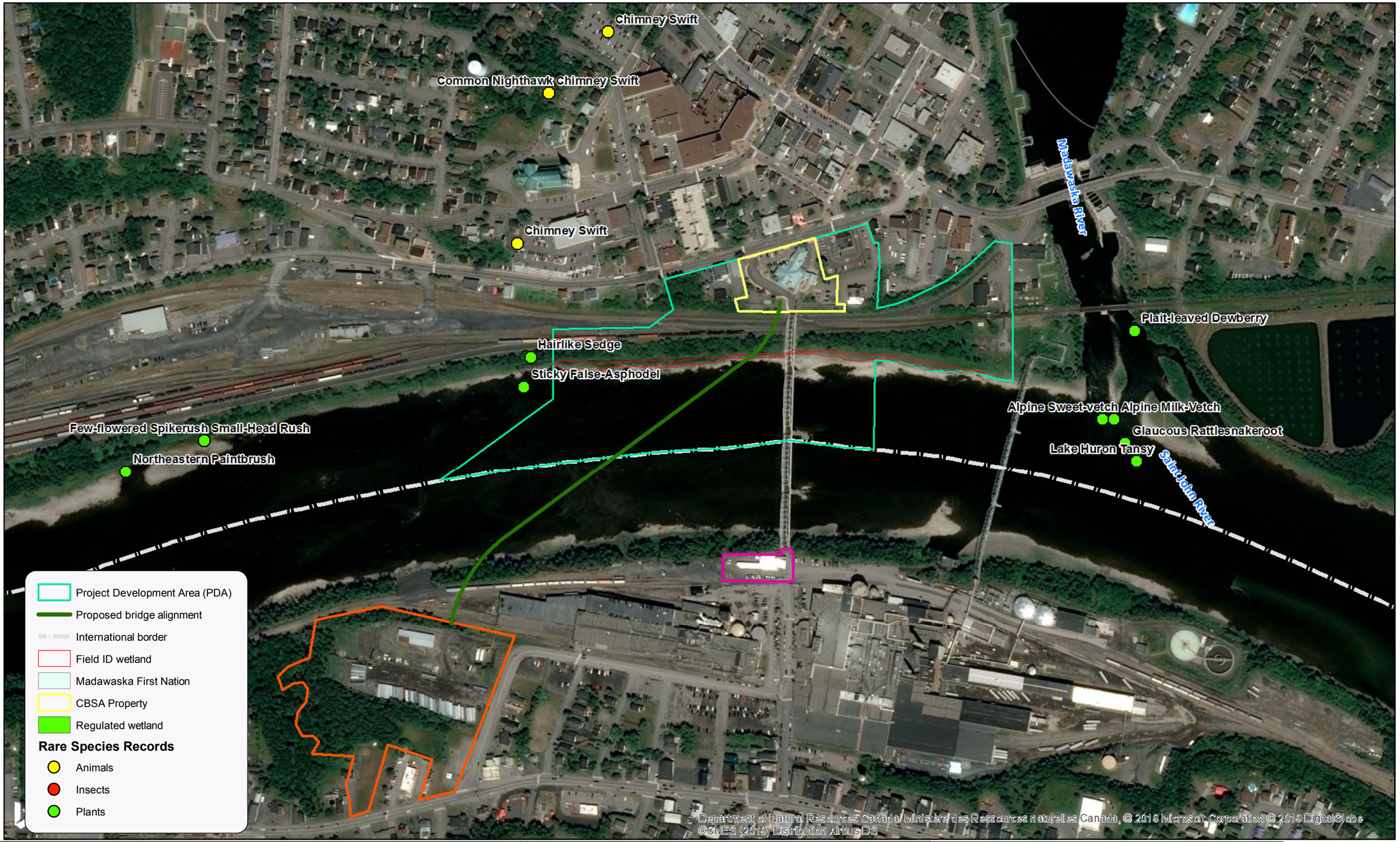
3.1 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and wetlands and vegetation is focused on a Project Development Area (PDA) which is shown on Figure 1.

The PDA for the Project is defined as the maximum anticipated area of physical disturbance associated with the construction and operation and maintenance of the Project, as well as the decommissioning of the existing bridge. For the purposes of this assessment, the PDA comprises a physical footprint of the Project and includes portions of the Canada Border Services Agency properties and adjacent private properties, east and west of the proposed new bridge location, a portion of land owned by the Canadian National Railways (CN), and a portion of the Saint John River (up to 250 m upstream of the new bridge and 250m downstream of the existing bridge to the east, and up to the international border to the south).

The PDA represents the Local Assessment Area LAA for fieldwork but desktop data for the occurrence of rare species and Environmentally Significant Areas was reviewed for a radius of 5 km around the site.

Because bridge design is not finalized and subsequent constructability consultations with potential contractors have not yet been held, the exact area of work cannot be specified at this stage. However, it is not anticipated that the entire project area will be affected by the project and the area shown on Figure 1 represents a maximum extent of interaction.



New Brunswick Department of Transportation and Infrastructure

Date: February 20, 2019

Projection: NB Stereographic

0 90 180 360 Meters

1:4,546

Madawaska-Edmundston International Bridge

Wetlands, Vegetation and Wildlife Features of Interest

Environmental Features

Drawn by: GMQ

Figure No.: 1

Checked by: VB

N

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

3.2 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental interactions between the Project and Wetlands and Vegetation include the following periods.

- Construction (including demolition of the existing bridge) – anticipated to last three years, dates to be determined;
- Operation and maintenance – in perpetuity; and,
- Decommissioning and/or abandonment of the new bridge – not anticipated.

It is anticipated that the construction phase will last three years. The bridge opening will coincide with the opening of the new United States. Land Port of Entry (LPoE) in Madawaska, Maine, which will be built simultaneously and is not included as part of this Project. A Project schedule will be prepared during the preliminary design phase.

4.0 EXISTING CONDITIONS FOR WETLANDS AND VEGETATION

This section provides and overview of the results of the field surveys for Wetlands and Vegetation and summarizes available information on Wetlands and Vegetation for the PDA.

4.1 SOURCES OF INFORMATION

To characterize the existing conditions for wetlands and vegetation and to inform field surveys, existing information and data for the area were reviewed. Fieldwork was conducted within the PDA to record location and extent of wetlands and other vegetated habitats as well as the presence of any plant SOCC or SAR.

The existing information on wetlands and vegetation Included:

- Atlantic Conservation Data Centre (ACCDC) data on SAR and SOCC locations and Environmentally Significant Areas (ESA). (AC CDC 2018)
- GeoNB provincial wetland inventory mapping[1]
- SNB aerial imagery[1]
- Field survey data from fieldwork conducted by NB DTI in June, August, October, and November of 2018.

[1] http://www.snb.ca/geonb1/e/index-E.asp

4.2 WETLANDS

4.2.1 Wetland Field Methods

A wetland survey was initially conducted in June of 2018, and an additional survey was conducted in early November of 2018 due to a change in the PDA to include additional riparian area. During the November survey, the delineated wetland boundary was extended along the shore and the overall vegetation community was assessed in the riparian area. However, an additional follow-up rare plant survey is planned within the new portions of the PDA for the summer of 2019. The results of this 2019 study will be addressed in a follow-up report and will consider the need for additional mitigation based on the results of that study.

Wetland delineations were conducted using a rapid two parameter method, assessing vegetation and hydrology where wetland boundary location was marked using a Trimble Geo7x unit with real-time differential locational correction.

The wetland habitat that was encountered was characterized by the dominant vegetation, and classified using the Canadian Wetland Classification System (Wetlands Working Group 1997).

4.2.2 Wetland Results

In reviewing available wetland mapping from GeoNB, there were no mapped wetlands shown to occur within 30 m of the PDA. The closest mapped wetland occurring more than a kilometer to the east. A review of aerial imagery suggested that there may be a small fringe of riparian wetland along the shore of the river that did not appear on GeoNB mapping. This narrow strip of wetland habitat was delineated in the field and found to be approximately five metres wide, and located along the shore of the river within the ice scour zone (See Figure 1). The total size of the wetland within the PDA is 0.3 ha. Most of the vegetation is herbaceous with scattered smaller woody plants such as willows (*Salix* spp.) and Indian hemp (*Apocynum cannabinum*). The dominant vegetation species observed were reed canary-grass (*Phalaris arundinacea*) (an invasive grass), and fringed brome (*Bromus ciliatus*). And the Canadian Wetland Classification wetland type is Riparian Marsh.

The hydrology of the wetland was defined by a combination of the high water table present due to the low elevation relative to the water level of the river, combined with seepage from the adjacent embankment. The wetland is inundated during typical high-water periods which likely occur multiple times during the growing season. There are two distinct surface water inputs from the landward side in the form of storm drains that emerge from the embankment to the west of the bridge. Where the entire wetland is subject to ice scouring, most plant species present are highly adapted to disturbance and any perennials such as the willows tend to be stunted and young. Invasive species such as purple loosestrife (*Lythrum salicaria*) and bittersweet nightshade (*Solanum dulcamara*) are scattered across the wetland, mostly on the upland edge, while the invasive variety of reed canary-grass is a dominant species in the wetland.

4.2.2.1 Wetland Function

Riparian marshes are typically associated with multiple valued functions such as sediment trapping, water filtering, streambank stabilization, floodwater storage, and biodiversity. The narrow strip of wetland along the river bank within

the PDA is unlikely to play an important role in these functions due to the small size, and the hard, rocky substrate hinders dense vegetation growth and provides a relatively stable shoreline which is not substantially improved on by the presence of the narrow fringe of wetland. While not locally important, the riparian wetland along the river is likely to be important at the landscape level and in some areas (well outside the PDA) is known to provide habitat for a wide variety of rare and endangered species.

Most of the wetland area within the PDA was surveyed for rare plants in June and August of 2018 and no rare plants or SAR were found. The wetland function may be re-evaluated should the wetland area in the newly extended PDA be found to contain SAR or rare plants following surveys for those areas planned for the summer of 2019. The presence of invasive plant species such as purple loosestrife (*Lythrum salicaria*) and the invasive strain of reed canary grass (*Phalaris arundinacea*) hinders the biodiversity-related functions of this wetland.

4.3 VEGETATION

4.3.1 Vegetation Field Methods

Vegetation field surveys were conducted in June and August of 2018 within the PDA (as defined at that time) on foot by an experienced biologist. Every vascular plant species encountered was recorded and vegetation communities were mapped and characterized by their dominant vegetation species. Where field identification was difficult, samples were collected and identification was conducted using available regional plant keys. Plant rarity rankings and nomenclature were used based on the ACCDC current database[2]. An additional site visit was conducted in November of 2018 to survey new areas where the PDA was expanded due to the potential need to access the site along the shoreline. The primary aim of this November visit was to delineate wetlands and characterize the riparian vegetation communities. Because this visit was conducted outside of the growing season, a follow-up rare plant survey will be conducted for these areas in the summer of 2019 to determine if rare plants are present in the extended portions of the PDA. New areas to survey as a part of the expanded PDA will include the westernmost 200m of shoreline of the PDA shown in Figure 1 and the easternmost 100 m of shoreline, as well as two treed vacant lots to the west of the CBSA facility. These treed lots are not anticipated to be used during construction, as archaeological features were identified on these properties.

4.3.2 Vegetation Results

4.3.2.1 SAR and SOCC

A review of ACCDC data (ACCDC 2018) on rare plant species for the area indicated the presence of some plant SOCC near the PDA, which are shown on Figure 1. However, of the seven rare plant records, six are more than a century old. All of these species are listed as S3 ‘Secure’ and are not at risk of extirpation at the landscape level. Given the dynamic disturbance regime of the river system with its high floods and ice floes, it is unlikely that these old location records still correspond with extant rare plant locations. However, these records do suggest potential for occurrence of these species in the area. The most recent record of glaucous rattlesnake root (*Prenanthes racemosa*) is an uncommon plant with an S3 ranking from the ACCDC, but its status is listed as ‘Secure’ by the CESCC. There

[2] http://accdc.com/en/ranks.html

were several other records of SOCC plants occurring along the river within 5 km of the PDA that had potential to occur within the PDA but were not found during the field survey.

No SAR plants are included in the ACCDC report within 5 km of the PDA and none were found in the field. The ACCDC data report is included as Attachment A.

4.3.2.2 Environmentally Significant Areas

The ACCDC report is included in Attachment A. There were no Environmentally Significant Areas (as identified by Tims (1995)) located within a kilometer of the PDA. The "Edmundston By-Pass Roadcuts ESA" and the "Saint Basile Indian Reserve ESA" are located to the northeast near the TransCanada highway and will not be affected by the Project.

4.3.2.3 Vegetation Communities

The terrestrial portion of the PDA is 10 ha is size, of which approximately 8 ha is largely unvegetated or mowed lawn. The remaining 2 ha of vegetated habitat within the PDA consists largely of riparian habitat along the embankment between the rail line and the river (1.5 ha), while an additional 0.3 ha consists of narrow strips of roadside tree and shrub habitat. There are two vacant lots to the west of the existing CBSA facility that are included in the PDA and support a small (0.2 ha) patch of immature hardwood forest. These lots are not expected to be disturbed by the project. There is also an additional 0.1 ha of rocky shrub and forb dominated habitat along the embankment between the CBSA and the rail line. This habitat is sparsely vegetated and is dominated by non-native species. Table 1 lists the dominant plant species for each major vegetation community type and a full list of plant species recorded in the field is included in Attachment B. The aquatic portion of the PDA (at the time of the survey) did not appear to be vegetated, although the shoreline wetland habitat was within the high-water mark of the stream.

Table 1 Upland vegetation communities present within the PDA

Habitat Type	*Area in PDA (ha)*	*Dominant Species*	*Condition*
***Riparian Habitat** (located between rail line and river – mostly upland.)* **Photos 1 & 4**	1.5	Manitoba maple (*Acer negundo*); trembling aspen (*Populus tremuloides*); speckled alder (*Alnus incana*); white birch (*Betula papyrifera*); reed-canary grass (*Phalaris arundinacea*); fringed brome (*Bromus ciliatus*); American elm (*Ulmus americana*); timothy (*Phleum pratensis*)	Disturbed frequently by ice scour and development. High abundance of non-native and invasive species
***Roadside tree and shrub** (dispersed along roads and between building lots.)* **Photo 2**	0.3	Trembling Aspen (*Populus tremuloides*); white spruce (*Picea glauca*); white birch (*Betula papyrifera*); red maple (Acer rubrum); pin cherry (*Prunus*	Common tree and shrub species mixed with a wide variety of ornamentals and

		pensylvanica); balsam poplar (*Populus balsamifera*); blackberry (*Rubus allegheniensis*).	non-native species. Subject to periodic disturbance.
Immature hardwood *(In overgrown lots to the west of the CBSA facility)* **Photo 3**	0.2	Manitoba maple (*Acer negundo*), Japanese barberry (*Berberis thunbergii*) red maple (*Acer rubrum*); choke cherry (*Prunus virginiana*); willow species (*Salix spp.*);	The lot was developed at one time but is regenerating in shrubs and trees. This lot I not expected to be disturbed)
Developed (All remaining area including buildings, paved areas, lawns, and gardens	8.0	NA	Where vegetated, mostly non-native species

Photo 1 Riparian habitat within the PDA showing abundance of invasive Manitoba maple. The view is looking south toward the river from the existing bridge on the Canadian side (August, 2018)

Photo 2 Roadside tree and shrub habitat within the PDA showing a mix of native and non-native species. The view is looking north along the southern side of the CBSA facility, taken from near the existing bridge on the Canadian side (August, 2018)

Photo 3 Immature hardwood habitat within the undeveloped lot to the west of the CBSA facility. This area is not anticipated to be disturbed during construction.

Photo 4 View of the shoreline wetland habitat in foreground with upland Riparian habitat behind. Taken from the river edge downstream of the existing bridge looking north

5.0 ASSESSMENT OF POTENTIAL PROJECT INTERACTIONS WITH WETLANDS AND VEGETATION

5.1 PROJECT-ENVIRONMENT INTERACTIONS FOR WETLANDS AND VEGETATION

This section described how the Project activities could interact with Wetlands and Vegetation in the absence of mitigation.

5.1.1 Potential Interactions with Wetlands and Vegetation during construction

5.1.1.1 Wetlands

Construction activities including clearing, grubbing removing overburden soils, and construction of a temporary access road have the potential to either permanently or temporarily displace vegetated habitats including wetlands. The PDA is a 10 ha polygon that includes the existing CBSA facility as well as adjacent properties that could potentially be needed for construction.

The anticipated effects on native vegetation and wetland communities will be small given that no regulated wetlands occur within the PDA and much of the area is commercially and industrially developed. The PDA extends along the river shoreline for approximately 250 m upstream of the new bridge and 250m downstream of the existing bridge. This area is included in case access is needed along the shoreline area for construction of the bridge abutment. While the final design and construction methods have not yet been determined, it is unlikely that the shoreline

approach from the west will be required. The most likely construction scenario will include an access road and work area under the bridge and extending to Ferry Avenue to the east for approximately 250m. This may be necessary due to restrictions in access to the shoreline due to rail traffic on the adjacent CN Rail line such that a direct access across the tracks will be blocked by rail cars for portions of the day. This access road would result in 0.12 ha of the riparian wetland being affected. While this is the most likely option, the possibility of shoreline access roads from both directions is being considered, so there is a potential for the entire 0.3 ha of wetland being affected by construction.

There is some potential to increase the proportion of invasive plant species within the wetland habitat as a result of the disturbance associated with construction, although the wetland is within the ice scour zone and is already subject to regular, intense disturbance and is not anticipated to change greatly outside of the permanent construction footprint.

The timing of construction might have effects on the function of wetland and vegetated habitat as there is more potential to affect wildlife that is supported by those habitats during the warmer months. This will be addressed in the Wildlife VC.

5.1.1.2 Vegetation

Of the ten hectares of PDA area, only approximately two hectares are vegetated (excluding lawns). It is expected that most of the vegetated habitat affected during construction will be through the installation of the temporary shoreline access road and work pad at the base of the bridge. This area will mainly affect the narrow band of wetland habitat along the shoreline. The trees portions of the PDA will be largely unaffected, including the 0.2 ha of undeveloped lots to the west of the CBSA facility. While the wetland habitat is of higher value, the majority of non-wetland vegetation community that might be affected by construction has low ecological integrity because of frequent exposure to disturbance and high proportions of non-native and invasive species such as Manitoba maple (*Acer negundo*), reed-canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), and bittersweet nightshade (*Solanum dulcamara*).

Because the bridge footprint will be somewhat similar to the existing bridge, the effects on the vegetation community are anticipated to be temporary and once the PDA regenerates, it is expected that the vegetation community will be of similar character, composition, and total area. There is a potential for increase in the proportion of invasive species due to the disturbance.

SAR and SOCC

There were no SAR or SOCC found within the PDA during field surveys and therefore no adverse effects are anticipated. Follow-up surveys will be conducted within the 2019 growing season to determine if there are any plant SAR or SOCC within the more recently added portions of the PDA.

5.1.2 Potential Interactions with Wetlands and Vegetation during operation and maintenance

5.1.2.1 Wetland and Vegetation

The application of road salt and sand during winter has the potential to affect the vegetation community in the vicinity of the new bridge. However, no significant differences attributable to salinity were observed in the vegetation near the current bridge vs. further away that would be attributed to increased salinity. The application of sand has the potential to result in an increase in sedimentation in the area of the Project.

Maintenance of the Project may create dust and other sediments that have the potential to enter the vegetated habitat and potentially alter them slightly, although this potential is low and any effect would be temporary.

5.1.3 Accidents, Malfunctions, and Unplanned Events

Accidents, malfunctions, and unplanned events are occurrences that are not part of planned activities or normal operation of the Project and have the potential to result in adverse environmental interactions. Given the adherence of Project activities to mitigation measures (e.g., good planning and design, vehicle and equipment maintenance, worksite health, safety, and environmental training of personnel), including those in the NBDTI Environmental Management Manual (EMM; NBDOT 2010), accidents, malfunctions, and unplanned events of a serious nature are unlikely to occur during any phase of the Project.

The accidents, malfunctions, and unplanned events that have potential to occur for this Project, and could potentially interact with the wetland and vegetated environment include:

- vehicle collision;
- hazardous material spill; and
- erosion and sediment control failure.

Spills and fire could alter or damage vegetation and wetland plant communities although the effects are considered temporary and the communities present are not of a rare or highly important type such that alterations would present a potentially significant effect.

Mitigation for accidents, malfunctions, and unplanned events is described in Section **Error! Reference source not found.**.

- hazardous material spill;
- erosion and sediment control failure;
- bridge washout;
- project-caused fire; and
- vehicle collision.

5.2 MITIGATION FOR WETLANDS AND VEGETATION

5.2.1 Standard Mitigation

Interaction of the Project activities with Wetlands and Vegetation will be managed through the use of mitigation measures, including adherence to the NBDTI EMM. Measures which will be employed to mitigate interactions with Wetlands and Vegetation are presented in **Error! Reference source not found.**

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

Table 2 Sections of the NBDTI EMM (4th ed.) Applicable to Wetlands and Vegetation

Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation in NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
Construction including: • substructure • approaches and Canadian Port of Entry Modification • temporary laydown areas or access roads • superstructure including bridge deck • removal of existing bridge	• Reduction in vegetation or wetland habitat • Increase in erosion • Dust emissions damaging vegetation communities	• 5.3 Clearing • 5.5 Detouring • 5.6 Dust Control • 5.7 Erosion and Sediment Management • 5.8 Excavation, Blasting and Aggregate Production • 5.11 Grubbing • 5.15 Structures • 5.17 Temporary Ancillary Facility Management • 5.19 Vehicle and Equipment Management • 5.20 Waste Management • 5.21 Winter Highway Maintenance • 5.22 Work Progression • 5.23 Working Near Environmentally Sensitive Areas • 5.25 Sulphide Bearing Rock & Acid Rock Drainage Management	• Any temporary access roads along the shoreline will be constructed using clean rock material and will be constructed on geogrid or geotextile and removed following construction and the pre-construction grade restored. • Any ruts created by Equipment within 30 m of a watercourse shall be immediately graded • smooth and blanketed with hay/straw mulch. • To prevent the spread of invasive plants, no washing of tools or machinery shall occur within 30 m or a watercourse of wetland. • Equipment shall not be stationed and materials shall not be stored in a wetland at any time, • All exposed erodible material within 30 m of a watercourse or wetland shall be stabilized with hay mulch at the end of each work day.
Operation and maintenance including: operation of infrastructure (including snow and ice removal), preservation and maintenance of structures.	• Introduction of deleterious substances damaging to vegetation or wetland habitat.	• 5.10 Fire Prevention and Contingency • 5.15 Structures • 5.16 Summer Highway Maintenance • 5.21 Winter Highway Maintenance	No additional mitigation recommended

Assessment of Potential Project Interactions with Wetlands and Vegetation
February 2019

Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation in NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
Accidents, malfunctions, and unplanned events including: • Hazardous Material Spill • Erosion and Sediment Control Failure	• Change or loss of vegetation and wetland habitat	• 5.10 Fire Prevention and Contingency • 5.12 Spill Management • 5.13 Storage and Handling of Petroleum Products • 5.15 Structures • 5.19 Vehicle and Equipment Management	No additional mitigation recommended

5.3 CHARACTERIZATION OF RESIDUAL PROJECT-ENVIRONMENTAL INTERACTIONS FOR WETLANDS AND VEGETATION

5.3.1 Construction

Mitigation measures as outlined in Section 5.2 and the NBDTI EMM will reduce the likelihood, duration and magnitude of effects on the wetland and vegetated environment.

The use of geogrid or geotextile to underlie any temporary access roads and work pads will facilitate the complete removal of any introduced material. The rocky substrate of the wetland is expected to quickly regenerate following removal of temporary access roads. The wetland habitat is subject to annual, high intensity disturbance through ice scour, and water-borne seed sources allow the wetland to quickly recover from disturbance. Management of invasive species will help to prevent the introduction and spread of invasive species but the string presence of invasive species on the site is expected to continue following construction.

Alteration or destruction of vegetated wetland habitat is not anticipated to result in changes to vegetation community types, at the local or landscape level. No effects on plant SAR or SOCC are anticipated.

In summary, no substantive residual effects are anticipated and those effects on wetlands and vegetation that occur during construction should be low in magnitude and temporary.

5.3.2 Operation and Maintenance

Substantive changes to vegetation and wetlands during operation and maintenance activities due to dust, sediment, or road salt, are not anticipated as the area of the bridge is small relative to the overall river size and discharge, and activities will be limited and conducted in accordance with the NBDTI EMM. As such, no substantive residual effects to the wetland and vegetated environment are anticipated as a result of Project-related activities during the construction or operation and maintenance phases of the project.

6.0 SUMMARY AND RECOMMENDATIONS

With the implementation of mitigation and environmental protection measures as described in the EMM and in this assessment, it is not anticipated that there will be any substantial permanent interaction between the Project and the wetlands and vegetation as a result of construction or operation and maintenance phases of the Project. The potential effects to the wetland and vegetated environment can be mitigated through standard environmental protection practices (e.g., use of temporary access, sediment and erosion control structures, avoiding sensitive periods, minimizing clearing), as described in NBDTI 's EMM (2010) and the EMP that will be prepared for the project.

The potentially adverse effects resulting from the temporary loss of a small area of wetland along the shoreline is temporary and the wetland is expected to recover fully following construction. The vegetation communities within the PDA are locally abundant and no SAR or SOCC were found to occur within the PDA. A follow-up survey will be

conducted in summer of 2019 to record any SAR or SOCC That occur in newly added portions of the PDA that were not surveyed in 2018.

7.0 REFERENCES

ACCDC (Atlantic Canada Conservation Data Centre). 2018. Data Report 5998: Edmundston/Madawaska Bridge, NB. Prepared January 15, 2018.

CESCC. 2015. Canadian Endangered Species Conservation Council. 2016. Wild Species 2015: The General Status of Species in Canada. National General Status Working Group: 128 pp.

National Wetlands Working Group. 1997. The Canadian Wetland Classification System, 2nd Edition. Warner, B.G. and C.D.A. Rubec (eds.), Wetlands Research Centre, University of Waterloo, Waterloo, ON, Canada. 68 p.

NBDELG 2002. New Brunswick Wetlands Conservation Policy. 2002. New Brunswick Departments of Environment and Natural Resources and Energy.

NBDOT (New Brunswick Department of Transportation). 2010. Environmental Management Manual. 4th Edition.

Tims, J. & Craig, N. 1995. Environmentally Significant Areas in New Brunswick (NBESA). NB Dept of Environment & Nature Trust of New Brunswick Inc, 6042 recs.

Appendix A ACCDC DATA REPORT

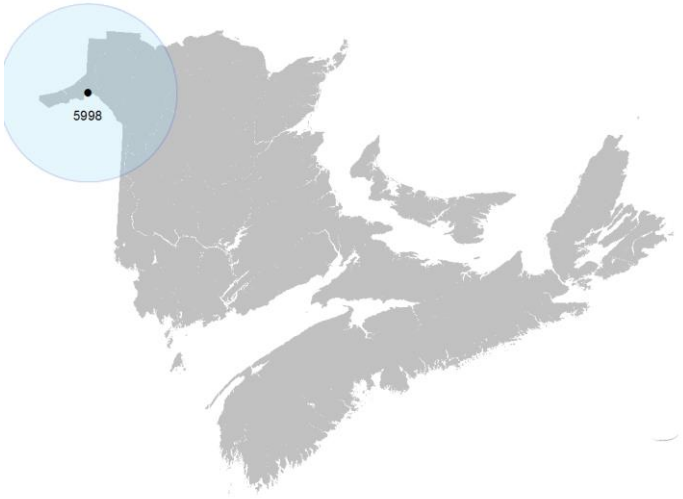
ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

DATA REPORT 5998: Edm Mad Bridge, NB

Prepared 15 January 2018
by J. Churchill, Data Manager

CONTENTS OF REPORT



Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (ACCDC) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The ACCDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the ACCDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees. URL: www.ACCDC.com.

Upon request and for a fee, the ACCDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the ACCDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

1.1 DATA LIST

Included datasets:

Filename	Contents
EdmMadBrNB_5998ob.xls	All Rare and legally protected *Flora and Fauna* in your study area
EdmMadBrNB_5998ob100km.xls	A list of Rare and legally protected *Flora and Fauna* within 100 km of your study area
EdmMadBrNB_5998sa.xls	All *Significant Natural Areas* in your study area

1.2 RESTRICTIONS

The ACCDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting ACCDC data, recipients assent to the following limits of use:

a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
c) The ACCDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
d) ACCDC data responses are restricted to the data in our Data System at the time of the data request.
e) Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
f) ACCDC data responses are not to be construed as exhaustive inventories of taxa in an area.
g) The absence of a taxon cannot be inferred by its absence in an ACCDC data response.

1.3 ADDITIONAL INFORMATION

The attached file DataDictionary 2.1.pdf provides metadata for the data provided.

Please direct any additional questions about ACCDC data to the following individuals:

Plants, Lichens, Ranking Methods, All other Inquiries
Sean Blaney, Senior Scientist, Executive Director
Tel: (506) 364-2658
sblaney@mta.ca

Animals (Fauna)
John Klymko, Zoologist
Tel: (506) 364-2660
jklymko@mta.ca

Plant Communities
Sarah Robinson, Community Ecologist
Tel: (506) 364-2664
srobinson@mta.ca

Data Management, GIS
James Churchill, Data Manager
Tel: (902) 679-6146
jlchurchill@mta.ca

Billing
Jean Breau
Tel: (506) 364-2657
jrbreau@mta.ca

Questions on the biology of Federal Species at Risk can be directed to ACCDC: (506) 364-2658, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Stewart Lusk, Natural Resources: (506) 453-7110.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Sherman Boates, NSDNR: (902) 679-6146. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NSDNR Regional Biologist:

Western: Duncan Bayne
(902) 648-3536
Duncan.Bayne@novascotia.ca

Western: Jason Power
(902) 634-7555
Jason.Power@novascotia.ca

Central: Shavonne Meyer
(902) 893-6353
Shavonne.Meyer@novascotia.ca

Central: Kimberly George
(902) 893-5630
Kimberly.George@novascotia.ca

Eastern: Lisa Doucette
(902) 863-7523
Lisa.Doucette@novascotia.ca

Eastern: Terry Power
(902) 563-3370
Terrance.Power@novascotia.ca

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Garry Gregory, PEI Dept. of Communities, Land and Environment: (902) 569-7595.

2.0 RARE AND ENDANGERED SPECIES

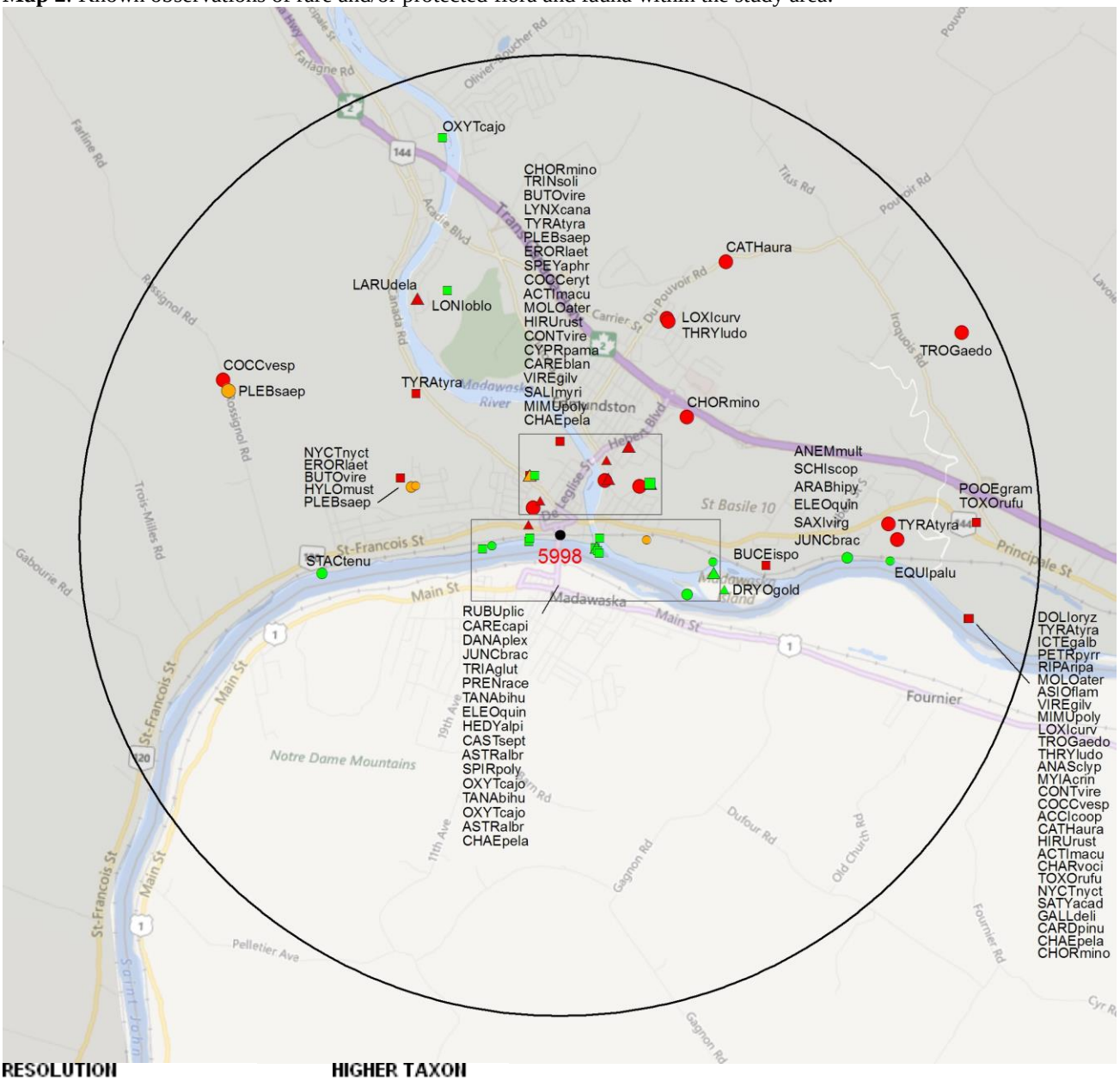
2.1 FLORA

The study area contains 29 records of 23 vascular, no records of nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 93 records of 35 vertebrate, 14 records of 5 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

Map 2: Known observations of rare and/or protected flora and fauna within the study area.



3.0 SPECIAL AREAS

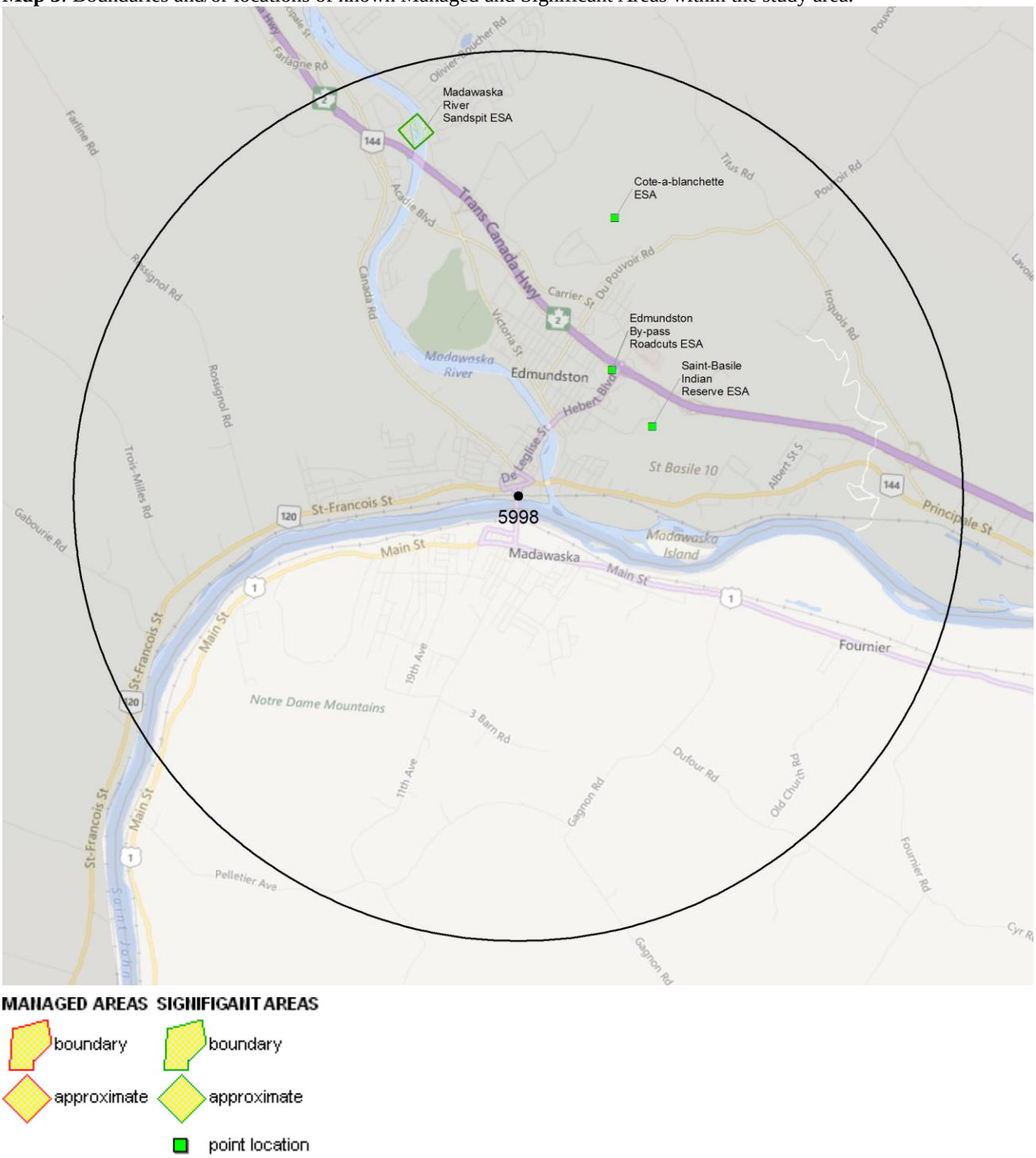
3.1 MANAGED AREAS

The GIS scan identified no managed areas in the vicinity of the study area (Map 3).

3.2 SIGNIFICANT AREAS

The GIS scan identified 4 biologically significant sites in the vicinity of the study area (Map 3 and attached file: *sa*.xls).

Map 3: Boundaries and/or locations of known Managed and Significant Areas within the study area.



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding "location-sensitive" species, section 4.3) within the study area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community. Note: records are from attached files *ob.xls/*ob.shp only.

4.1 FLORA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	*Rubus plicatifolius*	Plait-leaved Dewberry				S1	5 Undetermined	1	0.4 ± 5.0
P	*Carex blanda*	Eastern Woodland Sedge				S1	2 May Be At Risk	1	1.1 ± 2.0
P	*Saxifraga virginiensis*	Early Saxifrage				S1S2	2 May Be At Risk	1	3.0 ± 0.0
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S2	3 Sensitive	3	1.5 ± 0.0
P	*Anemone multifida*	Cut-leaved Anemone				S2	3 Sensitive	1	3.0 ± 0.0
P	*Castilleja septentrionalis*	Northeastern Paintbrush				S2	3 Sensitive	1	0.8 ± 5.0
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	2 May Be At Risk	1	0.7 ± 2.0
P	*Schizachyrium scoparium*	Little Bluestem				S2	3 Sensitive	1	3.0 ± 0.0
P	*Salix myricoides*	Bayberry Willow				S2?	3 Sensitive	1	1.1 ± 10.0
P	*Lonicera oblongifolia*	Swamp Fly Honeysuckle				S2S3	3 Sensitive	1	2.8 ± 5.0
P	*Juncus brachycephalus*	Small-Head Rush				S2S3	3 Sensitive	2	0.7 ± 0.0
P	*Prenanthes racemosa*	Glaucous Rattlesnakeroot				S3	4 Secure	1	0.4 ± 5.0
P	*Tanacetum bipinnatum ssp. huronense*	Lake Huron Tansy				S3	4 Secure	2	0.4 ± 5.0
P	*Arabis hirsuta var. pycnocarpa*	Western Hairy Rockcress				S3	4 Secure	1	3.0 ± 0.0
P	*Astragalus alpinus var. brunetianus*	Alpine Milk-Vetch				S3	4 Secure	2	0.4 ± 1.0
P	*Hedysarum alpinum*	Alpine Sweet-vetch				S3	4 Secure	1	0.4 ± 5.0
P	*Stachys tenuifolia*	Smooth Hedge-Nettle				S3	3 Sensitive	1	2.5 ± 0.0
P	*Carex capillaris*	Hairlike Sedge				S3	4 Secure	1	0.3 ± 5.0
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S3	4 Secure	2	0.7 ± 0.0
P	*Triantha glutinosa*	Sticky False-Asphodel				S3	4 Secure	1	0.3 ± 5.0
P	*Dryopteris goldiana*	Goldie's Woodfern				S3	3 Sensitive	1	1.8 ± 0.0
P	*Equisetum palustre*	Marsh Horsetail				S3	4 Secure	1	3.4 ± 0.0
P	*Spirodela polyrrhiza*	Great Duckweed				S3S4	4 Secure	1	1.6 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Hylocichla mustelina*	Wood Thrush	Threatened		Threatened	S1S2B,S1S2M	2 May Be At Risk	1	1.8 ± 7.0
A	*Hirundo rustica*	Barn Swallow	Threatened		Threatened	S2B,S2M	3 Sensitive	5	0.7 ± 4.0
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	1 At Risk	5	0.3 ± 0.0
A	*Riparia riparia*	Bank Swallow	Threatened			S2S3B,S2S3M	3 Sensitive	1	4.3 ± 7.0
A	*Dolichonyx oryzivorus*	Bobolink	Threatened		Threatened	S3B,S3M	3 Sensitive	3	4.3 ± 7.0
A	*Chordeiles minor*	Common Nighthawk	Threatened	Threatened	Threatened	S3B,S4M	1 At Risk	8	0.4 ± 0.0
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern	Special Concern	S2B,S2M	3 Sensitive	1	4.3 ± 7.0
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern	Special Concern	S2M,S2N	3 Sensitive	1	2.2 ± 5.0
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern			S3B,S3S4N,SUM	3 Sensitive	2	3.9 ± 0.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern		Special Concern	S4B,S4M	4 Secure	2	0.7 ± 4.0
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1S2B,S1S2M	2 May Be At Risk	1	4.3 ± 7.0
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S3	1 At Risk	3	1.1 ± 1.0
A	*Thryothorus ludovicianus*	Carolina Wren				S1B,S1M	8 Accidental	2	2.5 ± 0.0
A	*Butorides virescens*	Green Heron				S1S2B,S1S2M	3 Sensitive	2	1.0 ± 5.0
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1S2B,S1S2M	3 Sensitive	2	1.8 ± 7.0
A	*Troglodytes aedon*	House Wren				S1S2B,S1S2M	5 Undetermined	3	4.3 ± 7.0
A	*Mimus polyglottos*	Northern Mockingbird				S2B,S2M	3 Sensitive	2	0.7 ± 0.0
A	*Toxostoma rufum*	Brown Thrasher				S2B,S2M	3 Sensitive	4	4.3 ± 7.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Pooecetes gramineus*	Vesper Sparrow				S2B,S2M	2 May Be At Risk	1	4.3 ± 7.0
A	*Tringa solitaria*	Solitary Sandpiper				S2B,S5M	4 Secure	1	1.0 ± 5.0
A	*Anas clypeata*	Northern Shoveler				S2S3B,S2S3M	4 Secure	1	4.3 ± 7.0
A	*Myiarchus crinitus*	Great Crested Flycatcher				S2S3B,S2S3M	3 Sensitive	1	4.3 ± 7.0
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B,S2S3M	3 Sensitive	1	4.3 ± 7.0
A	*Loxia curvirostra*	Red Crossbill				S3	4 Secure	2	2.5 ± 0.0
A	*Carduelis pinus*	Pine Siskin				S3	4 Secure	2	4.3 ± 7.0
A	*Cathartes aura*	Turkey Vulture				S3B,S3M	4 Secure	2	3.3 ± 0.0
A	*Charadrius vociferus*	Killdeer				S3B,S3M	3 Sensitive	6	4.3 ± 7.0
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B,S3M	4 Secure	1	0.7 ± 4.0
A	*Vireo gilvus*	Warbling Vireo				S3B,S3M	4 Secure	2	1.0 ± 0.0
A	*Molothrus ater*	Brown-headed Cowbird				S3B,S3M	2 May Be At Risk	2	0.7 ± 4.0
A	*Icterus galbula*	Baltimore Oriole				S3B,S3M	4 Secure	3	4.3 ± 7.0
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B,S3S4M	3 Sensitive	9	0.8 ± 1.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S5M	4 Secure	7	0.7 ± 4.0
A	*Gallinago delicata*	Wilson's Snipe				S3S4B,S5M	4 Secure	3	4.3 ± 7.0
A	*Larus delawarensis*	Ring-billed Gull				S3S4B,S5M	4 Secure	1	2.9 ± 2.0
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Special Concern	S3B,S3M	3 Sensitive	1	0.9 ± 0.0
I	*Erora laeta*	Early Hairstreak				S1	2 May Be At Risk	3	0.7 ± 1.0
I	*Plebejus saepiolus*	Greenish Blue				S1S2	4 Secure	4	0.7 ± 1.0
I	*Satyrium acadica*	Acadian Hairstreak				S3	4 Secure	1	4.3 ± 7.0
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	5	0.7 ± 1.0

4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species "location sensitive". Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting your study area are indicated below with "YES".

New Brunswick

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
Chrysemys picta picta	Eastern Painted Turtle			No
Chelydra serpentina	Snapping Turtle	Special Concern	Special Concern	No
Glyptemys insculpta	Wood Turtle	Threatened	Threatened	No
Haliaeetus leucocephalus	**Bald Eagle**		**Endangered**	**YES**
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.	Special Concern	Endangered	No
Cicindela marginipennis	Cobblestone Tiger Beetle	Endangered	Endangered	No
Coenonympha nipisiquit	Maritime Ringlet	Endangered	Endangered	No
Bat Hibernaculum		[Endangered][1]	[Endangered][1]	No

1 *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NB Species at Risk Act.

4.4 SOURCE BIBLIOGRAPHY

The recipient of these data shall acknowledge the ACCDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

# recs	CITATION
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8	Clayden, S.R. 1998. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, 19759 recs.
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5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 4869 records of 87 vertebrate and 102 records of 28 invertebrate fauna; 4027 records of 228 vascular, 157 records of 76 nonvascular flora (attached: *ob100km.xls).

Taxa within 100 km of the study site that are rare and/or endangered in the province in which the study site occurs. All ranks correspond to the province in which the study site falls, even for out-of-province records. Taxa are listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record).

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Myotis septentrionalis*	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	2	87.0 ± 1.0	NB
A	*Rangifer tarandus pop. 2*	Woodland Caribou (Atlantic-Gasp├⌐sie pop.)	Endangered	Endangered	Extirpated	SX	0.1 Extirpated	1	87.2 ± 1.0	NB
A	*Emydoidea blandingii*	Blanding's Turtle - Nova Scotia pop.	Endangered	Endangered				1	94.5 ± 1.0	NB
A	*Sturnella magna*	Eastern Meadowlark	Threatened		Threatened	S1B,S1M	2 May Be At Risk	9	19.5 ± 7.0	NB
A	*Ixobrychus exilis*	Least Bittern	Threatened	Threatened	Threatened	S1S2B,S1S2M	1 At Risk	4	10.5 ± 0.0	NB
A	*Hylocichla mustelina*	Wood Thrush	Threatened		Threatened	S1S2B,S1S2M	2 May Be At Risk	120	1.8 ± 7.0	NB
A	*Caprimulgus vociferus*	Whip-Poor-Will	Threatened	Threatened	Threatened	S2B,S2M	1 At Risk	4	74.4 ± 7.0	NB
A	*Hirundo rustica*	Barn Swallow	Threatened		Threatened	S2B,S2M	3 Sensitive	289	0.7 ± 4.0	NB
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Special Concern	Threatened	S2B,S2M	1 At Risk	139	21.3 ± 0.0	NB
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2S3	1 At Risk	10	19.9 ± 0.0	NB
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	1 At Risk	114	0.3 ± 0.0	NB
A	*Riparia riparia*	Bank Swallow	Threatened			S2S3B,S2S3M	3 Sensitive	119	4.3 ± 7.0	NB
A	*Contopus cooperi*	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3B,S3M	1 At Risk	376	12.0 ± 0.0	NB
A	*Wilsonia canadensis*	Canada Warbler	Threatened	Threatened	Threatened	S3B,S3M	1 At Risk	424	5.3 ± 0.0	NB
A	*Dolichonyx oryzivorus*	Bobolink	Threatened		Threatened	S3B,S3M	3 Sensitive	169	4.3 ± 7.0	NB
A	*Chordeiles minor*	Common Nighthawk	Threatened	Threatened	Threatened	S3B,S4M	1 At Risk	106	0.4 ± 0.0	NB
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern	Special Concern	S2B,S2M	3 Sensitive	14	4.3 ± 7.0	NB
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern	Special Concern	S2M,S2N	3 Sensitive	1	2.2 ± 5.0	NB
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Special Concern	S3	3 Sensitive	1	49.5 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Special Concern	S3B,S3M	2 May Be At Risk	100	20.3 ± 7.0	NB
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern			S3B,S3S4N,SUM	3 Sensitive	192	3.9 ± 0.0	NB
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern			S3M	3 Sensitive	2	37.5 ± 0.0	NB
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern		Special Concern	S4B,S4M	4 Secure	191	0.7 ± 4.0	NB
A	*Podiceps auritus*	Horned Grebe	Special Concern		Special Concern	S4N,S4M	4 Secure	1	24.1 ± 2.0	NB
A	*Bubo scandiacus*	Snowy Owl	Not At Risk			S1N,S2S3M	4 Secure	2	35.0 ± 1.0	NB
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1S2B,S1S2M	2 May Be At Risk	8	4.3 ± 7.0	NB
A	*Fulica americana*	American Coot	Not At Risk			S1S2B,S1S2M	3 Sensitive	2	15.4 ± 0.0	NB
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	3	99.1 ± 1.0	NB
A	*Buteo lineatus*	Red-shouldered Hawk	Not At Risk	Special Concern		S2B,S2M	2 May Be At Risk	9	36.7 ± 0.0	NB
A	*Chlidonias niger*	Black Tern	Not At Risk			S2B,S2M	3 Sensitive	3	15.8 ± 0.0	NB
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S3	1 At Risk	84	1.1 ± 1.0	NB
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B,SUM	3 Sensitive	32	9.9 ± 0.0	NB
A	*Podiceps grisegena*	Red-necked Grebe	Not At Risk			S3M,S2N	3 Sensitive	1	24.1 ± 0.0	NB
A	*Haliaeetus leucocephalus*	Bald Eagle	Not At Risk		Endangered	S4	1 At Risk	88	4.3 ± 7.0	NB
A	*Puma concolor pop. 1*	Eastern Cougar	Data Deficient		Endangered	SU	5 Undetermined	8	72.8 ± 1.0	NB
A	*Tringa melanoleuca*	Greater Yellowlegs				S1?B,S5M	4 Secure	16	6.9 ± 0.0	NB
A	*Progne subis*	Purple Martin				S1B,S1M	2 May Be At Risk	18	75.1 ± 7.0	NB
A	*Thryothorus ludovicianus*	Carolina Wren				S1B,S1M	8 Accidental	2	2.5 ± 0.0	NB
A	*Oxyura jamaicensis*	Ruddy Duck				S1B,S2S3M	4 Secure	4	36.3 ± 0.0	NB
A	*Aythya affinis*	Lesser Scaup				S1B,S4M	4 Secure	1	55.5 ± 0.0	NB
A	*Eremophila alpestris*	Horned Lark				S1B,S4N,S5M	2 May Be At Risk	33	24.1 ± 1.0	NB
A	*Chroicocephalus ridibundus*	Black-headed Gull				S1N,S2M	3 Sensitive	1	64.8 ± 0.0	NB
A	*Butorides virescens*	Green Heron				S1S2B,S1S2M	3 Sensitive	10	1.0 ± 5.0	NB
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1S2B,S1S2M	3 Sensitive	17	1.8 ± 7.0	NB
A	*Empidonax traillii*	Willow Flycatcher				S1S2B,S1S2M	3 Sensitive	4	25.8 ± 7.0	NB
A	*Troglodytes aedon*	House Wren				S1S2B,S1S2M	5 Undetermined	5	4.3 ± 7.0	NB
A	*Calidris bairdii*	Baird's Sandpiper				S1S2M	3 Sensitive	2	6.8 ± 5.0	NB
A	*Microtus chrotorrhinus*	Rock Vole				S2?	5 Undetermined	5	90.0 ± 1.0	NB
A	*Mimus polyglottos*	Northern Mockingbird				S2B,S2M	3 Sensitive	27	0.7 ± 0.0	NB
A	*Toxostoma rufum*	Brown Thrasher				S2B,S2M	3 Sensitive	63	4.3 ± 7.0	NB
A	*Pooecetes gramineus*	Vesper Sparrow				S2B,S2M	2 May Be At Risk	19	4.3 ± 7.0	NB
A	*Pinicola enucleator*	Pine Grosbeak				S2B,S4S5N,S4S5M	3 Sensitive	57	16.2 ± 2.0	NB
A	*Tringa solitaria*	Solitary Sandpiper				S2B,S5M	4 Secure	13	1.0 ± 5.0	NB
A	*Asio otus*	Long-eared Owl				S2S3	5 Undetermined	12	17.8 ± 7.0	NB
A	*Picoides dorsalis*	American Three-toed Woodpecker				S2S3	3 Sensitive	16	8.7 ± 7.0	NB
A	*Salmo salar*	Atlantic Salmon				S2S3	2 May Be At Risk	105	57.9 ± 0.0	NB
A	*Anas clypeata*	Northern Shoveler				S2S3B,S2S3M	4 Secure	18	4.3 ± 7.0	NB
A	*Myiarchus crinitus*	Great Crested Flycatcher				S2S3B,S2S3M	3 Sensitive	22	4.3 ± 7.0	NB
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B,S2S3M	3 Sensitive	128	4.3 ± 7.0	NB
A	*Pluvialis dominica*	American Golden-Plover				S2S3M	3 Sensitive	2	6.9 ± 0.0	NB
A	*Loxia curvirostra*	Red Crossbill				S3	4 Secure	20	2.5 ± 0.0	NB
A	*Carduelis pinus*	Pine Siskin				S3	4 Secure	94	4.3 ± 7.0	NB
A	*Prosopium cylindraceum*	Round Whitefish				S3	4 Secure	6	26.9 ± 1.0	NB
A	*Salvelinus namaycush*	Lake Trout				S3	3 Sensitive	5	26.9 ± 1.0	NB
A	*Cathartes aura*	Turkey Vulture				S3B,S3M	4 Secure	24	3.3 ± 0.0	NB
A	*Rallus limicola*	Virginia Rail				S3B,S3M	3 Sensitive	8	8.0 ± 0.0	NB
A	*Charadrius vociferus*	Killdeer				S3B,S3M	3 Sensitive	235	4.3 ± 7.0	NB
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B,S3M	4 Secure	13	0.7 ± 4.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Vireo gilvus*	Warbling Vireo				S3B,S3M	4 Secure	53	1.0 ± 0.0	NB
A	*Piranga olivacea*	Scarlet Tanager				S3B,S3M	4 Secure	141	5.7 ± 7.0	NB
A	*Passerina cyanea*	Indigo Bunting				S3B,S3M	4 Secure	13	62.9 ± 7.0	NB
A	*Molothrus ater*	Brown-headed Cowbird				S3B,S3M	2 May Be At Risk	70	0.7 ± 4.0	NB
A	*Icterus galbula*	Baltimore Oriole				S3B,S3M	4 Secure	55	4.3 ± 7.0	NB
A	*Somateria mollissima*	Common Eider				S3B,S4M,S3N	4 Secure	2	72.4 ± 0.0	NB
A	*Dendroica tigrina*	Cape May Warbler				S3B,S4S5M	4 Secure	105	5.7 ± 7.0	NB
A	*Anas acuta*	Northern Pintail				S3B,S5M	3 Sensitive	6	25.2 ± 7.0	NB
A	*Mergus serrator*	Red-breasted Merganser				S3B,S5M,S4S5N	4 Secure	21	11.1 ± 7.0	NB
A	*Arenaria interpres*	Ruddy Turnstone				S3M	4 Secure	1	6.9 ± 0.0	NB
A	*Bucephala albeola*	Bufflehead				S3M,S2N	3 Sensitive	1	24.1 ± 1.0	NB
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B,S3S4M	3 Sensitive	165	0.8 ± 1.0	NB
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S5M	4 Secure	235	0.7 ± 4.0	NB
A	*Gallinago delicata*	Wilson's Snipe				S3S4B,S5M	4 Secure	205	4.3 ± 7.0	NB
A	*Larus delawarensis*	Ring-billed Gull				S3S4B,S5M	4 Secure	64	2.9 ± 2.0	NB
A	*Dendroica striata*	Blackpoll Warbler				S3S4B,S5M	4 Secure	82	20.3 ± 7.0	NB
A	*Calidris pusilla*	Semipalmated Sandpiper				S3S4M	4 Secure	8	6.9 ± 0.0	NB
A	*Calidris melanotos*	Pectoral Sandpiper				S3S4M	4 Secure	5	6.8 ± 5.0	NB
A	*Calidris alba*	Sanderling				S3S4M,S1N	3 Sensitive	3	6.9 ± 0.0	NB
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Special Concern	S3B,S3M	3 Sensitive	6	0.9 ± 0.0	NB
I	*Ophiogomphus howei*	Pygmy Snaketail	Special Concern	Special Concern	Special Concern	S2	2 May Be At Risk	1	14.2 ± 0.0	NB
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern			S3?	3 Sensitive	1	45.9 ± 0.0	NB
I	*Erora laeta*	Early Hairstreak				S1	2 May Be At Risk	4	0.7 ± 1.0	NB
I	*Leucorrhinia patricia*	Canada Whiteface				S1	2 May Be At Risk	7	83.9 ± 1.0	NB
I	*Plebejus saepiolus*	Greenish Blue				S1S2	4 Secure	13	0.7 ± 10.0	NB
I	*Ophiogomphus colubrinus*	Boreal Snaketail				S1S2	2 May Be At Risk	2	23.7 ± 0.0	NB
I	*Aeshna juncea*	Rush Darner				S2	3 Sensitive	1	83.9 ± 1.0	NB
I	*Coenagrion interrogatum*	Subarctic Bluet				S2	3 Sensitive	6	22.8 ± 0.0	NB
I	*Hesperia sassacus*	Indian Skipper				S3	4 Secure	1	5.7 ± 7.0	NB
I	*Papilio brevicauda*	Short-tailed Swallowtail				S3	4 Secure	2	20.7 ± 0.0	NB
I	*Satyrium acadica*	Acadian Hairstreak				S3	4 Secure	3	4.3 ± 7.0	NB
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	7	0.7 ± 1.0	NB
I	*Boloria eunomia*	Bog Fritillary				S3	5 Undetermined	4	39.8 ± 0.0	NB
I	*Boloria bellona*	Meadow Fritillary				S3	4 Secure	2	14.4 ± 1.0	NB
I	*Polygonia satyrus*	Satyr Comma				S3	4 Secure	4	20.6 ± 0.0	NB
I	*Polygonia gracilis*	Hoary Comma				S3	4 Secure	6	5.7 ± 7.0	NB
I	*Nymphalis l-album*	Compton Tortoiseshell				S3	4 Secure	3	5.7 ± 7.0	NB
I	*Gomphus vastus*	Cobra Clubtail				S3	3 Sensitive	2	19.9 ± 0.0	NB
I	*Gomphus abbreviatus*	Spine-crowned Clubtail				S3	4 Secure	5	14.2 ± 0.0	NB
I	*Somatochlora albicincta*	Ringed Emerald				S3	4 Secure	4	83.9 ± 1.0	NB
I	*Somatochlora cingulata*	Lake Emerald				S3	4 Secure	5	63.6 ± 1.0	NB
I	*Somatochlora forcipata*	Forcipate Emerald				S3	4 Secure	3	22.0 ± 0.0	NB
I	*Lestes eurinus*	Amber-Winged Spreadwing				S3	4 Secure	1	83.9 ± 1.0	NB
I	*Alasmidonta undulata*	Triangle Floater				S3	3 Sensitive	4	10.4 ± 1.0	NB
I	*Pantala hymenaea*	Spot-Winged Glider				S3B,S3M	4 Secure	1	94.4 ± 1.0	NB
I	*Satyrium liparops*	Striped Hairstreak				S3S4	4 Secure	2	5.7 ± 7.0	NB
I	*Coccinella transversoguttata richardsoni*	Transverse Lady Beetle				SH	2 May Be At Risk	2	56.9 ± 1.0	NB
N	*Campylium halleri*	Haller's Fine Wet Moss				S1	2 May Be At Risk	2	57.0 ± 1.0	NB
N	*Drepanocladus capillifolius*	Hair Hook Moss				S1	5 Undetermined	1	75.8 ± 1.0	NB
N	*Grimmia unicolor*	a Moss				S1	2 May Be At Risk	1	74.9 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
N	*Hypnum recurvatum*	Recurved Plait Moss				S1	2 May Be At Risk	3	57.0 ± 1.0	NB
N	*Bryum pallens*	a Moss				S1?	2 May Be At Risk	3	56.5 ± 0.0	NB
N	*Catoscopium nigritum*	Black Golf Club Moss				S1?	2 May Be At Risk	4	57.0 ± 1.0	NB
N	*Dicranum bonjeanii*	Bonjean's Broom Moss				S1?	2 May Be At Risk	1	56.2 ± 1.0	NB
N	*Seligeria recurvata*	a Moss				S1?	2 May Be At Risk	5	57.0 ± 1.0	NB
N	*Timmia megapolitana*	Metropolitan Timmia Moss				S1?	2 May Be At Risk	3	66.8 ± 1.0	NB
N	*Metacalypogeia schusterana*	Schuster's Pouchwort				S1S2	6 Not Assessed	2	83.5 ± 1.0	NB
N	*Calliergon richardsonii*	Richardson's Spear Moss				S1S2	2 May Be At Risk	2	82.9 ± 1.0	NB
N	*Campylium radicale*	Long-stalked Fine Wet Moss				S1S2	5 Undetermined	1	85.9 ± 100.0	NB
N	*Grimmia longirostris*	a Moss				S1S2	2 May Be At Risk	1	57.0 ± 1.0	NB
N	*Hygrohypnum bestii*	Best's Brook Moss				S1S2	3 Sensitive	1	57.0 ± 10.0	NB
N	*Oncophorus virens*	Green Spur Moss				S1S2	2 May Be At Risk	3	57.0 ± 1.0	NB
N	*Platydictya confervoides*	a Moss				S1S2	3 Sensitive	5	57.0 ± 1.0	NB
N	*Seligeria brevifolia*	a Moss				S1S2	3 Sensitive	1	95.2 ± 1.0	NB
N	*Timmia austriaca*	Austrian Timmia Moss				S1S2	2 May Be At Risk	3	66.2 ± 1.0	NB
N	*Tomentypnum falcifolium*	Sickle-leaved Golden Moss				S1S2	2 May Be At Risk	2	68.3 ± 1.0	NB
N	*Bryohaplocladium microphyllum*	Tiny-leaved Haplocladium Moss				S1S2	2 May Be At Risk	7	68.0 ± 1.0	NB
N	*Tritomaria scitula*	Mountain Notchwort				S1S3	6 Not Assessed	1	67.7 ± 1.0	NB
N	*Cirriphyllum piliferum*	Hair-pointed Moss				S2	3 Sensitive	2	57.0 ± 1.0	NB
N	*Didymodon ferrugineus*	a moss				S2	3 Sensitive	1	57.0 ± 1.0	NB
N	*Ditrichum flexicaule*	Flexible Cow-hair Moss				S2	3 Sensitive	6	56.7 ± 1.0	NB
N	*Fontinalis hypnoides*	a moss				S2	3 Sensitive	1	68.7 ± 15.0	NB
N	*Hypnum pratense*	Meadow Plait Moss				S2	3 Sensitive	1	83.5 ± 1.0	NB
N	*Isopterygiopsis pulchella*	Neat Silk Moss				S2	3 Sensitive	1	93.7 ± 2.0	NB
N	*Meesia triquetra*	Three-ranked Cold Moss				S2	2 May Be At Risk	1	86.4 ± 100.0	NB
N	*Physcomitrium immersum*	a Moss				S2	3 Sensitive	2	57.0 ± 1.0	NB
N	*Pohlia elongata*	Long-necked Nodding Moss				S2	3 Sensitive	1	93.7 ± 2.0	NB
N	*Seligeria calcarea*	Chalk Brittle Moss				S2	3 Sensitive	1	81.0 ± 0.0	NB
N	*Tortula mucronifolia*	Mucronate Screw Moss				S2	3 Sensitive	3	57.0 ± 1.0	NB
N	*Zygodon viridissimus var. rupestris*	a moss				S2	3 Sensitive	2	74.1 ± 0.0	NB
N	*Anomobryum filiforme*	a moss				S2	5 Undetermined	1	57.0 ± 1.0	NB
N	*Barbilophozia lycopodioides*	Greater Pawwort				S2?	6 Not Assessed	1	95.6 ± 1.0	NB
N	*Anomodon minor*	Blunt-leaved Anomodon Moss				S2?	2 May Be At Risk	2	66.6 ± 0.0	NB
N	*Bryum pallescens*	Pale Bryum Moss				S2?	5 Undetermined	1	57.0 ± 1.0	NB
N	*Schistostega pennata*	Luminous Moss				S2?	3 Sensitive	1	61.7 ± 1.0	NB
N	*Seligeria campylopoda*	a Moss				S2?	3 Sensitive	3	57.0 ± 1.0	NB
N	*Seligeria diversifolia*	a Moss				S2?	3 Sensitive	2	80.6 ± 1.0	NB
N	*Trichodon cylindricus*	Cylindric Hairy-teeth Moss				S2?	3 Sensitive	1	86.5 ± 0.0	NB
N	*Plagiomnium rostratum*	Long-beaked Leafy Moss				S2?	3 Sensitive	3	85.5 ± 1.0	NB
N	*Hypogymnia bitteri*	Powdered Tube Lichen				S2?	5 Undetermined	2	53.3 ± 0.0	NB
N	*Bryum uliginosum*	a Moss				S2S3	3 Sensitive	2	57.0 ± 1.0	NB
N	*Bryum weigelii*	Weigel's Bryum Moss				S2S3	3 Sensitive	1	80.4 ± 3.0	NB
N	*Campylium polygamum*	a Moss				S2S3	3 Sensitive	2	56.7 ± 1.0	NB
N	*Didymodon rigidulus*	Rigid Screw Moss				S2S3	3 Sensitive	6	56.7 ± 1.0	NB
N	*Orthotrichum speciosum*	Showy Bristle Moss				S2S3	5 Undetermined	3	19.5 ± 5.0	NB
N	*Pohlia proligera*	Cottony Nodding Moss				S2S3	3 Sensitive	1	93.7 ± 2.0	NB
N	*Saelania glaucescens*	Blue Dew Moss				S2S3	3 Sensitive	1	68.7 ± 15.0	NB

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N	*Taxiphyllum deplanatum*	Imbricate Yew-leaved Moss				S2S3	3 Sensitive	1	19.5 ± 5.0	NB
N	*Plagiomnium drummondii*	Drummond's Leafy Moss				S2S3	3 Sensitive	2	36.3 ± 3.0	NB
N	*Parmeliopsis ambigua*	Green Starburst Lichen				S2S3	5 Undetermined	1	53.3 ± 0.0	NB
N	*Tortella fragilis*	Fragile Twisted Moss				S3	3 Sensitive	2	57.0 ± 1.0	NB
N	*Hymenostylium recurvirostre*	Hymenostylium Moss				S3	3 Sensitive	1	57.0 ± 1.0	NB
N	*Solorina saccata*	Woodland Owl Lichen				S3	5 Undetermined	1	83.1 ± 2.0	NB
N	*Peltigera membranacea*	Membranous Pelt Lichen				S3	5 Undetermined	1	33.9 ± 0.0	NB
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3S4	3 Sensitive	4	56.7 ± 1.0	NB
N	*Barbula convoluta*	Lesser Bird's-claw Beard Moss				S3S4	4 Secure	2	56.7 ± 1.0	NB
N	*Calliergon giganteum*	Giant Spear Moss				S3S4	3 Sensitive	1	67.2 ± 3.0	NB
N	*Dicranella cerviculata*	a Moss				S3S4	3 Sensitive	2	10.4 ± 1.0	NB
N	*Dicranella varia*	a Moss				S3S4	4 Secure	8	48.9 ± 3.0	NB
N	*Encalypta ciliata*	Fringed Extinquisher Moss				S3S4	3 Sensitive	1	19.5 ± 5.0	NB
N	*Fissidens bryoides*	Lesser Pocket Moss				S3S4	4 Secure	3	68.7 ± 15.0	NB
N	*Helodium blandowii*	Wetland-plume Moss				S3S4	4 Secure	1	78.5 ± 3.0	NB
N	*Heterocladium dimorphum*	Dimorphous Tangle Moss				S3S4	4 Secure	2	68.7 ± 15.0	NB
N	*Isopterygiopsis muelleriana*	a Moss				S3S4	4 Secure	4	68.7 ± 15.0	NB
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	4 Secure	1	57.0 ± 1.0	NB
N	*Pogonatum dentatum*	Mountain Hair Moss				S3S4	4 Secure	1	10.4 ± 1.0	NB
N	*Splachnum rubrum*	Red Collar Moss				S3S4	4 Secure	1	85.4 ± 2.0	NB
N	*Tomentypnum nitens*	Golden Fuzzy Fen Moss				S3S4	4 Secure	1	78.5 ± 3.0	NB
N	*Weissia controversa*	Green-Cushioned Weissia				S3S4	4 Secure	1	56.7 ± 1.0	NB
N	*Abietinella abietina*	Wiry Fern Moss				S3S4	4 Secure	3	56.7 ± 1.0	NB
N	*Trichostomum tenuirostre*	Acid-Soil Moss				S3S4	4 Secure	2	68.7 ± 15.0	NB
N	*Rauiella scita*	Smaller Fern Moss				S3S4	3 Sensitive	1	74.1 ± 0.0	NB
N	*Nephroma parile*	Powdery Kidney Lichen				S3S4	4 Secure	2	33.1 ± 0.0	NB
P	*Juglans cinerea*	Butternut	Endangered	Endangered	Endangered	S1	1 At Risk	15	53.8 ± 2.0	NB
P	*Pedicularis furbishiae*	Furbish Lousewort	Endangered	Endangered	Endangered	S1	1 At Risk	45	52.5 ± 0.0	NB
P	*Symphyotrichum anticostense*	Anticosti Aster	Threatened	Threatened	Endangered	S2S3	1 At Risk	116	13.9 ± 5.0	NB
P	*Pterospora andromedea*	Woodland Pinedrops			Endangered	S1	1 At Risk	5	94.9 ± 0.0	NB
P	*Cryptotaenia canadensis*	Canada Honewort				S1	2 May Be At Risk	5	66.9 ± 1.0	NB
P	*Antennaria parlinii*	a Pussytoes				S1	2 May Be At Risk	1	51.0 ± 0.0	NB
P	*Arnica lonchophylla*	Northern Arnica				S1	2 May Be At Risk	3	82.5 ± 5.0	NB
P	*Erigeron acris ssp. politus*	Bitter Fleabane				S1	2 May Be At Risk	3	45.2 ± 1.0	NB
P	*Hieracium robinsonii*	Robinson's Hawkweed				S1	3 Sensitive	2	57.0 ± 1.0	NB
P	*Symphyotrichum laeve*	Smooth Aster				S1	5 Undetermined	2	87.4 ± 1.0	NB
P	*Canadanthus modestus*	Great Northern Aster				S1	2 May Be At Risk	43	30.0 ± 0.0	NB
P	*Cynoglossum virginianum*	Wild Comfrey				S1	2 May Be At Risk	1	74.9 ± 1.0	NB
P	*Cynoglossum virginianum var. boreale*	Wild Comfrey				S1	2 May Be At Risk	4	51.6 ± 0.0	NB
P	*Arabis x divaricarpa*	Limestone Rockcress				S1	2 May Be At Risk	1	97.2 ± 1.0	NB
P	*Cardamine concatenata*	Cut-leaved Toothwort				S1	2 May Be At Risk	4	83.1 ± 0.0	NB

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P	*Draba breweri var. cana*	Brewer's Whitlow-grass				S1	2 May Be At Risk	1	85.3 ± 1.0	NB
P	*Chenopodium capitatum*	Strawberry-blite				S1	2 May Be At Risk	5	7.4 ± 10.0	NB
P	*Chenopodium simplex*	Maple-leaved Goosefoot				S1	2 May Be At Risk	1	85.2 ± 0.0	NB
P	*Drosera anglica*	English Sundew				S1	2 May Be At Risk	5	84.0 ± 0.0	NB
P	*Drosera linearis*	Slender-Leaved Sundew				S1	2 May Be At Risk	4	92.6 ± 0.0	NB
P	*Oxytropis deflexa var. foliolosa*	Nodding Locoweed				S1	2 May Be At Risk	8	87.2 ± 0.0	NB
P	*Ranunculus lapponicus*	Lapland Buttercup				S1	2 May Be At Risk	17	43.8 ± 0.0	NB
P	*Rubus plicatifolius*	Plait-leaved Dewberry				S1	5 Undetermined	6	0.4 ± 5.0	NB
P	*Valeriana dioica var. sylvatica*	Marsh Valerian				S1	2 May Be At Risk	2	51.0 ± 0.0	NB
P	*Viola canadensis*	Canada Violet				S1	2 May Be At Risk	1	74.8 ± 0.0	NB
P	*Carex blanda*	Eastern Woodland Sedge				S1	2 May Be At Risk	1	1.1 ± 2.0	NB
P	*Carex cephaloidea*	Thin-leaved Sedge				S1	2 May Be At Risk	3	40.6 ± 0.0	NB
P	*Carex merritt-fernaldii*	Merritt Fernald's Sedge				S1	2 May Be At Risk	1	55.3 ± 0.0	NB
P	*Carex norvegica*	Norway Sedge				S1	2 May Be At Risk	7	33.3 ± 0.0	NB
P	*Carex norvegica ssp. inferalpina*	Scandinavian Sedge				S1	2 May Be At Risk	15	43.5 ± 0.0	NB
P	*Carex sterilis*	Sterile Sedge				S1	2 May Be At Risk	1	42.7 ± 0.0	NB
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	2 May Be At Risk	2	67.1 ± 0.0	NB
P	*Rhynchospora capillacea*	Slender Beakrush				S1	2 May Be At Risk	5	11.5 ± 0.0	NB
P	*Juncus stygius ssp. americanus*	Moor Rush				S1	2 May Be At Risk	1	39.1 ± 10.0	NB
P	*Allium canadense*	Canada Garlic				S1	2 May Be At Risk	5	20.9 ± 0.0	NB
P	*Malaxis brachypoda*	White Adder's-Mouth				S1	2 May Be At Risk	1	22.9 ± 1.0	NB
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S1	2 May Be At Risk	1	92.8 ± 1.0	NB
P	*Festuca subverticillata*	Nodding Fescue				S1	2 May Be At Risk	3	67.3 ± 10.0	NB
P	*Stuckenia filiformis ssp. occidentalis*	Thread-leaved Pondweed				S1	2 May Be At Risk	3	42.3 ± 0.0	NB
P	*Potamogeton friesii*	Fries' Pondweed				S1	2 May Be At Risk	5	42.3 ± 0.0	NB
P	*Potamogeton strictifolius*	Straight-leaved Pondweed				S1	2 May Be At Risk	2	67.1 ± 100.0	NB
P	*Dryopteris clintoniana*	Clinton's Wood Fern				S1	2 May Be At Risk	1	39.1 ± 10.0	NB
P	*Gymnocarpium robertianum*	Limestone Oak Fern				S1	2 May Be At Risk	3	80.9 ± 0.0	NB
P	*Huperzia selago*	Northern Firmoss				S1	2 May Be At Risk	3	34.9 ± 0.0	NB
P	*Galium trifidum ssp. subbiflorum*	Three-petaled Bedstraw				S1?	5 Undetermined	4	47.1 ± 0.0	NB
P	*Sisyrinchium mucronatum*	Michaux's Blue-eyed-grass				S1?	5 Undetermined	6	48.5 ± 0.0	NB
P	*Rumex aquaticus var. fenestratus*	Western Dock				S1S2	2 May Be At Risk	29	33.3 ± 0.0	NB
P	*Anemone multifida var. richardsiana*	Cut-leaved Anemone				S1S2	5 Undetermined	8	24.2 ± 1.0	NB
P	*Saxifraga virginiensis*	Early Saxifrage				S1S2	2 May Be At Risk	5	3.0 ± 0.0	NB
P	*Carex crawei*	Crawe's Sedge				S1S2	2 May Be At Risk	4	85.4 ± 0.0	NB
P	*Selaginella rupestris*	Rock Spikemoss				S1S2	2 May Be At Risk	4	30.4 ± 0.0	NB
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S1S3	2 May Be At Risk	3	75.0 ± 0.0	NB
P	*Osmorhiza depauperata*	Blunt Sweet Cicely				S2	3 Sensitive	6	30.5 ± 1.0	NB
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2	3 Sensitive	6	67.1 ± 0.0	NB
P	*Sanicula odorata*	Clustered Sanicle				S2	2 May Be At Risk	4	66.8 ± 1.0	NB

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P	*Solidago simplex var. racemosa*	Sticky Goldenrod				S2	2 May Be At Risk	23	31.7 ± 0.0	NB
P	*Impatiens pallida*	Pale Jewelweed				S2	2 May Be At Risk	14	65.9 ± 0.0	NB
P	*Betula minor*	Dwarf White Birch				S2	3 Sensitive	17	38.0 ± 1.0	NB
P	*Arabis drummondii*	Drummond's Rockcress				S2	3 Sensitive	2	42.9 ± 0.0	NB
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	1	49.2 ± 1.0	NB
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S2	3 Sensitive	2	75.0 ± 0.0	NB
P	*Shepherdia canadensis*	Soapberry				S2	3 Sensitive	23	55.6 ± 0.0	NB
P	*Astragalus eucosmus*	Elegant Milk-vetch				S2	2 May Be At Risk	8	74.7 ± 0.0	NB
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S2	3 Sensitive	32	1.5 ± 0.0	NB
P	*Quercus macrocarpa*	Bur Oak				S2	2 May Be At Risk	1	83.2 ± 1.0	NB
P	*Nuphar lutea ssp. rubrodisca*	Red-disked Yellow Pond-lily				S2	3 Sensitive	3	48.8 ± 5.0	NB
P	*Orobanche uniflora*	One-Flowered Broomrape				S2	3 Sensitive	2	75.0 ± 0.0	NB
P	*Polygala senega*	Seneca Snakeroot				S2	3 Sensitive	23	71.6 ± 50.0	NB
P	*Anemone multifida*	Cut-leaved Anemone				S2	3 Sensitive	52	3.0 ± 0.0	NB
P	*Anemone parviflora*	Small-flowered Anemone				S2	3 Sensitive	12	94.8 ± 1.0	NB
P	*Hepatica nobilis var. obtusa*	Round-lobed Hepatica				S2	3 Sensitive	1	99.7 ± 1.0	NB
P	*Ranunculus longirostris*	Eastern White Water-Crowfoot				S2	5 Undetermined	3	46.1 ± 1.0	NB
P	*Rosa acicularis ssp. sayi*	Prickly Rose				S2	2 May Be At Risk	25	47.1 ± 0.0	NB
P	*Galium kamtschaticum*	Northern Wild Licorice				S2	3 Sensitive	7	46.4 ± 0.0	NB
P	*Salix candida*	Sage Willow				S2	3 Sensitive	19	42.0 ± 50.0	NB
P	*Castilleja septentrionalis*	Northeastern Paintbrush				S2	3 Sensitive	24	0.8 ± 5.0	NB
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S2	3 Sensitive	3	97.3 ± 0.0	NB
P	*Dirca palustris*	Eastern Leatherwood				S2	2 May Be At Risk	2	9.9 ± 10.0	NB
P	*Phryma leptostachya*	American Lopseed				S2	3 Sensitive	1	67.1 ± 0.0	NB
P	*Verbena urticifolia*	White Vervain				S2	2 May Be At Risk	3	80.2 ± 1.0	NB
P	*Viola novae-angliae*	New England Violet				S2	3 Sensitive	12	7.7 ± 0.0	NB
P	*Symplocarpus foetidus*	Eastern Skunk Cabbage				S2	3 Sensitive	3	16.3 ± 0.0	NB
P	*Carex concinna*	Beautiful Sedge				S2	3 Sensitive	32	55.0 ± 0.0	NB
P	*Carex granularis*	Limestone Meadow Sedge				S2	3 Sensitive	25	69.9 ± 0.0	NB
P	*Carex gynocrates*	Northern Bog Sedge				S2	3 Sensitive	14	33.1 ± 1.0	NB
P	*Carex hirtifolia*	Pubescent Sedge				S2	3 Sensitive	3	17.3 ± 0.0	NB
P	*Carex livida var. radicaulis*	Livid Sedge				S2	3 Sensitive	30	39.1 ± 5.0	NB
P	*Carex plantaginea*	Plantain-Leaved Sedge				S2	3 Sensitive	2	85.2 ± 1.0	NB
P	*Carex prairea*	Prairie Sedge				S2	3 Sensitive	19	33.1 ± 1.0	NB
P	*Carex rostrata*	Narrow-leaved Beaked Sedge				S2	3 Sensitive	9	29.9 ± 1.0	NB
P	*Carex sprengelii*	Longbeak Sedge				S2	3 Sensitive	20	20.8 ± 0.0	NB
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S2	2 May Be At Risk	8	39.1 ± 5.0	NB
P	*Carex albicans var. emmonsii*	White-tinged Sedge				S2	3 Sensitive	2	39.1 ± 5.0	NB
P	*Elodea nuttallii*	Nuttall's Waterweed				S2	3 Sensitive	9	10.3 ± 0.0	NB
P	*Amerorchis rotundifolia*	Small Round-leaved Orchis				S2	2 May Be At Risk	24	33.7 ± 1.0	NB
P	*Calypso bulbosa var. americana*	Calypso				S2	2 May Be At Risk	10	36.1 ± 5.0	NB
P	*Coeloglossum viride var. virescens*	Long-bracted Frog Orchid				S2	2 May Be At Risk	4	22.9 ± 1.0	NB
P	*Cypripedium parviflorum var.*	Small Yellow Lady's-Slipper				S2	2 May Be At Risk	7	0.7 ± 2.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	makasin									
P	*Galearis spectabilis*	Showy Orchis				S2	2 May Be At Risk	2	67.0 ± 10.0	NB
P	*Goodyera oblongifolia*	Menzies' Rattlesnake-plantain				S2	3 Sensitive	3	26.7 ± 1.0	NB
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	3 Sensitive	5	17.3 ± 0.0	NB
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S2	3 Sensitive	2	42.9 ± 0.0	NB
P	*Elymus canadensis*	Canada Wild Rye				S2	2 May Be At Risk	1	39.1 ± 5.0	NB
P	*Poa glauca*	Glaucous Blue Grass				S2	4 Secure	22	67.3 ± 0.0	NB
P	*Schizachyrium scoparium*	Little Bluestem				S2	3 Sensitive	47	3.0 ± 0.0	NB
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S2	3 Sensitive	3	84.6 ± 0.0	NB
P	*Woodsia alpina*	Alpine Cliff Fern				S2	3 Sensitive	39	67.8 ± 0.0	NB
P	*Lycopodium sitchense*	Sitka Clubmoss				S2	3 Sensitive	3	22.9 ± 1.0	NB
P	*Botrychium minganense*	Mingan Moonwort				S2	3 Sensitive	6	68.5 ± 0.0	NB
P	*Selaginella selaginoides*	Low Spikemoss				S2	3 Sensitive	12	39.8 ± 5.0	NB
P	*Symphyotrichum novi-belgii var. crenifolium*	New York Aster				S2?	5 Undetermined	1	80.6 ± 1.0	NB
P	*Galium obtusum*	Blunt-leaved Bedstraw				S2?	4 Secure	1	31.7 ± 1.0	NB
P	*Salix myricoides*	Bayberry Willow				S2?	3 Sensitive	26	1.1 ± 10.0	NB
P	*Platanthera huronensis*	Fragrant Green Orchid				S2?	5 Undetermined	1	79.7 ± 0.0	NB
P	*Solidago altissima*	Tall Goldenrod				S2S3	4 Secure	69	71.3 ± 0.0	NB
P	*Barbarea orthoceras*	American Yellow Rocket				S2S3	3 Sensitive	13	23.5 ± 1.0	NB
P	*Callitriche hermaphroditica*	Northern Water-starwort				S2S3	4 Secure	15	29.5 ± 0.0	NB
P	*Lonicera oblongifolia*	Swamp Fly Honeysuckle				S2S3	3 Sensitive	41	2.8 ± 5.0	NB
P	*Epilobium coloratum*	Purple-veined Willowherb				S2S3	3 Sensitive	3	42.4 ± 5.0	NB
P	*Rumex pallidus*	Seabeach Dock				S2S3	3 Sensitive	1	87.0 ± 0.0	NB
P	*Amelanchier sanguinea var. gaspensis*	Round-Leaved Serviceberry				S2S3	5 Undetermined	2	65.7 ± 0.0	NB
P	*Galium labradoricum*	Labrador Bedstraw				S2S3	3 Sensitive	39	33.0 ± 1.0	NB
P	*Valeriana uliginosa*	Swamp Valerian				S2S3	3 Sensitive	58	33.1 ± 1.0	NB
P	*Carex adusta*	Lesser Brown Sedge				S2S3	4 Secure	4	74.3 ± 1.0	NB
P	*Juncus brachycephalus*	Small-Head Rush				S2S3	3 Sensitive	24	0.7 ± 0.0	NB
P	*Corallorhiza maculata var. maculata*	Spotted Coralroot				S2S3	3 Sensitive	6	16.0 ± 0.0	NB
P	*Listera auriculata*	Auricled Twayblade				S2S3	3 Sensitive	8	22.9 ± 1.0	NB
P	*Eragrostis pectinacea*	Tufted Love Grass				S2S3	4 Secure	1	76.7 ± 1.0	NB
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S2S3	3 Sensitive	4	43.6 ± 0.0	NB
P	*Stuckenia filiformis ssp. alpina*	Thread-leaved Pondweed				S2S3	3 Sensitive	15	26.9 ± 1.0	NB
P	*Potamogeton praelongus*	White-stemmed Pondweed				S2S3	4 Secure	18	26.6 ± 10.0	NB
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3 Sensitive	3	50.7 ± 10.0	NB
P	*Arnica lanceolata*	Lance-leaved Arnica				S3	4 Secure	74	27.0 ± 0.0	NB
P	*Artemisia campestris*	Field Wormwood				S3	4 Secure	3	12.7 ± 0.0	NB
P	*Artemisia campestris ssp. caudata*	Field Wormwood				S3	4 Secure	6	12.7 ± 0.0	NB
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	4 Secure	118	31.8 ± 0.0	NB
P	*Prenanthes racemosa*	Glaucous Rattlesnakeroot				S3	4 Secure	21	0.4 ± 5.0	NB
P	*Tanacetum bipinnatum ssp. huronense*	Lake Huron Tansy				S3	4 Secure	54	0.4 ± 5.0	NB
P	*Symphyotrichum*	Boreal Aster				S3	3 Sensitive	16	38.0 ± 5.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	boreale									
P	*Betula pumila*	Bog Birch				S3	4 Secure	1	84.1 ± 0.0	NB
P	*Arabis glabra*	Tower Mustard				S3	5 Undetermined	16	25.7 ± 0.0	NB
P	*Arabis hirsuta var. pycnocarpa*	Western Hairy Rockcress				S3	4 Secure	20	3.0 ± 0.0	NB
P	*Subularia aquatica var. americana*	Water Awlwort				S3	4 Secure	3	75.6 ± 0.0	NB
P	*Astragalus alpinus*	Alpine Milk-vetch				S3	4 Secure	1	85.4 ± 0.0	NB
P	*Astragalus alpinus var. brunetianus*	Alpine Milk-Vetch				S3	4 Secure	88	0.4 ± 1.0	NB
P	*Hedysarum alpinum*	Alpine Sweet-vetch				S3	4 Secure	164	0.4 ± 5.0	NB
P	*Gentianella amarella ssp. acuta*	Northern Gentian				S3	4 Secure	12	40.1 ± 0.0	NB
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	4 Secure	1	90.2 ± 0.0	NB
P	*Stachys tenuifolia*	Smooth Hedge-Nettle				S3	3 Sensitive	39	2.5 ± 0.0	NB
P	*Nuphar lutea ssp. pumila*	Small Yellow Pond-lily				S3	4 Secure	7	25.8 ± 0.0	NB
P	*Epilobium hornemannii*	Hornemann's Willowherb				S3	4 Secure	20	16.4 ± 5.0	NB
P	*Polygonum scandens*	Climbing False Buckwheat				S3	4 Secure	5	47.7 ± 0.0	NB
P	*Littorella uniflora*	American Shoreweed				S3	4 Secure	4	44.4 ± 0.0	NB
P	*Primula mistassinica*	Mistassini Primrose				S3	4 Secure	32	7.7 ± 0.0	NB
P	*Pyrola minor*	Lesser Pyrola				S3	4 Secure	14	22.9 ± 1.0	NB
P	*Clematis occidentalis*	Purple Clematis				S3	4 Secure	7	22.7 ± 0.0	NB
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	1	55.3 ± 0.0	NB
P	*Thalictrum venulosum*	Northern Meadow-rue				S3	4 Secure	17	53.4 ± 0.0	NB
P	*Rubus occidentalis*	Black Raspberry				S3	4 Secure	1	18.9 ± 1.0	NB
P	*Galium boreale*	Northern Bedstraw				S3	4 Secure	6	48.4 ± 0.0	NB
P	*Salix interior*	Sandbar Willow				S3	4 Secure	13	30.6 ± 5.0	NB
P	*Salix pedicellaris*	Bog Willow				S3	4 Secure	34	40.9 ± 0.0	NB
P	*Parnassia glauca*	Fen Grass-of-Parnassus				S3	4 Secure	144	7.7 ± 0.0	NB
P	*Veronica serpyllifolia ssp. humifusa*	Thyme-Leaved Speedwell				S3	4 Secure	16	8.0 ± 0.0	NB
P	*Viola adunca*	Hooked Violet				S3	4 Secure	3	73.4 ± 1.0	NB
P	*Viola adunca var. adunca*	Hooked Violet				S3	4 Secure	1	47.1 ± 0.0	NB
P	*Viola nephrophylla*	Northern Bog Violet				S3	4 Secure	116	7.7 ± 0.0	NB
P	*Carex arcta*	Northern Clustered Sedge				S3	4 Secure	26	29.8 ± 0.0	NB
P	*Carex atratiformis*	Scabrous Black Sedge				S3	4 Secure	180	30.0 ± 0.0	NB
P	*Carex capillaris*	Hairlike Sedge				S3	4 Secure	146	0.3 ± 5.0	NB
P	*Carex chordorrhiza*	Creeping Sedge				S3	4 Secure	11	90.2 ± 0.0	NB
P	*Carex conoidea*	Field Sedge				S3	4 Secure	11	25.1 ± 1.0	NB
P	*Carex eburnea*	Bristle-leaved Sedge				S3	4 Secure	88	46.5 ± 0.0	NB
P	*Carex exilis*	Coastal Sedge				S3	4 Secure	23	84.1 ± 0.0	NB
P	*Carex garberi*	Garber's Sedge				S3	3 Sensitive	23	7.7 ± 0.0	NB
P	*Carex haydenii*	Hayden's Sedge				S3	4 Secure	3	26.0 ± 0.0	NB
P	*Carex michauxiana*	Michaux's Sedge				S3	4 Secure	2	59.5 ± 1.0	NB
P	*Carex ormostachya*	Necklace Spike Sedge				S3	4 Secure	7	79.4 ± 0.0	NB
P	*Carex rosea*	Rosy Sedge				S3	4 Secure	7	16.1 ± 5.0	NB
P	*Carex tenera*	Tender Sedge				S3	4 Secure	8	13.3 ± 5.0	NB
P	*Carex tuckermanii*	Tuckerman's Sedge				S3	4 Secure	29	6.8 ± 0.0	NB
P	*Carex vaginata*	Sheathed Sedge				S3	3 Sensitive	39	33.1 ± 1.0	NB
P	*Carex wiegandii*	Wiegand's Sedge				S3	4 Secure	2	38.0 ± 5.0	NB
P	*Cyperus esculentus*	Perennial Yellow Nutsedge				S3	4 Secure	2	9.6 ± 0.0	NB
P	*Eleocharis intermedia*	Matted Spikerush				S3	4 Secure	25	47.6 ± 0.0	NB
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S3	4 Secure	46	0.7 ± 0.0	NB
P	*Rhynchospora*	Small-headed Beakrush				S3	4 Secure	10	7.7 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	capitellata									
P	*Trichophorum clintonii*	Clinton's Clubrush				S3	4 Secure	15	7.7 ± 0.0	NB
P	*Lemna trisulca*	Star Duckweed				S3	4 Secure	1	25.8 ± 0.0	NB
P	*Triantha glutinosa*	Sticky False-Asphodel				S3	4 Secure	103	0.3 ± 5.0	NB
P	*Cypripedium reginae*	Showy Lady's-Slipper				S3	3 Sensitive	14	39.1 ± 5.0	NB
P	*Liparis loeselii*	Loesel's Twayblade				S3	4 Secure	3	20.8 ± 0.0	NB
P	*Platanthera blephariglottis*	White Fringed Orchid				S3	4 Secure	9	74.8 ± 1.0	NB
P	*Bromus latiglumis*	Broad-Glumed Brome				S3	3 Sensitive	103	8.9 ± 0.0	NB
P	*Muhlenbergia richardsonis*	Mat Muhly				S3	4 Secure	57	7.6 ± 0.0	NB
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S3	4 Secure	8	22.2 ± 10.0	NB
P	*Potamogeton richardsonii*	Richardson's Pondweed				S3	3 Sensitive	41	22.3 ± 1.0	NB
P	*Adiantum pedatum*	Northern Maidenhair Fern				S3	4 Secure	11	68.5 ± 0.0	NB
P	*Cryptogramma stelleri*	Steller's Rockbrake				S3	4 Secure	46	6.8 ± 5.0	NB
P	*Asplenium trichomanes-ramosum*	Green Spleenwort				S3	4 Secure	24	43.3 ± 0.0	NB
P	*Dryopteris fragrans var. remotiuscula*	Fragrant Wood Fern				S3	4 Secure	18	31.7 ± 0.0	NB
P	*Dryopteris goldiana*	Goldie's Woodfern				S3	3 Sensitive	6	1.8 ± 0.0	NB
P	*Woodsia glabella*	Smooth Cliff Fern				S3	4 Secure	23	66.5 ± 0.0	NB
P	*Equisetum palustre*	Marsh Horsetail				S3	4 Secure	18	3.4 ± 0.0	NB
P	*Lycopodium sabinifolium*	Ground-Fir				S3	4 Secure	10	22.9 ± 1.0	NB
P	*Botrychium dissectum*	Cut-leaved Moonwort				S3	4 Secure	1	88.1 ± 10.0	NB
P	*Botrychium lanceolatum var. angustisegmentum*	Lance-Leaf Grape-Fern				S3	3 Sensitive	5	54.1 ± 5.0	NB
P	*Botrychium simplex*	Least Moonwort				S3	4 Secure	12	38.0 ± 8.0	NB
P	*Polypodium appalachianum*	Appalachian Polypody				S3	4 Secure	2	88.4 ± 0.0	NB
P	*Crataegus submollis*	Quebec Hawthorn				S3?	3 Sensitive	1	87.3 ± 1.0	NB
P	*Mertensia maritima*	Sea Lungwort				S3S4	4 Secure	1	98.0 ± 50.0	NB
P	*Lobelia kalmii*	Brook Lobelia				S3S4	4 Secure	97	7.7 ± 0.0	NB
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3S4	4 Secure	41	8.2 ± 1.0	NB
P	*Stachys pilosa*	Hairy Hedge-Nettle				S3S4	5 Undetermined	14	51.3 ± 0.0	NB
P	*Stachys pilosa var. pilosa*	Marsh Hedge-Nettle				S3S4	5 Undetermined	1	33.6 ± 1.0	NB
P	*Potentilla arguta*	Tall Cinquefoil				S3S4	4 Secure	48	10.8 ± 10.0	NB
P	*Geocaulon lividum*	Northern Comandra				S3S4	4 Secure	6	84.9 ± 1.0	NB
P	*Cladium mariscoides*	Smooth Twigrush				S3S4	4 Secure	3	90.5 ± 0.0	NB
P	*Eriophorum russeolum*	Russet Cottongrass				S3S4	4 Secure	1	91.1 ± 10.0	NB
P	*Spirodela polyrrhiza*	Great Duckweed				S3S4	4 Secure	6	1.6 ± 0.0	NB
P	*Corallorhiza maculata*	Spotted Coralroot				S3S4	3 Sensitive	9	22.9 ± 1.0	NB
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S3S4	4 Secure	13	7.3 ± 0.0	NB
P	*Calamagrostis stricta ssp. stricta*	Slim-stemmed Reed Grass				S3S4	4 Secure	4	41.1 ± 0.0	NB
P	*Potamogeton oakesianus*	Oakes' Pondweed				S3S4	4 Secure	1	87.7 ± 1.0	NB
P	*Carex scirpoidea*	Scirpuslike Sedge				SH	2 May Be At Risk	2	76.8 ± 1.0	NB
P	*Phleum alpinum*	Alpine Timothy				SH	2 May Be At Risk	1	89.2 ± 0.0	NB
P	*Gymnocarpium jessoense ssp. parvulum*	Asian Oak Fern				SH	2 May Be At Risk	5	49.9 ± 0.0	NB
P	*Botrychium lineare*	Narrow-leaved Moonwort				SH	2 May Be At Risk	1	24.3 ± 5.0	NB

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The recipient of these data shall acknowledge the ACCDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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Appendix B LIST OF PLANT SPECIES RECORDED DURING FIELD SURVEYS

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

Scientific Name	Common Name	Column5	CESCC Rank	Exotic?
Abies balsamea	Balsam Fir	S5	4 Secure	
Acer ginnala	Amur Maple	SNA	7 Exotic	Exotic
Acer negundo	Manitoba Maple	SNA	7 Exotic	Exotic
Acer rubrum	Red Maple	S5	4 Secure	
Acer spicatum	Mountain Maple	S5	4 Secure	
Achillea millefolium	Common Yarrow	S5	4 Secure	
Agrostis gigantea	Redtop	SNA	7 Exotic	Exotic
Allium schoenoprasum	Wild Chives	S4	4 Secure	
Ambrosia artemisiifolia	Common Ragweed	S5	4 Secure	
Anaphalis margaritacea	Pearly Everlasting	S5	4 Secure	
Anemone canadensis	Canada Anemone	S5	4 Secure	
Apios americana	American Groundnut	S4S5	4 Secure	
Apocynum cannabinum	Indian Hemp	S4	4 Secure	
Arctium lappa	Great Burdock	SNA	7 Exotic	Exotic
Arctium minus	Common Burdock	SNA	7 Exotic	Exotic
Argentina anserina	Common Silverweed	S5	4 Secure	
Artemisia vulgaris	Common Wormwood	SNA	7 Exotic	Exotic
Berberis thunbergii	Japanese Barberry	SNA	7 Exotic	Exotic
Betula papyrifera	Paper Birch	S5	4 Secure	
Betula populifolia	Gray Birch	S5	4 Secure	
Brassica rapa	Bird's Rape	SNA	7 Exotic	Exotic
Bromus ciliatus	Fringed Brome	S5	4 Secure	
Calamagrostis canadensis	Bluejoint Reed Grass	S5	4 Secure	
Carex gynandra	Nodding Sedge	S5	4 Secure	
Carex nigra	Smooth Black Sedge	S4S5	4 Secure	
Carex projecta	Necklace Sedge	S5	4 Secure	
Carex stipata	Awl-fruited Sedge	S5	4 Secure	
Carex torta	Twisted Sedge	S5	4 Secure	
Carex viridula	Greenish Sedge	S4	4 Secure	
Clematis virginiana	Virginia Clematis	S5	4 Secure	
Convolvulus arvensis	Field Bindweed	SNA	7 Exotic	Exotic
Cornus sericea	Red Osier Dogwood	S5	4 Secure	
Cornus sericea	Red Osier Dogwood	S5	4 Secure	
Crategus sp.	a hawthorn	NA	NA	NA
Dactylis glomerata	Orchard Grass	SNA	7 Exotic	Exotic
Danthonia spicata	Poverty Oat Grass	S5	4 Secure	
Dasiphora fruticosa	Shrubby Cinquefoil	S4	4 Secure	
Daucus carota	Queen Anne's Lace	SNA	7 Exotic	Exotic
Desmodium canadense	Canada Tick-trefoil	S4S5	4 Secure	
Digitaria ischaemum	Smooth Crab Grass	SNA	7 Exotic	Exotic
Echinocystis lobata	Wild Cucumber	S5	4 Secure	
Eleocharis tenuis	Slender Spikerush	S4S5	4 Secure	
Elymus repens	Quack Grass	SNA	7 Exotic	Exotic
Elymus virginicus	Virginia Wild Rye	S5	4 Secure	
Equisetum arvense	Field Horsetail	S5	4 Secure	
Equisetum sylvaticum	Woodland Horsetail	S5	4 Secure	

Erigeron annuus	Annual Fleabane	S4S5	4 Secure	
Erigeron strigosus	Rough Fleabane	S5	4 Secure	
Euonymus europaeus	European Euonymus	SNA	7 Exotic	Exotic
Eupatorium perfoliatum	Common Boneset	S5	4 Secure	
Euthamia graminifolia	Grass-leaved Goldenrod	S5	4 Secure	
Festuca rubra	Red Fescue	S5	4 Secure	
Fraxinus americana	White Ash	S4S5	4 Secure	
Galium trifidum	Three-petaled Bedstraw	S5	4 Secure	
Hieracium aurantiacum	Orange Hawkweed	SNA	7 Exotic	Exotic
Hieracium canadense	Canada Hawkweed	S5	4 Secure	
Humulus lupulus var. lupulus	Common Hop	SNA	7 Exotic	Exotic
Hypericum ellipticum	Pale St John's-Wort	S5	4 Secure	
Hypericum perforatum	Common St. John's-wort	SNA	7 Exotic	Exotic
Impatiens capensis	Spotted Jewelweed	S5	4 Secure	
Iris pseudacorus	Yellow Iris	SNA	7 Exotic	Exotic
Iris versicolor	Harlequin Blue Flag	S5	4 Secure	
Juinperus sp.	creeping juniper cultivar	NA	4 Exotic	Exotic
Juncus alpinoarticulatus	A Rush	S4	4 Secure	
Juncus balticus var. littoralis	Baltic Rush	S5	4 Secure	
Juncus brevicaudatus	Narrow-Panicled Rush	S5	4 Secure	
Juncus dudleyi	Dudley's Rush	S4	4 Secure	
Juncus filiformis	Thread Rush	S5	4 Secure	
Juncus nodosus	Knotted Rush	S4S5	4 Secure	
Juncus tenuis	Slender Rush	S5	4 Secure	
Lactuca canadensis	Canada Lettuce	S5	4 Secure	
Laportea canadensis	Canada Wood Nettle	S5	4 Secure	
Leontodon autumnalis	Fall Dandelion	SNA	7 Exotic	Exotic
Lonicera morrowii	Morrow's Honeysuckle	SNA	7 Exotic	Exotic
Lycopus americanus	American Water Horehound	S5	4 Secure	
Lysimachia ciliata	Fringed Yellow Loosestrife	S5	4 Secure	
Lysimachia terrestris	Swamp Yellow Loosestrife	S5	4 Secure	
Lythrum salicaria	Purple Loosestrife	SNA	7 Exotic	Exotic
Melilotus albus	White Sweet-clover	SNA	7 Exotic	Exotic
Melilotus altissimus	Tall Yellow Sweet-clover	SNA	7 Exotic	Exotic
Melilotus officinalis	Yellow Sweet-clover	SNA	7 Exotic	Exotic
Mentha arvensis	Wild Mint	S5	4 Secure	
Myosotis arvensis	Field Forget-me-not	SNA	7 Exotic	Exotic
Oenothera biennis	Common Evening Primrose	S5	4 Secure	
Oenothera pilosella	Meadow Evening Primrose	SNA	7 Exotic	Exotic
Oxalis montana	Common Wood Sorrel	S5	4 Secure	
Pastinaca sativa	Wild Parsnip	SNA	7 Exotic	Exotic
Phalaris arundinacea	Reed Canary Grass	S5	4 Secure	
Phleum pratense	Common Timothy	SNA	7 Exotic	Exotic
Phlox paniculata	Garden Phlox	SNA	7 Exotic	Exotic
Picea glauca	White Spruce	S5	4 Secure	
Picea mariana	Black Spruce	S5	4 Secure	
Picea rubens	Red Spruce	S5	4 Secure	

Plantago lanceolata	English Plantain	SNA	7 Exotic	Exotic
Plantago major	Common Plantain	SNA	7 Exotic	Exotic
Poa compressa	Canada Blue Grass	SNA	7 Exotic	Exotic
Poa pratensis	Kentucky Blue Grass	S5	4 Secure	
Polygonum cilinode	Fringed Black Bindweed	S5	4 Secure	
Populus balsamifera	Balsam Poplar	S5	4 Secure	
Populus tremuloides	Trembling Aspen	S5	4 Secure	
Populus tremuloides	Trembling Aspen	S5	4 Secure	
Prunus pensylvanica	Pin Cherry	S5	4 Secure	
Prunus virginiana	Chokecherry	S5	4 Secure	
Ranunculus flammula	Lesser Spearwort	S5	4 Secure	
Ranunculus repens	Creeping Buttercup	SNA	7 Exotic	Exotic
Robinia viscosa	Clammy Locust	SNA	7 Exotic	Exotic
Rosa blanda	Smooth Rose	S5	4 Secure	
Rubus allegheniensis	Alleghaney Blackberry	S5	4 Secure	
Rubus idaeus	Red Raspberry	S5	4 Secure	
Rubus pubescens	Dwarf Red Raspberry	S5	4 Secure	
Salix eriocephala	Cottony Willow	S5	4 Secure	
Salix pellita	Satiny Willow	S4S5	4 Secure	
Sisyrinchium montanum	Mountain Blue-eyed-grass	S5	4 Secure	
Solidago hispida	Hairy Goldenrod	S4	4 Secure	
Solidago juncea	Early Goldenrod	S5	4 Secure	
Sonchus arvensis	Field Sow Thistle	SNA	7 Exotic	Exotic
Sorbus americana	American Mountain Ash	S5	4 Secure	
Spiraea alba	White Meadowsweet	S5	4 Secure	
Spiraea japonica	Japanese Spiraea	SNA	7 Exotic	Exotic
Stachys pilosa	Hairy Hedge-Nettle	S3S4	5 Undetermined	
Symphyotrichum ciliolatum	Fringed Blue Aster	S5	4 Secure	
Symphyotrichum cordifolium	Heart-leaved Aster	S5	4 Secure	
Tanacetum vulgare	Common Tansy	SNA	7 Exotic	Exotic
Taraxacum officinale	Common Dandelion	SNA	7 Exotic	Exotic
Thalictrum pubescens	Tall Meadow-Rue	S5	4 Secure	
Thuja occidentalis	Eastern White Cedar	S5	4 Secure	
Trifolium arvense	Rabbit's-foot Clover	SNA	7 Exotic	Exotic
Trifolium aureum	Yellow Clover	SNA	7 Exotic	Exotic
Trifolium pratense	Red Clover	SNA	7 Exotic	Exotic
Trifolium repens	White Clover	SNA	7 Exotic	Exotic
Tussilago farfara	Coltsfoot	SNA	7 Exotic	Exotic
Ulmus americana	White Elm	S4	4 Secure	
Viburnum opulus var. opulus	Highbush Cranberry	SNA	7 Exotic	Exotic
Vicia cracca	Tufted Vetch	SNA	7 Exotic	Exotic
Vitis riparia	Riverbank Grape	S4	4 Secure	
Zizia aurea	Golden Alexanders	S4	4 Secure	

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

Appendix F WILDLIFE AND WILDLIFE HABITAT

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320)

Appendix F Wildlife and Wildlife Habitat February 2019

Appendix F – VC Wildlife and Wildlife Habitat

Environmental Impact Assessment Registration for the Replacement of the Madawaska-Edmundston International Bridge (E320) - NBDTI

February 2019

Prepared by:

Environmental Unit, Design Branch
New Brunswick Department of Transportation and Infrastructure

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

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ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

February 2019

1.0 INTRODUCTION

This document is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project (the Project). This document includes an analysis of the potential interactions between Project activities and the Wildlife and Wildlife Habitat Valued Component (VC) of the EIA for the Project.

2.0 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Wildlife is considered a valued component of the project environment because of the recognized diversity and importance of wildlife habitat along riparian corridors of large waterways such as the Saint John River, and because of the protected regulatory status of many wildlife species, including birds as described in Section 2.1 below.

To assess the interactions of the Project with wildlife and wildlife habitat, four relevant components have been identified that will be addressed in this VC:

- *Non-Avian Terrestrial Wildlife* which, for this assessment, includes all incidental sightings and evidence of wildlife species but does not include birds and fish. This component focusses on any wildlife species at risk (SAR) and species of conservation concern (SOCC) that have potential to interact with the Project. Wildlife SAR are considered species that have a protective status under Schedule 1 of the federal *Species at Risk Act* (*SARA*) or are protected under the provincial *New Brunswick Species at Risk Act* (*NBSAR*). Wildlife SOCC include species that have a Atlantic Canada Conservation Data Centre (ACCDC) S-rank of S1 to S3;
- *Terrestrial Wildlife Habitat* describes the general environmental conditions observed within the Project footprint and includes Critical Habitat as described in recovery strategies for SAR that might occur;
- *Environmentally Significant Areas* (ESAs) are areas designated as protected, ecologically important, or managed by federal, provincial, or non-government agencies; and
- *Birds,* including SAR and SOCC, and *Bird Habitat*. Bird SAR are considered species that have a protective status under Schedule 1 of the federal *SARA* or are protected under the provincial *NBSAR*. Bird SOCC include species that have a ACCDC rank of S1 to S3.

2.1 REGULATORY CONTEXT

Migratory birds are protected under the federal Migratory Bird Convention Act (MBCA). Many bird species and certain wildlife species are protected under federal or provincial Species at Risk Acts (SARA and NBSAR) or under the New Brunswick Fish and Wildlife Act. As such, Project related activities (e.g., vegetation clearing, ground disturbance, noise, etc.) present potential interactions with wildlife and their habitat, which could impact terrestrial species and/or ecosystem health and violate laws that protect these species. For some SAR, Critical Habitat is identified in recovery strategy documents and is also protected under SARA.

2.2 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and wildlife and wildlife habitat is focused on a Project Development Area (PDA) which is shown on **Figure 1.** of Appendix E.

The PDA for the Project is defined as the maximum anticipated area of physical disturbance associated with the construction and operation and maintenance of the Project, as well as the decommissioning of the existing bridge. For the purposes of this assessment, the PDA comprises a physical footprint of the Project and includes portions of the Canada Border Services Agency properties, adjacent private properties east and west of the proposed new bridge location, a portion of land owned by the Canadian National Railways (CN), and a portion of the Saint John River (up to 250 m upstream of the new bridge and 250 m downstream of the existing bridge to the east, and up to the international border to the south).

The Local Assessment Area (LAA) for wildlife includes the PDA plus the adjacent river area. The ACCDC data report was ordered for a 5 km radius around the PDA for consideration of potential SAR and SOCC that could occur in the LAA and identification of nearby ESAs. Although the survey was conducted within the PDA, birds species were detected by sight or sound from up to 150 m outside the PDA.

The bridge design has not yet been finalized. However, it is not anticipated that the entire PDA will be affected by the project and the area shown on Figure 1 of Appendix E represents a maximum extent of interaction.

2.3 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental interactions between the Project and Wildlife and wildlife habitat include the following periods.

- Construction (including demolition of the existing bridge) – anticipated to last three years, dates to be determined;
- Operation and maintenance – in perpetuity; and,
- Decommissioning and/or abandonment of the new bridge – not anticipated.

It is anticipated that the construction phase will last three years. The bridge opening will coincide with the opening of the new United States Land Port of Entry (LPoE) in Madawaska, Maine, which will be built simultaneously and is not included as part of this Project. The Project schedule will be prepared during the preliminary design phase.

3.0 EXISTING CONDITIONS FOR WILDLIFE AND WILDLIFE HABITAT

This section provides and overview of the results of the field surveys for wildlife and wildlife habitat and summarizes available information on wildlife and wildlife habitat for the PDA.

3.1 SOURCES OF INFORMATION

To characterize the existing conditions for wildlife and wildlife habitat and to inform field surveys, existing information and data for the area were reviewed. Fieldwork was conducted within the PDA to record location and extent of wetlands and other vegetated habitats as well as the presence of any plant SOCC or SAR.

The existing information on wildlife and wildlife habitat Included:

- Atlantic Conservation Data Centre (ACCDC) data on SAR and SOCC locations and Environmentally Significant Areas (ESA). (AC CDC 2018)
- SNB aerial imagery
- Field survey data from fieldwork conducted by NB DTI in June, August, October, and November of 2018.
- Species at Risk Recovery Strategies as applicable, for the identification of Critical Habitat.

3.2 TERRESTRIAL WILDLIFE HABITAT

3.2.1 Terrestrial Habitat Field Methods

Terrestrial habitat types were determined by reviewing the NBDERD forest inventory and then field verified. A DTI ecologist conducted a terrestrial habitat inventory over several sites visits in 2018. The habitats were primarily characterized based on site visits in June and August of 2019 but additional survey was conducted in early November of 2018 due to a change in the PDA to include additional riparian habitat. The habitat was characterized based on major habitat type (forest, wetland, developed) and each was evaluated in terms of potential to support SAR or SOCC. Any evidence of wildlife presence was recorded in the field. If a recovery strategy or action plan for a SAR with potential to occur within the PDA identified Critical Habitat, it was identified.

3.2.2 Terrestrial Habitat Results

The terrestrial portion of the PDA is 10 ha is size, of which approximately 8 ha is developed (buildings, pavement, or mowed lawn. The remaining 2 ha of vegetated habitat within the PDA consists largely of riparian habitat along the embankment between the rail line and the river (1.5 ha), while an additional 0.3 ha consists of narrow strips of roadside tree and shrub habitat. There are two vacant lots to the west of the existing CBSA (Canadian Border Services Agency) facility that are included in the PDA and support a small (0.2 ha) patch of immature hardwood forest. These lots are not expected to be disturbed by the project. There is also an additional 0.1 ha of rocky shrub and forb dominated habitat along the embankment between the CBSA facility and the rail line. This habitat is sparsely vegetated and is dominated by non-native species. Table 1 of Appendix E lists the dominant plant species for each major vegetation community type and a full list of plant species recorded in the field is included in Attachment B of Appendix E. The aquatic portion of the PDA (at the time of the survey) did not appear to be vegetated, although the shoreline wetland habitat was within the high-water mark of the stream. In general, the habitat types within the PDA are disturbed, developed, and/or have a high abundance of non-native and invasive species and are not considered to be of limited availability on the landscape.

3.2.2.1 Environmentally Significant Areas and Critical Habitat

The ACCDC report is included in Attachment A of Appendix E. There were no Environmentally Significant Areas (as identified by Tims (1995)) located within a kilometer of the PDA. The "Edmundston By-Pass Roadcuts ESA" and the "Saint Basile Indian Reserve ESA" are located to the northeast near the TransCanada highway and will not be affected by the Project.

No Critical Habitat as defined in any terrestrial SAR recovery strategy or action plan was present within the PDA.

3.3 NON-AVIAN TERRESTRIAL WILDLIFE

3.3.1 Non-Avian Wildlife Methods

In addition to the ACCDC records for wildlife species occurring within 5 km of the PDA (Attachment A of Appendix E), any wildlife species encountered during the site visits were recorded. The potential for the habitats encountered to support wildlife SAR known to occur in the area was evaluated.

3.3.2 Non-Avian Wildlife Results

The only direct evidence of wildlife species encountered in the field were red squirrels (*Tamiasciurus hudsonicus*) seen around the CBSA facility and raccoon (*Procyon lotor*) tracks near the river.

There were two non-avian wildlife SAR that have records within 5 km of the PDA which are Canada lynx (Lynx canadensis) (Endangered S3); and monarch butterfly (*Danaus plexippus*) (Endangered under COSEWIC, S3B,S3M). Refer to Attachment A of Appendix E for the complete list of SOCC within 5 km of the PDA.

While there is potential for monarch butterfly to occur within the PDA, there were no milkweed species (*Asclepias* spp.) observed, and this species is necessary for reproduction. Canada lynx tends to inhabit contiguous tracts of boreal forest and rarely ventures into urban areas. The monarch butterfly is dependent on the presence of milkweed species (*Asclepias spp.*) for successful reproduction and no milkweeds were found within the PDA. Three SOC butterfly records listed in the ACCDC report as occurring within 5 km of the PDA but all of these can occur in a wide range of habitats that are not limiting on the landscape. The Acadian hairstreak (*Satyrium acadica*) (S3) is somewhat specialized, laying eggs on willow species which are known to occur along the river bank within the PDA, however the population of this species are listed as Secure.

The habitat present within the PDA is likely to support a wide range of wildlife that are typical to urban settings such as eastern striped skunks (*Mephitis mephitis*) various rodents (*Rodentia*), and possibly red foxes (*Vulpes vulpes*) along the shore. Because of the urban setting and small proportion of the PDA that is vegetated, it is not considered a high potential area for rare species.

3.4 BIRDS AND BIRD HABITAT

3.4.1 Birds and Bird Habitat Methodology

NBDTI ecologist Greg Quinn conducted a series of bird surveys that included a spring (May 1st 2018) and fall (October 14th 2018) visit to observe migration patterns as well as a walkover in June of 2018 where all bird species were identified by sight or sound and recorded by species, location, and highest level of breeding evidence. Bird surveys were only conducted on days where there was no precipitation and wind speed was below Beaufort scale of 3. During the June field visit, existing structures were investigated for migratory bird nesting – particularly barn and cliff swallows that are known to nest on bridges and buildings. The potential for ACCDC records of bird SAR and SOCC in or near the PDA was evaluated based on the habitat conditions encountered.

The migratory bird surveys were conducted starting at dawn and observations were made from a vantage point at the top of the embankment near the CBSA facility, from-which most of the river portion of the PDA could be viewed. It was anticipated that the river could serve as a migratory pathway and high proportion of bird migration traffic through the area was expected to follow the river corridor. Thirty-minute observation periods were conducted starting at dawn and repeated every two hours for a total of four observation periods. The species, sex and behavior of all bird observed over the river or along the shore were recorded.

3.4.2 Birds and Bird Habitat Results

A review of ACCDC data (ACCDC 2018) on wildlife species indicated the presence of some SAR and SOCC near the PDA, which are shown on Figure 1 of Appendix E. Eight SAR that occur within 5 km of the PDA are Canada lynx (Lynx canadensis) (Endangered S3); bald eagle (*Halialeetus leucocephalus*) (Endangered, S4); chimney swift (*Chaetura pelagica*) (Threatened S2S3B,S2M); common nighthawk (*Chordeiles minor*) (Threatened S3Bm,S3M). wood thrush (*Hylocichla mustelina*) (Threatened S1S2B,S1S2M); barn swallow (*Hirundo rustica*) (Threatened S2B,S2M); and bobolink (Dolichonys oryzivorous) (Threatened S3B,S3M). Common nighthawk is currently being reviewed for a possible downgrading of its status to Special Concern (ECCC 2019[1]). There are also several SOCC within 5 km of the PDA and all are birds, including several species listed as Special Concern under COSEWIC and/or SARA:

No SOCC or SAR previously observed near the PDA were observed during any of the site visits or bird surveys. There was also no evidence of nesting swallows on the existing structures in the PDA. There was no suitable breeding habitat in the PDA for any of the bird SAR that have been recorded within 5 km with the possible exception of common nighthawk which can nest on gravel building roofs, parking lots or other areas. However, it is unlikely that there will be any breeding in an area that will be disturbed by the project. The open type of habitats within the PDA are either subject to regular human traffic or periodic inundation from the river which make them unsuitable nesting areas. It is not known whether any of the rooves within the PDA are suitable for nesting. There is no Critical Habitat for SAR identified within the PDA in any recovery documents or action plans.

[1] https://www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding/listing-process/minister-environment-response-assessments-october-2018.html

There are several bird SOCC species which have been recorded in the area that could potentially nest within urban settings and are known to nest in conditions similar to those found within the PDA. However, given the small size of the PDA and the low proportion of the area with vegetation, it is unlikely that any of these are using the area for breeding given that none were seen over several site surveys in 2018. Incidental birds will also be recorded in 2019 during follow-up rare plant surveys in recently added portions of the PDA. IF any SOC or SAR are encountered during that survey, potential effects on them and potential mitigation will be considered at that time.

A complete list of the birds encountered is included in Table 1. Bird observations are listed by survey date and include best evidence of breeding for the June breeding bird survey. A total number of individuals sighted is listed where probable multiple observations of the same birds are not counted in the total to the extent possible.

Table 1. Counts and breeding evidence for birds recorded within or near the PDA for each of three surveys.

		# Individuals Recorded				
Species	**Scientific Name**	**May Migration**	**June Breeding Survey**	**June Highest Breeding Evidence**	**October Migration**	**S Rank**
American crow	Corvus brachyrhynchos	5	1	S	6	S5
american goldfinch	Carduelis tristis	4	3	P	4	S5
American redstart	Setophaga ruticillia		2	S		S5B,S5M
American robin	Turdus migratorius		1	S	3	S5B,S5M
black-capped chickadee	Poecile atricapilla		4	CF		S5
Canada goose	Branta canadensis				7	SNAB,S5M
cedar waxwing	Bombycilla garrulus		4	P		S5B.S5M
chipping sparrow	Spizella passerina		2	S		S5B,S5M
common goldeneye	Bucephala clangula		4	FY		S4B,S5M,S4N
common grackle	Quiscalis quiscula		3			S5B,S5M
common loon	Gavia immer				3	S4B,S4M,S4N
common merganser	Mergus merganser		1			S5B,S4N,S5M
dark-eyed junco	Juncus hyemalis	3	1	S	3	S5
double crested cormorant	Phalacrocorax occidentalis	3			4	S5
gray catbird	Dumtella carolinensis		1	S		S4B,S4M
green-winged teal	Anas crecca				5	S4B,S5M
hooded merganser	Lophodytes cucullatus	6				S4B,S5M
mallard duck	Anas platyrhynchos	1			8	S5B,S4N,S5M
red-breasted merganser	Mergus serrator	4			2	S3B,S5M,S4S5N
red-eyed vireo	Vireo olvaceus		2	P		S5B,S5M
ring-billed gull	Larus delawarensis				6	S3S4B,S4N
ring-necked duck	Aytha collaris				6	S5B,S5M
rock dove	Columba livia	5	7	P		SNA
song sparrow	Melospiza melodia		3	S		S5B,S5M
tree swallow	Tachycineta bicolor		1			S4B,S4M
veery	Catharus fuscescens		2	s		S4B,S4M
yellow warbler	Dendroica petechia		8	S		S5B,S5M
Breeding Codes: S = male singing; P = pair in suitable habitat; CF = adult carrying food; FY = flightless young present						

4.0 ASSESSMENT OF POTENTIAL PROJECT INTERACTIONS WITH WILDLIFE AND WILDLIFE HABITAT

4.1 PROJECT-ENVIRONMENT INTERACTIONS FOR WILDLIFE AND WILDLIFE HABITAT

This section described how the Project activities could interact with wildlife and wildlife habitat in the absence of mitigation.

4.1.1 Potential Interactions with Wildlife and Wildlife Habitat during construction

Construction activities including clearing, grubbing removing overburden soils, and construction of a temporary access road have the potential to harm or disturb wildlife, including birds and their habitat. The PDA is a 10 ha polygon that includes the existing CBSA facility as well as adjacent properties that could potentially be needed for construction.

4.1.2 Terrestrial Wildlife and Habitat Potential Effects

Potential effects to terrestrial wildlife and habitat as a result of the construction phase of the Project include the following:

- Some minor vegetation clearing will take place within the PDA and wildlife will not be able to utilize this area during the construction phase of the Project. However, the affected habitat is not considered to be of high value for wildlife and the conditions are abundant in the surrounding area. The loss of wildlife habitat will be temporary, and access roads and work pads will be removed following construction;
- Noise from construction activities may disrupt wildlife. Increased noise levels will be limited to active working periods when machinery is operating within the PDA. This effect is also temporary; and
- Use of artificial light during nighttime operations may attract or disrupt wildlife species. In general, construction activities will be limited to day-light hours. As such, this effect is not discussed further in this VC assessment.

4.1.3 Birds and Bird Habitat Potential Effects

Potential effects to birds and bird habitat as a result of the construction phase of the Project include the following:

- While there are bird SAR and SOCC that have been recorded within 5 km of the PDA, there were none seen during the 2018 bird surveys and given the highly developed urban setting of the PDA, there is a low likelihood of bird SAR using the PDA for breeding. There is no Critical Habitat identified for bird SAR within the PDA, and the habitat types present are not unique or scarce within the landscape. Many of the trees and plant species are non-native, young, and there were no cavity trees found that could provide nesting opportunities for cavity nesting species. The disturbance to the vegetated habitats are largely temporary and any work areas or access roads will be decommissioned following construction and allowed to revegetate. A follow-up bird survey will be conducted by NBDTI In the breeding season of 2019 to investigate newly added portions of the PDA and any new species encountered will be considered for possible effects and mitigation if warranted;
- Migratory birds may utilize the habitat within the PDA and these birds and their nests are protected under the federal *MBCA*. Construction activities may alter or destroy migratory bird habitat as a result of the

vegetation clearing, in-filling of wetlands and/or alteration of the riverbanks. Suitable habitat for these species is not limited within the area and similar habitat conditions were observed on adjoining properties;
- Noise from construction activities may disrupt bird species within the Project and Assessment Areas, or deter migratory birds from utilizing these areas. Sound quality potential effects are limited to active working periods when machinery is operating within the PDA;
- Attraction to cleared or stockpile areas may result in an increase in bird injuries or deaths, and/or destruction of nests;
- Use of artificial light during nighttime operations may attract bird species. In general, construction activities will be limited to day-light hours. As such, this effect is not discussed further in this VC assessment; and
- Accidental contaminant spills may result in bird injury or death and/or destruction of nests, habitat or foraging areas.

4.2 OPERATIONAL AND MAINTENANCE PHASES POTENTIAL EFFECTS

Potential effects on birds, bird habitat, terrestrial wildlife and terrestrial habitat are detailed in the following sub-sections for the wildlife and wildlife habitat PDA during the operational and maintenance phases of the Project.

4.2.1 Terrestrial Wildlife and Habitat Potential Effects

Potential effects to terrestrial wildlife as a result of the operational and maintenance phases of the Project include the following:

- Noise from maintenance activities may disrupt wildlife species. Increased noise levels will be limited to active working periods when machinery is operating within the PDA and is not likely to exceed noise levels currently observed on-site; and
- Accidental contaminant spills may result in wildlife injury or death and/or destruction of habitat or foraging areas.

4.2.2 Birds and Bird Habitat Potential Effects

Potential effects to birds and bird habitat as a result of the operational and maintenance phases of the Project include the following:

- Vegetation clearing as part of summer maintenance activities may destroy or alter bird SAR and/or migratory bird habitat. Vegetation clearing is not anticipated to be necessary for operations and maintenance;
- Noise from maintenance activities may disrupt bird species within the PDA, or deter migratory birds from utilizing the area. Sound quality potential effects are limited to active working periods when machinery is operating within the PDA. Operational noise is not expected to exceed noise levels currently observed on-site;
- Bridges can pose risks to migrating birds, which have been known to strike bridges, causing injuries and mortality. The new bridge will not have a superstructure like the existing bridge and therefore will be lower than the existing bridge and the likelihood of bird strikes is anticipated to be lower;

4.3 ACCIDENTS, MALFUNCTIONS, AND UNPLANNED EVENTS

Accidents, malfunctions, and unplanned events are occurrences that are not part of planned activities or normal operation of the Project and have the potential to result in adverse environmental interactions. Given the adherence of Project activities to mitigation measures (e.g., good planning and design, vehicle and equipment maintenance, worksite health, safety, and environmental training of personnel), including those in the NBDTI Environmental Management Manual (EMM; NBDOT 2010), accidents, malfunctions, and unplanned events of a serious nature are unlikely to occur during any phase of the Project.

The accidents, malfunctions, and unplanned events that have potential to occur for this Project, and could potentially interact with wildlife and wildlife habitat include:

- vehicle collision;
- hazardous material spill; and
- erosion and sediment control failure.

Spills could harm wildlife species including birds although because the project is small in scope, large spills directly related to the project that could cause mortality to terrestrial wildlife and birds are unlikely. However, an agreement between the Atlantic Wildlife Institute (AWI) and DTI has been reached whereby AWI would serve as a spill response coordinator and form the core of a spill response team that would respond to any wildlife related emergencies related to spills. AWI is the only organization in New Brunswick that carries the necessary permits to respond to the range of wildlife emergencies that could involve regulated species such as migratory birds or species at risk. The spill response plan will be included with the project EMP.

Mitigation for accidents, malfunctions, and unplanned events is described in Section 4.4.

4.4 MITIGATION FOR WILDLIFE AND WILDLIFE HABITAT

4.4.1 Standard and Additional Mitigation

Interaction of the Project activities with wildlife and wildlife habitat will be managed through the use of mitigation measures, including adherence to the NBDTI EMM. Measures which will be employed to mitigate interactions with wildlife and wildlife habitat are presented in Table 2.

Table 3 Sections of the NBDTI EMM (4th ed.) Applicable to Wildlife and Wildlife Habitat and additional recommended mitigation.

Project Component	Summary of Potential Interaction	Standard NBDTI EMM Mitigation Measures	Additional Recommended Mitigation Measures
Construction Phase			
Birds and Bird Habitat	• Construction activities may alter or destroy migratory bird habitat.	• 5.3 Clearing; • 5.7 Erosion and Sediment Management; • 5.8 Excavation, Blasting and Aggregate Production; • 5.10 Fire Prevention and Contingency; • 5.15 Structures; • 5.22 Work Progression; and • 5.23 Working Near Environmentally Sensitive Areas.	• If vegetation clearing must take place within the bird-breeding season (April 15 to August 31), a non-intrusive nesting survey of the PDA will be conducted by a qualified birder; • The piers and abutments of the existing bridge should be surveyed for bird nests prior to the remeroval of the structure. • If a nesting bird species is encountered, contact with and disturbance of the species and its habitat will be avoided; and • An appropriate vegetated buffer will be established around any nests encountered to protect them from disturbance and work in that area will be avoided until after the birds have fledged or vacated. • An avian Management Plan will be included in the EMM

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Project Component	Summary of Potential Interaction	Standard NBDTI EMM Mitigation Measures	Additional Recommended Mitigation Measures
Birds and Bird Habitat	• Noise from construction activities may disrupt bird species or deter migratory birds from utilizing the area.	• 5.8 Excavation, Blasting and Aggregate Production; • 5.15.1 Structures Construction • 5.17 Temporary Ancillary Facility Management; and • 5.19 Vehicle and Equipment Management.	• An avian Management Plan will be included in the EMM.
	• Attraction to cleared/stockpile areas may result in an increase in bird injuries and/or deaths or destruction of nests.	• 5.3 Clearing; • 5.15.1 Structures Construction • 5.18 Topsoil; • 5.20 Waste Management; • 5.22 Work Progression; and • 5.23 Working Near Environmentally Sensitive Areas.	• Any exposed spoil piles that could present nesting opportunities to migratory birds will be covered when inactive during the breeding season.
Terrestrial Wildlife and Habitat	• Vegetation clearing will alter/destroy wildlife habitat within the PDA.	• 5.3 Clearing; • 5.7 Erosion and Sediment Management; • 5.8 Excavation, Blasting and Aggregate Production; • 5.10 Fire Prevention and Contingency; • 5.15 Structures; • 5.22 Work Progression; and • 5.23 Working Near Environmentally Sensitive Areas.	• No additional mitigation measures are recommended.
	• Noise from construction activities may disrupt wildlife.	• 5.8 Excavation, Blasting and Aggregate Production; • 5.15.1 Structures Construction • 5.17 Temporary Ancillary Facility Management; and • 5.19 Vehicle and Equipment Management.	

Project Component	Summary of Potential Interaction	Standard NBDTI EMM Mitigation Measures	Additional Recommended Mitigation Measures
Terrestrial Wildlife and Habitat	• Possibility of increased human interaction as a result of increased personnel within the PDA, possible attraction to waste/garbage stored on site, and proximity to wildlife habitat (*e.g.,* forest, wetlands, river).	• 5.20 Waste Management.	• No additional mitigation measures are recommended.
Operational / Maintenance Phase			
Birds and Bird Habitat	• Vegetation clearing as part of summer maintenance activities or maintenance activities may destroy or alter bird SAR and/or migratory bird habitat.	• 5.3 Clearing; • 5.7 Erosion and Sediment Management; • 5.10 Fire Prevention and Contingency; • 5.15.2 Structures Maintenance; • 5.16 Summer Highway Maintenance; and • 5.23 Working Near Environmentally Sensitive Areas.	• If vegetation clearing must take place within the bird-breeding season (April 15 to August 31), a non-intrusive nesting survey of the PDA will be conducted by a qualified birder; • If a nesting bird species is encountered, contact with and disturbance of the species and its habitat will be avoided; and • An appropriate vegetated buffer will be established around any nests encountered to protect them from disturbance and work in that area will be avoided until after the birds have fledged or vacated. • An avian Management Plan will be included in the EMM

Assessment of Potential Project Interactions with Wildlife and Wildlife Habitat
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Project Component	Summary of Potential Interaction	Standard NBDTI EMM Mitigation Measures	Additional Recommended Mitigation Measures
Birds and Bird Habitat	• Noise from maintenance activities may disrupt bird species within the PDA or deter migratory birds from utilizing the area.	• 5.15.2 Structures Maintenance; • 5.16 Summary Highway Maintenance; • 5.17 Temporary Ancillary Facility Management; • 5.19 Vehicle and Equipment Management; and • 5.21 Winter Highway Maintenance.	• No additional mitigation measures are recommended.
Terrestrial Wildlife and Habitat	• Noise from maintenance activities may disrupt wildlife species.	• 5.15.2 Structures Maintenance; • 5.16 Summary Highway Maintenance; • 5.17 Temporary Ancillary Facility Management; • 5.19 Vehicle and Equipment Management; and • 5.21 Winter Highway Maintenance.	• No additional mitigation measures are recommended.
Accidents, Malfunctions and Unplanned Events			
Fire	• Increased potential for destruction of habitat and wildlife death from fire.	• 5.10 Fire Prevention and Contingency; • 5.12 Spill Management; • 5.13 Storage and Handling of Petroleum Products; • 5.14 Storage and Handling of Other Hazard Materials; and • 5.19 Vehicle and Equipment Management.	• A wildlife-specific spill response plan is included with the EMP

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February 2019

Project Component	Summary of Potential Interaction	Standard NBDTI EMM Mitigation Measures	Additional Recommended Mitigation Measures
Accidental Release of Contaminants	• Increased potential for contaminants to be released into habitat through the accidental release of fuels and lubricants from construction/maintenance equipment or vehicle collisions.	• 5.10 Fire Prevention and Contingency; • 5.12 Spill Management; • 5.13 Storage and Handling of Petroleum Products; • 5.14 Storage and Handling of Other Hazard Materials; and • 5.19 Vehicle and Equipment Management	
Failure of Erosion Control Structures	• Potential for sediment loading in habitats from ground disturbance.	• 5.3 Clearing; • 5.7 Erosion and Sediment Management; • 5.18 Topsoil; • 5.22 Work Progression; and • 5.23 Working Near Environmentally Sensitive Areas.	

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320) – NBDTI

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4.5 CHARACTERIZATION OF RESIDUAL PROJECT-ENVIRONMENTAL INTERACTIONS FOR WILDLIFE AND WILDLIFE HABITAT

4.5.1 Construction

Mitigation measures as outlined in Section 5.2 and the NBDTI EMM will reduce the likelihood, duration and magnitude of effects on the wildlife and wildlife habitat, including migratory birds.

The construction phase of the Project is expected to temporarily affect the wildlife and wildlife habitat within the PDA. The construction of the proposed bridge will result in only a minor temporary loss of existing terrestrial wildlife habitat. Any temporary access roads or work pads will be removed and allowed to revegetate following construction. The loss of habitat is not expected to impact any wildlife species at a population level, and the habitat conditions that will be lost are widely available in the Assessment Area. Furthermore, the proposed mitigation measures will reduce adverse effects to the extent that the construction phase of the Project is not expected to result in any significant residual effects to wildlife and wildlife habitat or birds.

4.5.2 Operation and Maintenance

The operational and maintenance phases of the Project will not significantly alter environmental conditions that are currently observed on-site. The implementation of the proposed mitigation measures will minimize risks of adverse effects to wildlife and wildlife habitat and therefore, interactions during the operational and maintenance phases are considered to be minor.

5.0 SUMMARY AND RECOMMENDATIONS

With the implementation of mitigation and environmental protection measures as described in the EMM and in this assessment, it is not anticipated that there will be any substantial permanent interaction between the Project and the wildlife and wildlife habitat as a result of construction or operation and maintenance phases of the Project. The potential effects to wildlife and wildlife habitat can be mitigated through standard environmental protection practices (e.g., use of temporary access, sediment and erosion control structures, avoiding sensitive periods, minimizing clearing), as described in NBDTI ’s EMM (2010) and the EMP that will be prepared for the project.

The vegetation communities within the PDA are locally abundant and no SAR or SOCC were found to occur within the PDA. A follow-up survey will be conducted in summer of 2019 to record any SAR or SOCC That occur in newly added portions of the PDA that were not surveyed in 2018.

6.0 REFERENCES

ACCDC (Atlantic Canada Conservation Data Centre). 2018. Data Report 5998: Edmundston/Madawaska Bridge, NB. Prepared January 15, 2018.

CESCC. 2015. Canadian Endangered Species Conservation Council. 2016. Wild Species 2015: The General Status of Species in Canada. National General Status Working Group: 128 pp.

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Appendix G HERITAGE RESOURCES

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320)

Appendix G Heritage Resources
February 2019

Appendix G – Heritage Resources

Environmental Impact Assessment Registration for the Replacement of the Madawaska-Edmundston International Bridge (E320)

February 2019

Prepared for:

Province of New Brunswick
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Statement of Limitations

This document entitled APPENDIX G – HERITAGE RESOURCES is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project and was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of the New Brunswick Department of Transportation and Infrastructure and the Maine Department of Transportation (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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1.0 INTRODUCTION

This document is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project (the Project). The Project is being proposed by the New Brunswick Department of Transportation and Infrastructure (NBDTI) and the Maine Department of Transportation (Maine DOT) and consists of the construction, operation, and maintenance of a new international bridge as well as the demolition of the existing international bridge over the Saint John River. The bridge spans between the City of Edmundston, New Brunswick and the Town of Madawaska, Maine.

This document includes an analysis of the potential interactions between Project activities and heritage resources Valued Component (VC) of the EIA for the Project.

2.0 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Heritage resources are those resources, both human-made and naturally occurring, related to activities from the past that remain to inform present and future societies of that past. Heritage resources are relatively permanent, although highly tenuous, features of the environment. If present, their integrity is highly susceptible to construction and ground-disturbing activities. Heritage resources have been selected as a VC in recognition of the interest of provincial and federal regulatory agencies which are responsible for the effective management of these resources, the general public, and Indigenous peoples that have an interest in the preservation and management of heritage resources related to their history and culture. They include consideration of historical, archaeological, built heritage, and palaeontological resources. Heritage resources will focus on archaeological, built heritage, and palaeontological resources, as all resources that would be understood to be “historical” are captured under one of the other heritage resource types.

Project activities that include surface or sub-surface ground disturbance have the potential for interaction with heritage resources, where they are present. Accordingly, construction represents the Project phase with the greatest potential for interaction with heritage resources, as it is during this phase that the ground breaking and earth moving activities will take place to construct Project components.

In this assessment, the potential changes to heritage resources as a result of the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

2.1 REGULATORY CONTEXT

Heritage resources in New Brunswick are regulated under the *Heritage Conservation Act* (2010). The regulatory management of heritage resources falls under the New Brunswick Department of Tourism, Heritage, and Culture, and is administered by its Archaeological Services Branch (for archaeological

resources), Historic Places Section (for built heritage resources), and Natural Sciences Section (for palaeontological resources).

The review for heritage resources has been undertaken through the completion of historical, archaeological, built heritage, and palaeontological research. The Province of New Brunswick provides guidance for conducting heritage assessments, such as the *Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick* (the "Archaeological Guidelines"; Archaeological Services 2012).

Consultation and engagement activities have been ongoing as part of the heritage resources component of the Project. During the background research for heritage resources, regional experts, and regulatory agencies were contacted in order to gather information on potential heritage resources within the PDA.

3.0 BOUNDARIES

3.1 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and heritage resources is focused on a Project Development Area (PDA) and a Local Assessment Area (LAA).

The PDA for the Project is defined as the area of physical disturbance associated with the construction and operation and maintenance phases of the Project, as well as with the decommissioning of the existing bridge. For the purposes of this assessment, the PDA comprises a physical footprint of the Project and includes portions of the Canada Border Services Agency properties and adjacent private properties, east and west of the proposed new bridge location, a portion of land owned by the Canadian National Railways (CN), and a portion of the Saint John River (from 250 metres (m) upstream of the new bridge to 250 m downstream of the existing bridge to the east, and up to the international border to the south).

The LAA for heritage resources is defined as the area within which the environmental effects of the Project can be measured or predicted. The LAA for heritage resources is limited to the PDA, as it is only within the PDA that construction and ground-disturbing activities could interact with heritage resources. Heritage resources located outside of the PDA are discussed in the "existing conditions" section below only inasmuch as they inform this assessment regarding the potential for unknown heritage resources within the PDA, however these will not be directly affected by the Project and are not considered further in this assessment.

The PDA, which is also the LAA for heritage resources, is shown on Figure 1.

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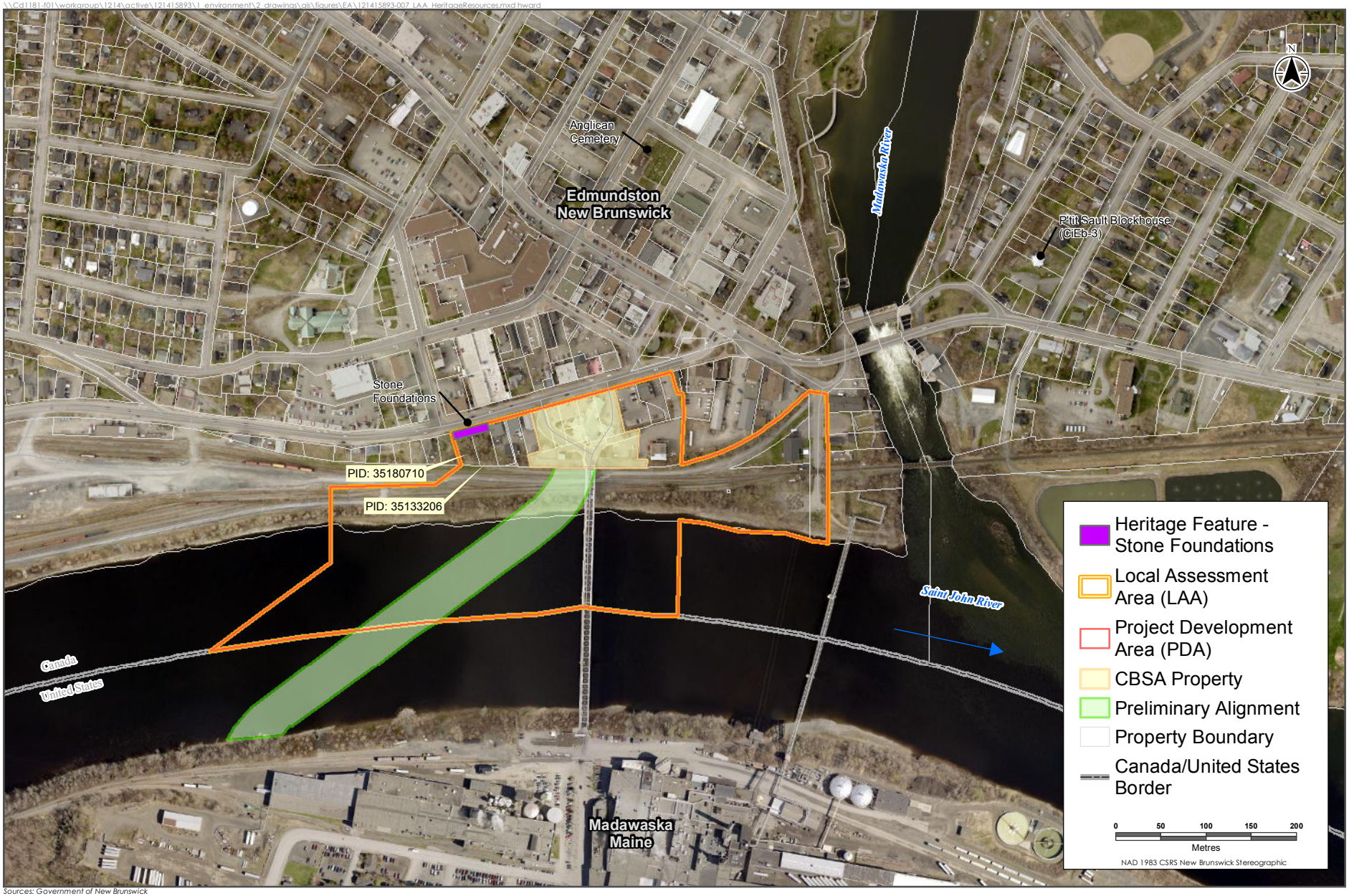

Sources: Government of New Brunswick
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Local Assessment Area for Heritage Resources

Stantec

Boundaries
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3.2 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental interactions between the Project and heritage resources include the following periods.

- Construction - including construction of the new bridge (anticipated to last three years) and demolition of the existing bridge (anticipated to last one additional year);
- Operation and maintenance – in perpetuity; and,
- Decommissioning and abandonment of the new bridge – not anticipated.

It is anticipated that construction of the new bridge will last three years. Decommissioning of the existing bridge, considered as part of the construction phase, will commence after opening of the new bridge. A project schedule will be prepared during the preliminary design of the bridge.

There are potential environmental interactions with heritage resources that may occur during the construction phase of the Project. The new bridge will be designed for an anticipated life-span of 75 years. Any environmental assessment or permitting requirements for the decommissioning of the proposed new bridge would be conducted in accordance with the regulations and requirements in place at that time and are not included in this assessment.

4.0 EXISTING CONDITIONS FOR HERITAGE RESOURCES

This section provides an overview of the results of the background research undertaken to determine known and potential heritage resources within or near the PDA.

4.1 SOURCES OF INFORMATION

The following sources were consulted to gather an understanding of the general and specific history in the area of review:

- Published, unpublished, and on-line works about local history, the environment, and previous archaeological work carried out in the area;
- The Archaeological Potential Map of the area of review, provided by Archaeological Services Branch (AS), showing areas with high and medium potential for Pre-Contact Period archaeological sites, based on anthropological, geographic, and geological data;
- Provincial archaeological sites database;
- Representatives from AS;
- Documents in the New Brunswick Archives;
- Department of Energy and Resource Development historic aerial photographs;
- The Canadian Register of Historic Places and the New Brunswick Register of Historic Places databases; and
- Regional expert in palaeontological information, Dr. Randall Miller, Curator Emeritus for the Geology and Palaeontology Section of the Natural Science Department for the New Brunswick Museum.

4.2 PREVIOUS STUDIES

A search of the AS report database in August 2018 identified a list of archaeological project manuscripts and reports on file at AS for projects and research conducted in and around the PDA. While no professional archaeological assessments have previously taken place within the PDA, several assessments have been undertaken in the surrounding area (AMEC Earth & Environmental 2007; Bourgeois 1997; Bourgeois 2004; Dickinson & Jeandron 1998; Dignam and Associates 2004; JWEL 2003; Leonard 2011). Where relevant, information provided by these heritage resource assessments is presented in the sections below.

4.3 ENVIRONMENT

The Project is located in the Madawaska Ecodistrict of the Central Uplands ecoregion. The landscape of this ecodistrict includes the westernmost extension of the province, sometimes called the “panhandle”, and is defined by elevated rocky outcrops and ridges with deeply incised gorges and canyons formed by its meandering rivers, especially the Green, the Little Main Restigouche, the Madawaska, and the St. Francis rivers (NBDNR 2007). Elevation ranges from 510 m in the northeast of the ecodistrict to about 150 m in the southwest at the confluence of the Saint John and Madawaska rivers (NBDNR 2007). Geology within the PDA is characterized by Devonian clastic sedimentary rocks such as slate, siltstone, and greywacke of the Temiscouata Formation compressed into tight upright folds giving outcrops a typically shattered appearance (NBDNR 2007).

The dominant soils of the ecodistrict are derived primarily from non-calcareous slate, siltstone, and greywacke that weathers slowly yielding a moderately acidic soil (NBDNR 2007). Alluvial deposits are common near the PDA along the Saint John River and lower stretches of the Madawaska and Green river valleys (NBDNR 2007). Forest cover is dominated by hardwood stands (sugar maple, yellow birch, and beech) capping the elevated ridges with increasing conifers forming a mixed forest type along mid-slopes, while softwoods (balsam fir and spruce varieties) tend to dominate lower slopes and valley bottoms (NBDNR 2007).

4.4 PRE-CONTACT PERIOD

The Pre-contact period is defined as the period of human occupation of the lands of eastern Canada for the entirety of the timeframe from the first arrival of humans, approximately 11,500 years Before Present (BP), up to the time of contact between these Indigenous populations and the European explorers when they first encountered North America, generally interpreted to be approximately 500 to 1000 years BP.

A review of the Archaeological Potential Map for the Project indicated that there are no registered Pre-contact Period archaeological sites located within the PDA (AS 2018). According to the Archaeological Potential Map, there are no areas within this section of the PDA that cross potential palaeo shorelines. However, it should be noted that there is the potential to encounter post glacial landforms, especially in areas adjacent to glaciofluvial outwash and glacial drainage, as identified by the surficial geology of the PDA (Department of Forests, Mines & Energy 1976; Rampton 1984). Much of the land along the Saint

John River shoreline portion of the PDA consists of steep slopes which are generally areas with low potential for human occupation and use.

It is well documented from archaeological evidence from several locations in the Maritimes, such as Debert, Nova Scotia, and Pennfield, New Brunswick, that the first peoples to inhabit what is now modern-day New Brunswick likely arrived in that region at the end of the Pleistocene (McMillan and Yellowhorn 2004; Suttie et al. 2013), approximately 11,000 years BP. Much of what is now northwestern New Brunswick would have remained under glacial ice sheets until around 10,600 BP, when the initial Wisconsinan deglaciation during the Allerød warm period began. However, due to the dynamic nature of the environment, with such events as the Younger Dryas ice re-advance, followed by another deglaciation, much of this area would likely not have been suitable for human occupation until after about 9,000 years BP (Bonnichsen et al. 1985; Cwyner et al. 1994; Seaman 2006). As was the case throughout what is now Canada, as the glaciers melted, human populations moved into each area as soon as climatic and subsistence conditions allowed and early Indigenous populations could have settled in the general area of the Project (Bonnichsen et al. 1985; Cwyner et al. 1994).

The PDA lies within the traditional territory of the Indigenous people of the Wolastoqiyik First Nation, whose territory is largely defined by the drainage area of the Saint John River, which they had originally named the Wolastoq, or “beautiful river” (Rayburn 1975). Indigenous populations who inhabited the northwestern part of New Brunswick would have likely travelled across this area while hunting for the various fauna occupying the landscape. By using the Madawaska River as a crucial link in a portage between the Saint John and St. Lawrence rivers via Lake Temiscouata and Riviere-du-Loup, they could canoe and portage 720 km from what is now Saint John to Quebec City in five days (NBDNR 2007). There is also a portage between the Saint John and the Restigouche which was known as the most travelled of all routes across New Brunswick and involved canoeing from Grand River up to Wagansis, followed by a two or three-mile portage to Wagan Brook, which flows into the Restigouche (Ganong 1899). According to Ganong, another portage (which has an “old and new path”) links the Saint John and Restigouche river valleys through a difficult portage between the Pemouit (or 4th) branch of the Green River and the Southwest branch of the Kedgwick (Bailey 1894; Cooney 1832; Ganong 1899; Wilkinson 1852).

An archaeological Impact assessment (AIA) was completed for this Project, including walkover surveys conducted on September 27 and October 30, 2018. This AIA determined that the PDA had in general low potential for Pre-contact archaeological resources due to previous heavy disturbance of the area from industrial and urban development, and mainly due to topographical conditions such as steep slope along the Saint John River shoreline. Most habitation and land use activities during the Pre-contact Period would have taken place along river shorelines. However, the steep slopes of this particular area within the PDA, in conjunction with the heavily disturbed areas beyond where the slopes begin to level off, indicates that the potential for Pre-contact archaeological resources is low.

4.5 HISTORIC PERIOD

The Historic Period is generally defined as the period starting with the settlement of mostly European derived peoples to North America, approximately 500 years ago, until the modern era.

A review of the Archaeological Potential Map for the Project (AS 2018) indicated that there are no registered Historic Period archaeological sites located within the PDA (Figure 1). However, there is one registered archaeological site (CiEb-3) located approximately 0.5 km northeast of the PDA, on the east side of the Madawaska River. Known as the P'tit Sault Blockhouse Provincial Historic Site, it is listed on the Canadian Register of Historic Places (CRHP) as of 2005 (CRHP 2018) when the original blockhouse was reconstructed by the Madawaska Historical Society (JWEL 2003). Originally built on a strategic hillock in 1841, it formed an important part of the British line of defense during the Aroostook War (JWEL 2003; Bourgeois 2004). The original blockhouse was destroyed by accidental fire in 1855 (CRHP 2018).

The Archaeological Potential Map for the Project also shows that there is at least one historic cemetery in proximity (0.25 km north of the PDA), but it is located outside of the PDA for the Project (Figure 1).

Acadian settlers from the lower Saint John River valley became the first non-Indigenous settlers to inhabit the area in 1786-87 (NBDNR 2007). The City of Edmundston itself was established through the economic development of the logging industry during the latter half of the 19th Century and was named after a former governor of New Brunswick, Sir Edmund Walker Head, who visited the area in 1856 (City of Edmundston 2018). The arrival of the railway in the late 1870s provided further impetus to a thriving logging industry and Edmundston served as the trading centre for lumber merchants (NBDNR 2007).

The AIA completed for this Project discovered two historic period structure foundation features situated on two properties (PIDs 35180710 and 35133206) inside the PDA, interpreted here as house foundations. Their location is depicted on Figure 1. Based on a review of historic aerial photographs, the two houses associated with these foundations can be clearly seen on the 1940s and 1955 aerials. By 1966, the aerials reveal that the house on one property (PID 35180710) was still present but the house on the adjacent property to the east (PID 35133206) had been demolished or otherwise removed and the property left vacant. By the early 1980s, the other house (PID 35180710) was gone and both lots were overtaken by trees and vegetation. At some point, maintenance or upgrades to Rue Saint François led to most of the features becoming buried beneath the street's toe-of-slope, with only the southern portions of the foundations remaining exposed today.

The review of historic aerials also revealed at least one structure located at the ferry landing in the eastern part of the PDA (at the end of Ferry Avenue). The structure may have been associated with ferry operations which likely ceased when the existing international bridge was opened in 1921. While the structure was still present to at least 1966, the field component of the AIA did not observe any obvious signs of structures in that area. It is possible that the building was removed to make way for the pulp pipeline trestle currently located to the east of the ferry landing area.

NBDTI has confirmed that it will avoid the two properties upon which the house foundations are located. Aside from the two house foundations, the PDA has in general low potential for historic period

archaeological resources. This is due to previous heavy disturbance from industrial and urban development within the PDA, and mainly due to topographical conditions such as steep slope along the Saint John River shoreline. Most habitation and land use activities during the early Historic Period would have taken place along river shorelines. However, the steep slopes of this particular area within the PDA, in conjunction with the heavily disturbed areas beyond where the slopes begin to level off, indicates that the potential for Historic Period archaeological resources is low.

4.6 PALAEONTOLOGICAL RESOURCES

A palaeontological report based on known data sources was prepared by the New Brunswick Museum (Miller 2018). The report noted that geological formations within the PDA consist entirely of sedimentary rocks of the Devonian Age Temiscouata Formation (Miller 2018). The report states that there are no documented fossil sites located within the PDA; however, fossils have been documented a few kilometres to the east and west of the PDA, and therefore, Project activities that involve the excavation of bedrock could encounter fossils (Miller 2018).

4.7 BUILT HERITAGE RESOURCES

A search of the Canadian Register of Historic Places (CRHP 2018) and the New Brunswick Register of Historic Places (NBRHP 2018) revealed a record of 39 historic places or heritage sites, 10 of which, including the aforementioned P'tit Sault Blockhouse Provincial Historic Site, are located within a 2 km radius of the PDA; however, it is anticipated that none of these sites will be affected by Project activities. Therefore, as there are no registered historic places or heritage sites within the PDA, built heritage resources will not be considered further in this assessment.

5.0 ASSESSMENT OF POTENTIAL PROJECT INTERACTIONS WITH HERITAGE RESOURCES

5.1 PROJECT-ENVIRONMENT INTERACTIONS FOR HERITAGE RESOURCES

This section describes how Project activities could interact with heritage resources as well as the techniques and practices that will be applied to mitigate these potential interactions.

5.1.1 Potential Interactions with Heritage Resources During Construction

During construction, activities that could result in a potential interaction with heritage resources include site preparation, clearing, grubbing, detouring, and ditching, excavation and blasting, and structure assembly. Ground breaking, earth moving, and in-filling activities will be limited to areas of the PDA where major construction components and activities are anticipated. These components include the proposed new bridge substructure (abutments, piers, and footings), bridge approaches and Canadian

Port of Entry modifications (detouring, ditching, culverts), bridge superstructure including bridge deck, and staging areas including temporary access roads. Undocumented heritage resources, where present, are typically located in the soil or rock layers of the earth and therefore potential interactions between these resources, if they are present, and the Project would take place during construction. Any potentially adverse interactions with heritage resources that might occur due to construction activities will be permanent, as no subsurface heritage site can be returned to the ground in its original state after it is disturbed.

Vegetation clearing for the Project will largely be carried out by mechanical means and has the potential to interact with heritage resources as these activities may result in some ground disturbance. Where access and staging occur, there is the potential for the use of heavy equipment to result in ground disturbance and potentially interact with subsurface heritage resources. Excavation and structure assembly may involve mechanical augering, excavation, or blasting, all of which have the potential to interact with heritage resources.

5.1.2 Potential Interactions with Heritage Resources During Operation and Maintenance

During operation and maintenance, it is anticipated that there will be no interaction between heritage resources and operation and maintenance activities. Any area where ground disturbance is required for operation and maintenance activities will have already been disturbed during construction activities and therefore any encounters with heritage resources will have been addressed during that phase of the Project.

5.1.3 Accidents, Malfunctions, and Unplanned Events

Accidents, malfunctions, and unplanned events are occurrences that are not part of planned activities or normal operation of the Project and have the potential to result in adverse environmental interactions. Given the adherence of Project activities to mitigation measures (e.g., good planning and design, vehicle and equipment maintenance, worksite health, safety, and environmental training of personnel), including those in the NBDTI Environmental Management Manual (EMM; NBDOT 2010), accidents, malfunctions, and unplanned events of a serious nature are unlikely to occur during any phase of the Project.

The accidents, malfunctions, and unplanned events that have potential to occur for this Project, and could potentially interact with heritage resources include:

- Hazardous material spill; and
- Erosion or sediment control failure.

The potential for a hazardous material spill is limited to Project activities involving the use of vehicles and heavy construction equipment, resulting in the rupture of a hydraulic fluid line or the release of fuel. The release of a hazardous material could penetrate into the upper soil layers of the earth where archaeological resources, if present, are typically located. Many archaeological artifacts, features, and deposits consist of non-durable, organic materials and interactions with hazardous materials as a result of

a spill would be detrimental to those resources. Moreover, the release of hazardous materials in areas where heritage resources are present would contaminate and adversely affect the wider contextual information to be gathered from the area, or even prevent altogether the safe recovery of heritage resources located therein.

Mitigation for accidents, malfunctions, and unplanned events is described in Section 5.2.

5.2 MITIGATION FOR HERITAGE RESOURCES

Interaction of the Project activities with heritage resources will be managed through use of mitigation measures, including adherence to the NBDTI EMM. Measures which will be employed to mitigate interactions with heritage resources are presented in Table 1.

Table 1 Mitigation Measures Applicable to Heritage Resources

Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation in NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
Construction including: • substructure • approaches and Canadian Port of Entry Modification • superstructure including bridge deck • removal of existing bridge	• Ground disturbance during site preparation, clearing, grubbing, excavation and blasting, and structure assembly. • Ground disturbance during site preparation, clearing, grubbing, detouring, culverts, and ditching, excavation and blasting, and approach construction. • Ground disturbance or in-filling for the construction of staging areas. • Ground disturbance during site preparation, excavation, and structure disassembly.	• 5.23 Working Near Environmentally Sensitive Areas	Implement the measures recommended as a result of the AIA: • Shovel testing and additional documentation for the properties where the two historic period structure foundations were discovered if avoidance of these properties is not possible.
Accidents, malfunctions, and unplanned events including: • Hazardous Material Spill • Erosion and Sediment Control Failure	• Contamination of heritage resources where present and the wider contextual information. • Loss of heritage resources and/or the wider contextual information.	• 5.23 Working Near Environmentally Sensitive Areas	No additional mitigation recommended

5.3 CHARACTERIZATION OF RESIDUAL PROJECT-ENVIRONMENTAL INTERACTIONS FOR HERITAGE RESOURCES

5.3.1 Construction

For the purposes of characterizing the residual environmental effects for a change in heritage resources, it is anticipated that the entire PDA will be developed for the Project. The construction phase of the Project represents the greatest potential for interaction with heritage resources, should any be present, and any ground breaking and earth moving activities of surface soils and rock have the potential to adversely affect the nature and integrity of heritage resources.

In the event that heritage resources are discovered in the PDA, the *Heritage Conservation Act* stipulates a duty to report the discovery of heritage resources and requires a permit to collect these resources. For heritage resources, the recovery and collection of these resources, should any be encountered, and presenting them to the Archaeological Services Branch of New Brunswick, will mitigate potential environmental effects to these resources.

The residual environmental effects of the Project, should there be an encounter with heritage resources during the construction phase of the Project, would be adverse. However, with the implementation of the mitigation described above, this interaction is unlikely, and if it were to occur, would be reduced by the implementation of the heritage resources discovery response plan in the NBDTI EMM.

6.0 SUMMARY AND RECOMMENDATIONS

In consideration of the above and considering the nature of the interactions between the Project and heritage resources as well as the planned implementation of known and proven mitigation and environmental protection measures as described in the EMM and in this assessment, as well as adherence to applicable legislation and guidelines, it is not anticipated that there will be significant interaction between the Project and heritage resources during any phases of the Project or during accident, malfunctions or unplanned events. At this time, follow-up work or additional archaeological assessment is not warranted or recommended.

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Appendix H LAND USE AND ECONOMY

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320)

Appendix H Land Use and Economy
February 2019

Stantec

Appendix H – Land Use and Economy

Environmental Impact Assessment Registration for the Replacement of the Madawaska-Edmundston International Bridge (E320)

February 2019

Prepared for:

Province of New Brunswick
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Statement of Limitations

This document entitled Appendix H – Land Use and Economy is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project and was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Province of New Brunswick, Department of Transportation and Infrastructure the New Brunswick Department of Transportation and Infrastructure and the Maine Department of Transportation (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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1.0 INTRODUCTION

This document is an appendix to the Environmental Impact Assessment (EIA) process for the proposed Madawaska-Edmundston International Bridge Replacement Project (the Project). The Project is being proposed by the New Brunswick Department of Transportation and Infrastructure (NBDTI) and the Maine Department of Transportation (Maine DOT). The Project consists of construction, operation and maintenance of a new international bridge as well as demolition of the existing international bridge over the Saint John River between the City of Edmundston, New Brunswick and the Town of Madawaska, Maine.

This document includes an analysis of the potential interactions between Project activities and the land use and economy Valued Component (VC) of the EIA for the Project.

2.0 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Land use and economy has been selected as a VC due to the potential for the Project to interact with residential, commercial, industrial and recreational land use, resource land use, transportation, and the local economy. The potential interactions between the Project and current use of land and resources for traditional purposes by Indigenous persons are assessed in this section as well.

In this assessment, the potential changes to land use and economy as a result of the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

2.1 REGULATORY CONTEXT

Land use planning in New Brunswick is guided by the *New Brunswick Community Planning Act* within unincorporated areas and the *New Brunswick Municipalities Act* in incorporated areas such as cities, towns and villages. The Northwest Regional Service Commission (NWRSC) provides land use and regional planning services for Edmundston and surrounding areas. The City of Edmundston's strategic plan, Agenda for the Future, was adopted by City Council in 2014 and is updated on an annual basis.

Operation and maintenance of highway infrastructure is largely regulated through the New Brunswick *Highway Act* and *Motor Vehicle Act*. The interactions of the Project with recreational uses of the land include fishing, hunting, and trapping, which are regulated through the New Brunswick *Fish and Wildlife Act.*

As Crown agencies, provincial and federal agencies have a duty to consult with First Nations on matters that may infringe upon the rights of Indigenous Peoples as established under Section 35 of the Constitution Act. The New Brunswick Duty to Consult Policy (2011) provides direction to the provincial government on consultation with the Mi'kmaq and Wolastoqey First Nations.

Indigenous fishing activities take place in two distinct fisheries, the communal commercial fishery, and the Food, Social, and Ceremonial (FSC) Fishery. The general provisions that are set out under the federal *Fisheries Act* (refer to the aquatic environment VC, Appendix D) for the communal commercial fishery apply to the FSC fishery in terms of general protection of commercial, recreational or Aboriginal (CRA) species. Provisions under the *Fisheries Act* protect fish and fish habitat, including fisheries resources, and apply specific regulations governing fisheries. FSC licenses are issued under the authority of the *Fisheries Act* and of subsection 4(1) of the *Aboriginal Communal Fishing Licenses Regulations*.

Fishery resources are protected from uncontrolled fishing activity through various measures such as area closures, fishing quotas, fishing seasons, and gear and vessel restrictions as described and detailed under the regulations presented above and by Fisheries Management Decisions applied by DFO in accordance with the roles and responsibilities outlined in the *Fisheries Act*.

3.0 BOUNDARIES

3.1 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the Project and land use and economy is focused on the Project Development Area (PDA) and a Local Assessment Area (LAA).

The PDA for the Project is defined as the area of physical disturbance associated with the construction and operation and maintenance phases of the Project, as well as decommissioning of the existing bridge. For the purposes of this assessment, the PDA comprises a physical footprint of the Project and includes portions of the Canada Border Services Agency (CBSA) properties and adjacent private properties, east and west of the proposed new bridge location, a portion of land owned by the Canadian National Railways (CN), and a portion of the Saint John River (from 250 metres (m) upstream of the new bridge to 250 m downstream of the existing bridge to the east, and up to the international border to the south).

The LAA for land use and economy is defined as the area within which the environmental effects of the Project can be measured or predicted. The LAA for economy considers the County of Madawaska, within which the City of Edmundston and Madawaska First Nation are located, as the economic benefits from the construction activities may be wide-spread within the County. Environmental effects on land use and current use are anticipated to be much more localized and have been assessed within a 500 m buffer on each side of the PDA. The total area of the LAA for economy is approximately 3,498 km², and the total area of the LAA for land use (including current use) is 1.12 km². The PDA and the LAAs are shown on Figures 1 and 2.

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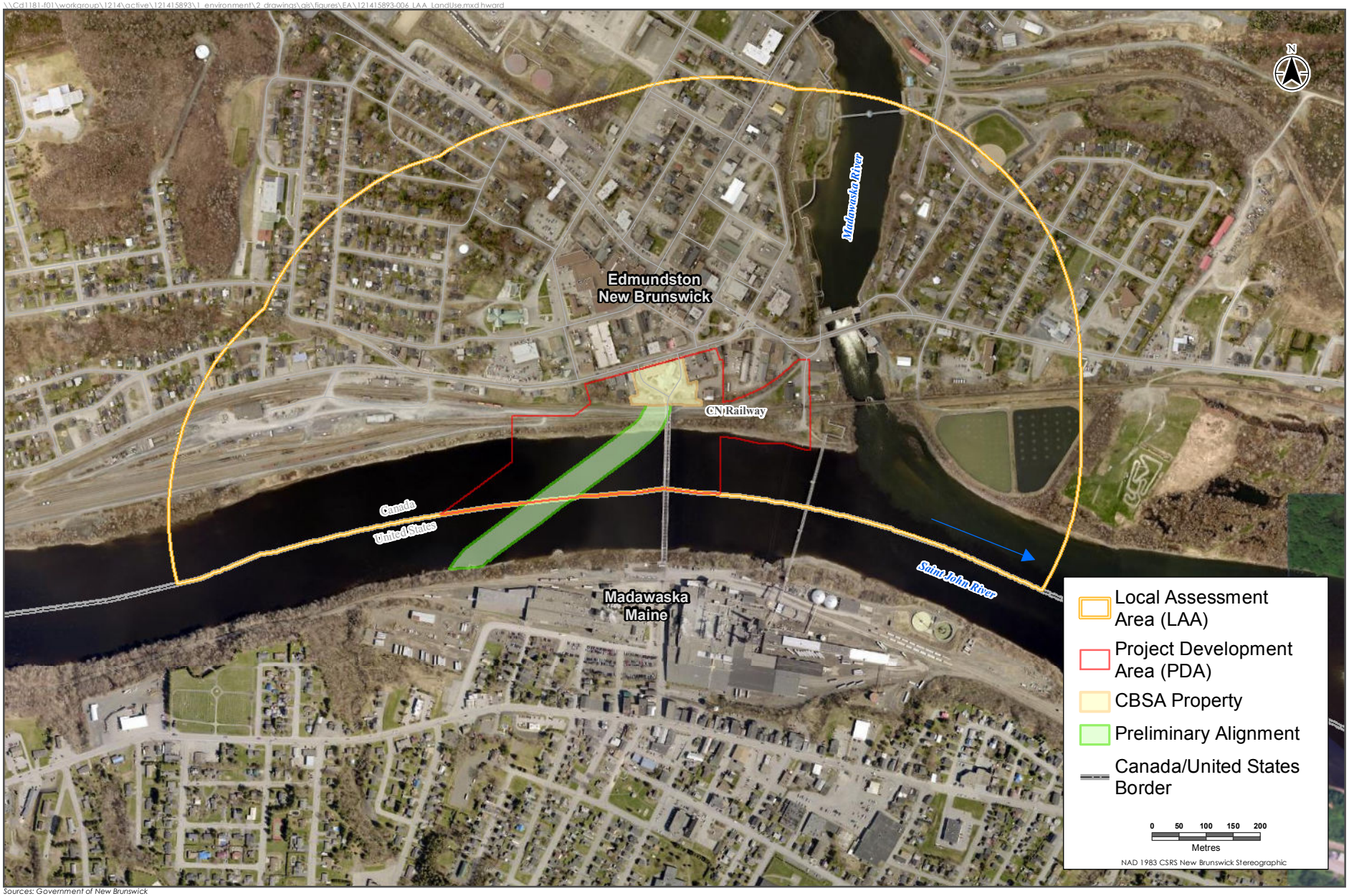

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Local Assessment Area for Land Use

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121415893 - NBDTI - MADAWASKA-EDMUNDSTON BRIDGE

Figure 1

Boundaries
February 2019

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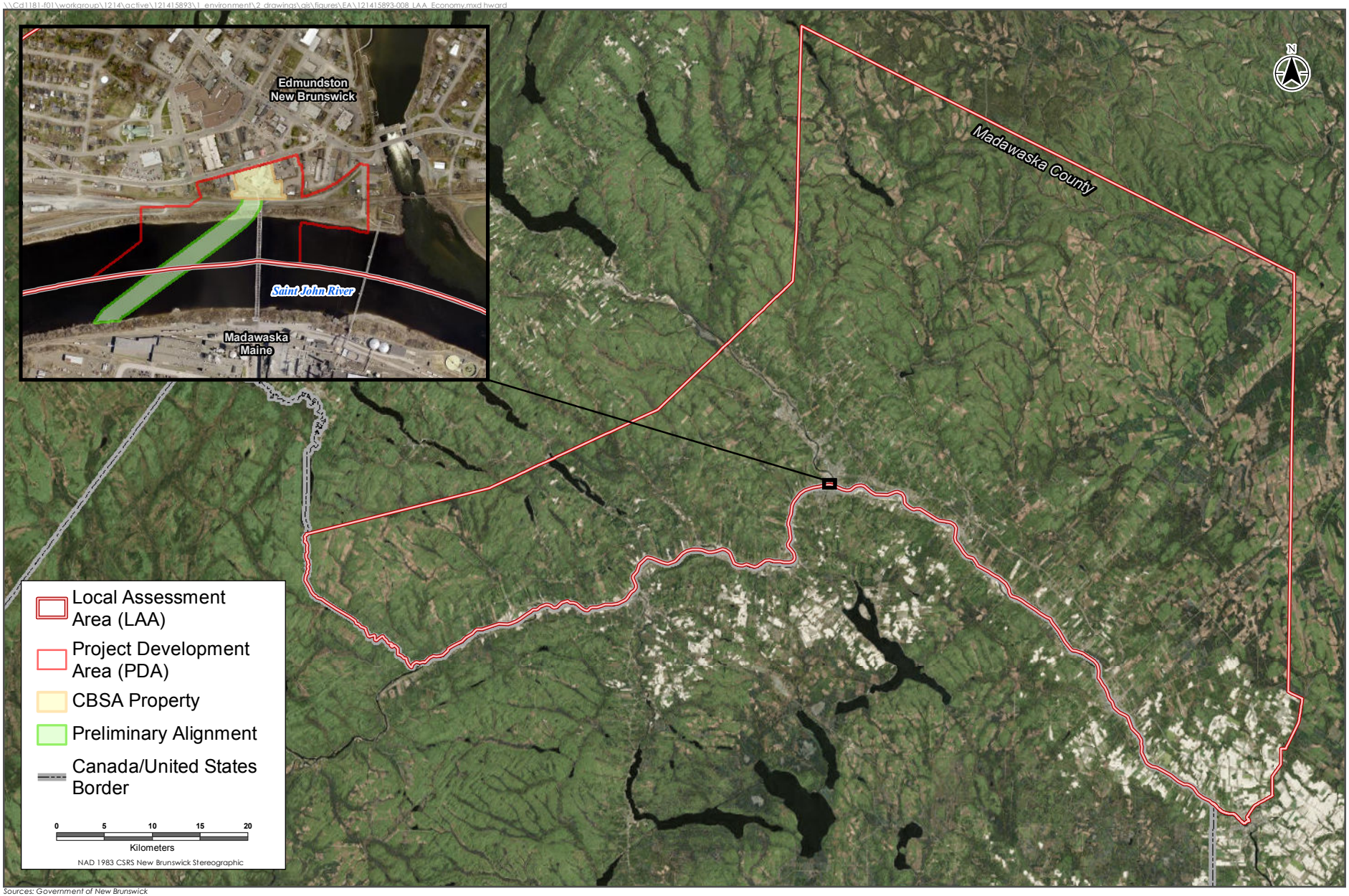

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Local Assessment Area for Economy

Stantec

121415893 - NBDTI - MADAWASKA-EDMUNDSTON BRIDGE

Figure 2

Boundaries
February 2019

3.2 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential environmental interactions between the Project and land use and economy include the following phases.

- Construction - including construction of the new bridge (anticipated to last three years) and demolition of the existing bridge (anticipated to last one additional year);
- Operation and maintenance – in perpetuity; and,
- Decommissioning and abandonment of the new bridge – not anticipated.

It is anticipated that construction of the new bridge will last three years. Decommissioning of the existing bridge, considered as part of the construction phase, will commence after the opening of the new bridge. A project schedule will be prepared during the preliminary design of the bridge.

There are potential environmental interactions with Land Use and Economy that will occur during the construction, operation and maintenance phases of the Project. The new bridge will be designed for an anticipated life-span of 75 years. Any environmental assessment or permitting requirements for the decommissioning of the proposed new bridge would be conducted in accordance with the regulations and requirements in place at that time and are not included in this assessment.

4.0 EXISTING CONDITIONS FOR LAND USE AND ECONOMY

Information on baseline conditions was primarily obtained from spatial analysis and baseline research. Baseline research included a review of statistical data sources and published reports. These published reports include published maps and aerial photography, the Government of New Brunswick (various departments), and past project assessments and technical reports that were reviewed for relevant information.

4.1 LAND USE

The Project is located within downtown Edmundston and is located on several contiguous federally-owned parcels of land (CBSA customs facility) and a Canadian National (CN) Railway property. Based on preliminary consultation with the NB Department of Energy and Resource Development, it appears that the river bottom between the shore and the international border (located in the middle of the river) belongs to the upland owner, in this case CN as well. One property adjacent to and to the west of the Canadian Border Facility will likely be needed for the Project, NBDTI is negotiating with the landowner to acquire their property.

The largest component of the land use LAA is urban (62 ha, or 55% of the total area), followed by water (28 ha, or 25%), and highways/railroads (6 ha (4%) and 6.2 ha (5%), respectively). Vegetation covers approximately 4.7 ha of the LAA (4.2%).

There are 395 buildings within the land use LAA, including 293 residential and 102 commercial or institutional buildings (including a swimming pool, church, post office, fire station, auto centre, parking area, cemetery and pumping station). The PDA includes 6 buildings, half are commercial, and half are residential.

The nearest Mineral Claim is approximately 20 km NE from the Project, and the nearest Oil and Gas License is 155 km SE.

Hunting, boating, recreational water use, snowmobiling, and fishing are popular recreational activities in the area. Edmundston is on the border of Wildlife Management Zones 1 and 2. These zones are open to hunting, trapping and snaring. Snowmobile trail #130 passes northeast of the land use LAA on the east side of the Madawaska River.

4.2 TRANSPORTATION

Edmundston is located along New Brunswick Route 2, a four-lane all weather divided highway. There is a municipal airport located approximately 20 km northwest of the City of Edmundston. As mentioned above, the Project is located on several federally-owned parcels of land, including a CN Railway property. A railway crosses through the PDA (Figure 1).

The existing international bridge that connects Canada to the United States carries both public and commercial traffic. Transport Canada estimates that approximately 73 heavy-duty commercial trucks passed through the Edmundston border-crossing per day in 2016, for a total of 26,504 trucks that year (Transport Canada 2017). Due to the condition of the existing bridge, as of October 27, 2017 weight restrictions have been applied to the bridge that prohibit the passage of vehicles heavier than 5 tons from crossing. Therefore, large trucks and certain emergency vehicles are currently not permitted to cross the existing bridge. Heavier vehicles are being re-routed to the Clair/Fort Kent international bridge 32 km upstream, or the Saint-Leonard/Van Buren international bridge 43 km downstream.

4.3 LOCAL ECONOMY

Approximately 32,741 people live within Madawaska County (Statistics Canada 2016) (most recently available Census data). The employment rate in Edmundston is 51.4% (Statistics Canada 2016). The northwest region of New Brunswick (which includes Madawaska, Carleton and Victoria counties) has high percentages of employment levels in the areas of sales and service occupations (24.7%), trades, transport and equipment related occupations (17.8%), and business, finance and administrative occupations (15.9%) (Government of New Brunswick 2013). The occupational composition in the area is more heavily weighted, compared to the rest of the province, on jobs unique to primary industry; processing, manufacturing, utilities; trades transport and equipment operators; and sales and service occupations (Government of New Brunswick 2013). Average individual income levels in the region are slightly lower than provincial averages. The average employment income of individuals (full-year and full-time) in the northwest region of New Brunswick is $36,841, compared to $41,412 for the province. Average family income levels in the northwest region are also lower than the provincial average ($58,053

compared to $63,913). Some of the largest employers in the region include McCain Foods Ltd., Vitalité Health Network, Anglophone West School District and Twin Rivers Paper (Government of New Brunswick 2013).

The Twin Rivers Paper pulp mill is located within the City of Edmundston and produces pulp, which is sent in a pipeline across the Saint John River to its twin mill in Madawaska, and energy. Energy is produced by a 45-Megawatt biomass cogeneration plant that is sold to NB Power (Twin Rivers Paper 2018). Twin Rivers Paper owns and operates several utility lines that cross the existing international bridge, under a license agreement with the State of Maine and the Province of New Brunswick. Only two of these utility lines, which convey liquids/slurries, are believed to be operational. Some buried utilities owned by Twin Rivers Paper are not shown on maps (NBDTI 2018).

A community college campus affiliated with the Collège communautaire du Nouveau-Brunswick is located in Edmundston, along with a university campus affiliated with the University of Moncton.

Emergency services within the Economy LAA are provided by various community police and fire stations, such as those located within the City of Edmundston. The three Edmundston fire stations, located in Saint-Jacques, Saint-Basile and downtown Edmundston, include over 60 firefighters. In addition to the standard fire-fighting duties, they provide rescue services relating to car accidents, hazardous materials and a variety of other rescue services (City of Edmundston 2018).

Several temporary accommodation options serve the Economy LAA, including 10 hotels/motels/inns in Edmundston (including Travelodge, Four Points by Sheraton, Days Inn, Comfort Inn, and Best Western Plus) and several cottages available for rent (Tourism Edmundston 2018).

4.4 USE OF LAND AND RESOURCES BY INDIGENOUS PERSONS

The Project is located with the traditional homeland of the Wolastoqiyik. Since the retreat of the glaciers from this area approximately 12,000 years ago and the populating of this area following that time, the Saint John River has provided subsistence and economy for the Wolastoqiyik peoples. The river is the main corridor of transportation and conveyance between Wolastoqiyik communities from what are now Québec, Maine, and New Brunswick. More recently, with the establishment of the First Nation Reserve system in Canada under the *Indian Act*, six Wolastoqiyik communities were created in New Brunswick: Madawaska Maliseet (located 1 km down river from the Project), Tobique (*Negootuk* or *Neqotkuk)*, Woodstock, Kingsclear (*Pilick*), St. Mary's (*Sitansisk*), and Oromocto (*Welmooktuk*).

Traditional land and resource use territory for the Wolastoqiyik, as shown in Goddard (1996), includes a broad swath of hunting, gathering and fishing territory anchored around the Saint John River. The PDA would have been used by early First Nation people for hunting, fishing, and gathering prior to the development of the City of Edmundston in the mid-19th century (Bailey 1894; Ganong 1899; NBDNR 2007). The Project crosses the Wolastoq River (the Saint John River) which was the ancient travel route that facilitated trade and social interaction between Wolastoqiyik and Penobscot, and that extended from the pre-European period through to the early 20th Century. More recently the land for the existing and

new bridge access road and abutment has not been available for use due to the urbanized nature of the location, the presence of the railway, and the secured access for the international border.

5.0 ASSESSMENT OF POTENTIAL PROJECT INTERACTIONS WITH LAND USE AND ECONOMY

5.1 PROJECT-ENVIRONMENT INTERACTIONS FOR LAND USE AND ECONOMY

This section describes how the Project activities could interact with land use and economy.

5.1.1 Potential Interactions with Land Use and Economy During Construction

The Project may interact with land use and economy during construction through interactions with land use, transportation, local economy, and the use of land and resources by Indigenous persons.

The Project is located in a highly controlled, secure location due to the surrounding facilities such as the CBSA Facility, private homes and businesses, and the railway. Therefore, there is currently restricted public access to much of the PDA, with the exception of the river and shoreline area. Access to the approaches to the bridge is already limited due to steep slopes thus the use of this area for recreational activity has been limited for many years. During construction, there may be additional restrictions to river and shoreline access for boating or fishing in the immediate areas of the bridges for safety reasons, and these restricted areas will be relatively isolated.

Construction activities have the potential to cause delays for vehicular and/or pedestrian traffic and disrupt local traffic patterns in the transportation network leading to and from the PDA and surrounding area. This could potentially reduce traffic to nearby businesses. Construction will also result in a slight increase in passenger vehicles and heavy trucks transporting workers, materials and equipment to and from the site.

There will likely be a boost to the local economy due to construction of the Project. Increased demand for labour, goods, and services due to Project activities during construction will likely create employment within the Economy LAA and generate revenue for businesses and associated tax revenue for governments.

The two operational Twin Rivers Paper pipelines that cross the existing bridge will require relocation upon demolition of the existing bridge (NBDTI 2018).

With respect to use by Indigenous Persons, there may be restrictions to river and shoreline access for safety reasons, as mentioned above, but these restricted areas will be relatively isolated. The majority of the river and shoreline areas outside of the construction safety and security zone will remain accessible to Indigenous peoples and the general public throughout construction and operation of the Project. Full

access to the river and shoreline areas will be restored once the construction of the new bridge is complete and the decommissioning of the existing bridge is finished.

5.1.2 Potential Interactions with Land Use and Economy During Operation and Maintenance

During its operational and maintenance phase, the Project will facilitate the safe movement of traffic between Canada and the US at this location. The weight restrictions that are currently being applied to the existing bridge will no longer be a factor and normal large trucks and emergency vehicles will be permitted to access the bridge and will no longer required to re-route to other international crossing locations.

With the exception of the footprint of the bridge piers, the river and shoreline areas will be fully accessible during operation of the Project, consistent with current access. Fishing and harvesting activities by Indigenous people previously restricted by construction will be able to resume, with the exception of the footprint of the new bridge piers.

5.1.3 Accidents, Malfunctions, and Unplanned Events

Accidents, malfunctions, and unplanned events are occurrences that are not part of planned activities or normal development of the Project and have the potential to result in adverse environmental interactions. Given the adherence of Project activities to mitigation measures (e.g., good planning and design, vehicle and equipment maintenance, worksite health, safety, and environmental training of personnel), including those in the NBDTI Environmental Management Manual (EMM; NBDOT 2010), accidents, malfunctions, and unplanned events of a serious nature are unlikely to occur during any phase of the Project.

Accidents, malfunctions, and unplanned events that have the potential to occur for this Project, and could potentially interact with land use and economy include:

- hazardous material spill;
- project-caused fire; and
- vehicle collision.

The potential for a hazardous material spill is limited to operation of vehicles and heavy construction equipment, especially rupture of a hydraulic fluid line or the release of fuel. Release of a hazardous material could result in contamination of property, resulting in a decrease in property value or the enjoyment of the property by the property owners or users. Hazardous materials could spill into the river, resulting in contamination of the water and damage to aquatic life. A spill of hazardous material could also result in degradation of the aesthetic appeal of an area, resulting in a decrease in the enjoyment of residents and land users.

The potential for a Project-caused fire includes the use of vehicles, equipment, or the improper discarding of cigarettes. A fire could result in the loss of private property (homes and businesses), and other land use types, therefore adversely affecting residents and land users. The Project location is not remote, and local emergency response services are available.

There is the potential for a Project vehicle to collide with another vehicle, Project infrastructure, other infrastructure or people. A vehicle collision could result in damage to property, the release of a hazardous material, or injury to people. The project is not remote, and local emergency response services are available.

Mitigation for accidents, malfunctions, and unplanned events is included in Section 5.2.

5.2 MITIGATION FOR LAND USE AND ECONOMY

Interaction of the Project activities with land use and economy will be managed through the use of mitigation measures, including adherence to the NBDTI EMM and applicable permits. Measures that will be employed to mitigate interactions with land use and economy are presented in Table 1.

Table 1 Mitigation Measures Applicable to Land Use and Economy

Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation in NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
Construction including: • substructure • approaches and Canadian Port of Entry Modification • superstructure including bridge deck • removal of existing bridge	• Traffic delays • Altered/restricted access to land, affecting land use and activities	• 5.5 Detouring • 5.7 Erosion and Sediment Management • 5.17 Temporary Ancillary Facility Management • 5.20 Waste Management • 5.23 Working Near Environmentally Sensitive Areas	• Flow of traffic will be maintained to the extent possible around and within the Project area during construction and operation and maintenance in accordance with the NBDTI Work Area Traffic Control Manual (WATCM).
	• Altered/restricted access to water, affecting fishing and boating activities	• 5.7 Erosion and Sediment Management • 5.17 Temporary Ancillary Facility Management • 5.20 Waste Management • 5.23 Working Near Environmentally Sensitive Areas	• The proponent will maintain a navigational opening through the work area to allow for the passage of boats during construction, to access areas upstream and downstream from the Project.
	• Short-term increase in employment and revenue generation for businesses and tax revenue for governments	No standard mitigation recommended	No additional mitigation recommended
Operation and maintenance including: operation of infrastructure (including snow and ice removal), preservation and maintenance of structures.	• Increase in traffic in the area • Presence of new bridge piers	• 5.16 Summer Highway Maintenance • 5.21 Winter Highway Maintenance	• Flow of traffic will be maintained to the extent possible around and within the Project area during construction and operation and maintenance in accordance with the NBDTI Work Area Traffic Control Manual (WATCM).

Assessment of Potential Project Interactions with land use and economy
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Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation in NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
Accidents, malfunctions, and unplanned events including: • Hazardous Material Spill • Project-caused Fire • Vehicle Collision	• Contamination of land, affecting land use and activities • Contamination of water affecting water-based activities • Fire damage to property and land • Property damage, the release of a hazardous material, or injury to people	• 5.10 Fire Prevention and Contingency • 5.12 Spill Management • 5.13 Storage and Handling of Petroleum Products • 5.14 Storage and Handling of Other Hazardous Materials • 5.19 Vehicle and Equipment Management • 5.20 Waste Management • 5.23 Working Near Environmentally Sensitive Areas	No additional mitigation recommended

5.3 CHARACTERIZATION OF RESIDUAL PROJECT-ENVIRONMENTAL INTERACTIONS FOR LAND USE AND ECONOMY

5.3.1 Construction

The anticipated effects of Project construction on land use and economy are largely localized, short-term and temporary. One private property adjacent to and to the West of the Canadian Border Facility will likely be needed for the project, NBDTI is negotiating with the landowner for the use of their property.

Interruption of the use of land and resources by Indigenous persons will also be localized and/or short-term.

Some short-term disruption to recreational activities and fishing, is possible. These activities are anticipated to return to normal upon completion of the construction phase of the Project.

Owners of private land will be consulted and accommodated for use of their land as appropriate, prior to construction. Access restrictions will be defined and will be limited in size to reduce the interactions with land and resource users.

While construction activities are expected to restrict access or cause delays for vehicular and/or pedestrian traffic, and local traffic patterns, such disruptions will be temporary and intermittent in nature and limited to the construction phase of the Project. The increase in passenger vehicles and heavy trucks transporting workers, materials and equipment to and from site will be managed through NBDTI's standard procedures (WATCM Manual). All large-sized vehicles will obtain appropriate weights and size permits. Any road closures required during construction will be limited and short-term.

Increased demand for labour (in particular construction and safety personnel), goods and services (including increased occupancy in local hotels/motels) due to Project activities during construction will create positive economic benefits within the Economy LAA by generating revenue for local businesses and associated tax revenue for governments.

5.3.2 Operation and Maintenance

The operation and maintenance phase of the Project will facilitate the uninterrupted and safe movement of traffic between Edmundston and Madawaska, which is viewed as a beneficial residual effect of the Project on land use and economy.

With the completion of the new international bridge, traffic levels will return to what they were prior to October 27, 2017, when weight restrictions were placed on the existing bridge for large trucks and certain emergency vehicles.

Overall, the completed Project will facilitate smooth traffic flow and access between Edmundston and Madawaska, and result in a return to pre-weight restriction traffic conditions which in general is anticipated to be a positive effect for the economy over time.

6.0 SUMMARY AND RECOMMENDATIONS

With the implementation of the mitigation and environmental protection measures described in this assessment, it is not anticipated that there will be substantial negative effects caused by the Project on land use and economy during any phases of the Project. Potentially adverse effects resulting from restricted access to the relatively small land and water area needed for construction are not anticipated to have a measurable overall effect in the LAA. Nuisance interactions as a result of land-based traffic or restrictions to boat traffic and angling in portions of the Saint John River during construction will be short term. Standard and Project-specific mitigation presented here should be enacted to improve benefits to existing local businesses and to reduce adverse effects during construction to local residents and businesses. NBDTI will be meeting with First Nations to confirm the determination of potential impacts of the project on their use of land and resources in the PDA and LAA.

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Appendix I EFFECTS OF THE ENVIRONMENT ON THE PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT REGISTRATION FOR THE REPLACEMENT OF THE MADAWASKA-EDMUNDSTON INTERNATIONAL BRIDGE (E320)

Appendix I Effects of the Environment on the Project
February 2019

Appendix I – Effects of the Environment on the Project

Environmental Impact Assessment Registration for the Replacement of the Madawaska-Edmundston International Bridge (E320)

February 2019

Prepared for:

Province of New Brunswick
Department of Transportation and Infrastructure

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Statement of Limitations

This document entitled Appendix I – Effects of the Environment on the Project is an appendix to the Environmental Impact Assessment (EIA) registration document for the proposed Madawaska-Edmundston International Bridge Replacement Project and was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of the New Brunswick Department of Transportation and Infrastructure and the Maine Department of Transportation (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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February 2019

1.0 INTRODUCTION

This document is an appendix to the Environmental Impact Assessment (EIA) process for the proposed Madawaska-Edmundston International Bridge Replacement Project (the Project). The Project is being proposed by the New Brunswick Department of Transportation and Infrastructure (NBDTI) and the Maine Department of Transportation (Maine DOT) and consists of the construction, operation and maintenance of a new international bridge as well as the demolition of the existing international bridge over the Saint John River. The bridge spans between the city of Edmundston, New Brunswick and the town of Madawaska, Maine.

Effects of the environment on the Project is technically not a Valued Component (VC); however, it is analyzed here for continuity in the assessment of potential interactions between the Project and the environment.

2.0 RATIONALE FOR SELECTION AS A VALUED COMPONENT

Effects of the environment on the Project has been identified for assessment due to the potential for environmental forces, natural hazards and environmental conditions to interact with the Project. Interactions between the environment and the Project may include naturally-occurring events associated with:

- Climate (including weather),
- Climate change,
- Sea level rise,
- Flooding,
- Erosion and mass wasting,
- Seismic activity,
- Natural forest fires,
- Contaminated sites, and
- Sulphide bearing rock.

If adverse effects of the environment on the Project are not accounted for or unmanaged, they can result in adverse changes to Project components, construction schedule, and costs. Typically, these potential effects are addressed through Project design, scheduling, and operational procedures implemented in consideration of expected normal and extreme environmental conditions.

In this assessment, the potential effects of the environment on the Project are considered. The scope of the assessment is based on applicable regulations and policies, professional judgement of the study team, and knowledge of potential interactions.

3.0 BOUNDARIES

3.1 SPATIAL BOUNDARIES

The assessment of potential environmental interactions between the effects of the environment on the Project encompasses only one spatial boundary: the Project Development Area (PDA), as described below.

The PDA for the Project is defined as the area of physical disturbance associated with the construction and operation and maintenance phases of the Project, as well as the decommissioning of the existing bridge. For the purposes of this assessment, the PDA comprises the physical footprint of the Project and includes portions of the Canada Border Services Agency properties and adjacent private properties, east and west of the proposed new bridge location, a portion of land owned by the Canadian National Railways (CN), and a portion of the Saint John River (from 250 metres (m) upstream of the new bridge to 250 m downstream of the existing bridge to the east, and up to the international border to the south).

Because this section is assessing the potential effects of the environment on the Project, the spatial boundary for effects to the Project is limited to those areas having Project-related infrastructure within them, and thus limited to the PDA (Figure 1 of the EIA document). There is no local assessment area associated with the effects of the environment on the Project.

3.2 TEMPORAL BOUNDARIES

The temporal boundaries for the assessment of the potential effects of the environment on the Project include the following phases.

- Construction - including construction of the new bridge (anticipated to last three years) and demolition of the existing bridge (anticipated to last one additional year);
- Operation and maintenance – in perpetuity; and,
- Decommissioning and abandonment of the new bridge – not anticipated.

It is anticipated that construction of the new bridge will last three years. Decommissioning of the existing bridge, considered as part of the construction phase, will commence after the opening of the new bridge. A project schedule will be prepared during the preliminary design of the bridge.

There are potential interactions between the environment and the Project during the construction and operation phases of the Project. The new bridge will be designed for an anticipated life-span of 75 years. Any environmental assessment or permitting requirements for the decommissioning of the proposed new bridge would be conducted in accordance with the regulations and requirements in place at that time and are not included in this assessment.

4.0 EXISTING CONDITIONS FOR EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Information on baseline conditions was primarily obtained from baseline research, which included a review of statistical data sources and published reports. These published reports include the Governments of New Brunswick and Canada (various departments), scientific literature, and past project assessments/technical reports that were reviewed for relevant information.

4.1 CLIMATE

Climate can be characterized by the long-term and seasonal meteorological conditions experienced by a region, in particular: temperature, humidity, precipitation, sunshine, cloudiness, and winds. The Government of Canada has developed statistical summaries of data collected from weather stations located all over the country for a recent 30-year period (1981 – 2010), referred to as climate normals data. There is an Environment and Climate Change Canada (ECCC) weather station located in Edmundston, New Brunswick (climate ID: 810AL00; latitude: 47°20'47.000" N; longitude: 68°11'16.000" W; elevation: 163 metres) (Government of Canada 2018a).

Climate readings at the Edmundston weather station indicate that January is typically the coldest month of the year, with a daily average temperature of -12.9 °C. July is typically the warmest month of the year, with a daily average temperature of 18.2 °C. The average annual precipitation in Edmundston is 1,011 mm, with July being the month with the most rain and January being the month with the most snow (Government of Canada 2018a).

4.1.1 Extreme Weather Events

The Government of Canada lists floods, hurricanes, landslides, severe storms, storm surges, and tornadoes among New Brunswick's regional environmental hazards in the federal "Get Prepared" campaign (Government of Canada 2018b). Tornadoes occasionally occur in New Brunswick, although they are very rare (Cheng et al. 2013).

Extreme storms in New Brunswick tend to be more common and severe during the winter months. Winter storms can consist of high winds and a mixture of snow, rain, and ice. Extreme rainfall in the spring can result in flooding from high freshet flows (spring thaw from snow and ice). In the winter of 2008, the province experienced record-breaking snowfalls, approximately 50% higher than normal. In April of that year, extreme rain in the spring caused high freshet flows and runoff (400% higher than normal in northwest N.B) which resulted in flooding, costing the province $23 million (NBDELG 2012). More recently, extreme flooding occurred along the Saint John River in the spring of 2018, and water levels were nearly as high as they were in 2008. Dozens of homes in the province were evacuated (some of which were in Edmundston), and Highway 144 in the Edmundston area experienced damage from erosion (CTV News 2018, CBC News 2018).

4.2 CLIMATE CHANGE

Climate change is "a change in the state of climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or variability of its properties and that persists for an extended period, typically decades or longer" (IPCC 2014). Climate change can be due to natural forces (such as solar cycles or volcanic eruptions) and/or human activities that cause changes to the atmosphere or in land use (IPCC 2014).

Greenhouse gas (GHG) emissions, released from human activities and urban development, are recognized as a contributing factor to climate change (IPCC 2007). A GHG is any gas that contributes to potential climate change. Greenhouse gases absorb and trap heat that is radiated by the earth, preventing it from escaping to the atmosphere. This natural phenomenon is commonly known as the "greenhouse effect"; an increase in GHGs in the atmosphere intensifies the GHG effect by increasingly trapping heat within the atmosphere, thereby intensifying potential for climate change (EPA 2016).

4.2.1 Climate Change Projections

Predictions of future climate change trends are derived from mathematical/statistical models. While such models can provide useful information for predicting climate change, their ability to forecast regional changes is limited compared to larger-scale predictions, such as continental climate change (Randall et al. 2007; Flato et al. 2013). However, the results obtained from climate change prediction models can be used as a guide for Project planning and can facilitate Project design and adaptation.

There is an overall consensus among the climatological community that over the next century, Atlantic Canada is likely to experience warmer temperatures, increased precipitation, more frequent storm events, increased storm intensity, and increased flooding (Lemmen et al. 2008; Lines et al. 2005, 2008).

4.2.1.1 Climate Change Projections

The Government of New Brunswick calculated climate change projections for the province (GNB 2017); they were developed from the application of existing ECCC historical weather station data in the province to the guidance provided by the Intergovernmental Panel on Climate Change (IPCC) in their Fifth Assessment Report (AR5) (IPCC 2014). The climate change predictions for New Brunswick are based on four GHG concentrations trajectories adopted by the IPCC in AR5. These trajectories are referred to as representative concentration pathways (RCP), and are indicative of the potential range of radiative forcing values that could result in GHG-related heating of the planet by the year 2100, as compared to pre-industrial values (Moss et al., 2010).

The four RCP values are RCP2.6, RCP4.5, RCP6, and RCP8.5, and represent scenarios in which GHG-related heating of the planet by the year 2100 occurs at a rate of 2.6 Watts per square metre (W/m²), 4.5 W/m², 6 W/m², and 8.5 W/m², respectively. Data for New Brunswick only includes climate projection scenarios for RCP4.5 and RCP8.5. Since RCP4.5 assumes GHG emissions will peak around the year 2040 and then decline thereafter, and Canada has set GHG target emission reductions at 30% below 2005 levels by 2030 (ECCC 2018), climate change assessments in this report refer to the intermediate

climate projection scenarios for RCP4.5. For the purposes of this report, climate change scenarios for the year 2080 are used in the assessment of potential interactions with the operation of the Project.

There is an ECCC weather station located in Edmundston; forecasted temperature data from this weather station is presented herein, however precipitation data from this station is unavailable. The nearest ECCC weather station with available precipitation data is located in Saint-Leonard, which is approximately 38 km Southeast from Edmundston. These data are considered to be representative of the Edmundston area (Table 1).

Table 1 Forecasted Temperature and Precipitation Data in Edmundston and Saint-Leonard, N.B.

Weather Station Location	Mean Annual Temperature (ºC)		Mean Precipitation (mm)		Winter Precipitation (mm)		Spring Precipitation (mm)	
	Year: Current (normals 1980-2010)	Year: 2080; RCP4.5	Year: Current (normals 1980-2010)	Year: 2080; RCP4.5	Year: Current (normals 1980-2010)	Year: 2080; RCP4.5	Year: Current (normals 1980-2010)	Year: 2080; RCP4.5
Edmundston, NB	3.4	6.3	N/A	N/A	N/A	N/A	N/A	N/A
Saint-Leonard, NB	3.6	6.5	1,088.6	1,189.4	242.7	279.3	238.3	265.6

N/A = data not available for this ECCC weather station

RPC4.5= represent scenario in which GHG-related heating of the planet by the year 2100 occurs at a rate of 4.5 Watts per square metre (W/m²)

Source: GNB 2017

Mean annual temperatures at both the Edmundston and Saint-Leonard weather stations are estimated to increase by close to 3°C by the year 2080 under an intermediate climate projection scenario (RCP4.5) (Table 1). Increased temperatures could result in higher freshet flows in the spring (discussed above in Section 5.1.1.1).

The projected mean total annual precipitation for the weather station located in Saint-Leonard is estimated to increase from 1088.64 mm (1080 mm in 2010) to 1189.36 mm by the year 2080 (Table 1). This represents a 9% increase in total annual mean precipitation. Winter precipitation (snow and ice) and spring precipitation are expected to increase by 15% and 11%, respectively, by the year 2080 (Table 1). Increased water flow in the Saint John River, especially in the spring, is anticipated as a result of heavy rain and increased spring freshet which, in turn, will result from increased snow and ice in the winter months. Effects associated with this increase in total annual precipitation over the next several decades are not expected to cause adverse effects on the Project infrastructure since the bridge will be designed to accommodate this increase.

4.3 SEA LEVEL RISE, FLOODING, EROSION AND MASS WASTING

The Project area is not included in the Updated Sea-Level Rise and Flooding Estimates for New Brunswick Coastal Sections (R.J. Daigle Enviro, 2017) because it is not located on the coast of the province and therefore will not be directly affected by sea level rise.

The Project is located outside of New Brunswick's Flood Map Index (GNB 2018a), which describes the anticipated frequency, depth and width of flooding in parts of the province known to be at risk from river flooding. The Saint John River flood stage in Edmundston is 139.0 m (NBDELG 2012; ECCC 2018). During the 2008 flood (discussed under Section 4.1.1), the flood stage was recorded as 143.1 m, just slightly lower than the highest recorded flood stage (143.191 m in April 1991) (ECCC 2018).

Ice jams can occur when pieces of floating ice accumulate near river bends, mouths of tributaries, downstream of dams or upstream of bridges or obstructions. The obstructions caused by ice jams can result in flooding, and flash flooding can occur when ice jams suddenly break apart (NWS 2018). Severe ice jams have occurred in the Saint John River up to 60 km downstream of the proposed bridge site, and water levels in Edmundston have been impacted by ice jams that have occurred in other areas, such as Saint-Anne-de-Madawaska. However, the historical increase in water levels caused by ice jams and flooding have been below the superstructure of the existing and proposed bridges (Hilcon Limited 2018).

Erosion, the process where geologic materials are worn away and transported by environmental forces such as wind or water (NGS 2018), and mass wasting, the downward movement of geologic materials and vegetation (NGS 2018), can occur in riverbanks, steep terrains and rugged topography. The highest erosion rates in New Brunswick occur along the Northeast coast (NBDELG 2018). The Government of Canada does not list erosion among New Brunswick's regional environmental hazards in the federal "Get Prepared" campaign (Government of Canada 2018b).

Flooding and erosion, in relation to extreme weather events and climate change, is discussed further under Sections 4.1 and 5.0.

4.4 SEISMIC ACTIVITY

Seismic activity is characterized by the local geography of an area and the movement and/or fracture of rocks within the Earth (e.g., movement of tectonic plates). These movements release seismic waves that cause vibration of the ground, otherwise known as earthquakes (NRCan 2016a).

The Project lies within the Northern Appalachians seismic zone, which includes New Brunswick and extends towards New England. Historically, seismic activity in this area has been low, although there have been earthquakes with a magnitude of 5 or less (on the Richter scale) near Edmundston. However, it is unlikely that an earthquake with a magnitude of less than 5 would cause damage (NRCan 2016b).

Project structures will be built in accordance with industry standards to withstand minor seismic events (the bridge will be built according to the ASSHTO Bridge Code requirements for Seismic Zone 1). As

such, it is not anticipated that there will be any likely interaction between seismic activity and the Project. Therefore, seismic activity is not considered further in this report.

4.5 NATURAL FOREST FIRES

The Canadian Wildland Fire Information System (CWFIS) is a computer-based fire management information system that monitors short-term and long-term forest fire danger conditions across Canada, creating maps year-round and throughout forest fire season, which typically occurs between May and September (NRCan 2018a). The Fire Weather Index (FWI), a component of CWFIS, is a numeric rating of forest fire intensity (NRCan 2018b). The FWI in Northwest New Brunswick is rated as 0-5 during forest fire season (based on data collected over a 30-year period from 1981 – 2010). This is the lowest range of possible forest fire risk, the highest being a rating of >30 (NRCan 2018c).

The PDA is mostly urban, with a small amount of vegetation (see the land use and economy VC and wetlands and vegetation VC, Appendix H and F, respectively), and it is located directly adjacent to the Saint John River. The risk of forest fires occurring within the Project area is low, because of the land use types in the area and because the region has a very low FWI rating. Therefore, natural forest fires are not considered further in this report.

4.6 CONTAMINATED SITES

A contaminated site is “one at which substances occur at concentrations (1) above background (normally occurring) levels and pose or are likely to pose an immediate or long term hazard to human health or the environment, or (2) exceeding levels specified in policies and regulations” (TBCS 2018a). The Federal Contaminated Sites Inventory includes information on all known contaminated sites under the control of federal departments, agencies and consolidated Crown corporations, as well as sites that have been (or are being) investigated (TBCS 2018a).

There are three federal contaminated sites near the Project area (TBCS 2018b). They include:

- Site 04783001, Francois Street: this is the Canada Border Services Agency facility, which is owned by Public Services and Procurement Canada. A Phase 1 Environmental Site Assessment (ESA) was conducted and determined that no further work was required. There is potential that soils on this site may be disturbed through the realignment of the access roads to the bridge.
- Site 00017130 Edmundston Carrefour Assomption: this Fisheries and Oceans Canada site has been identified as potentially contaminated but has not been assessed. It is located less than 200 m Northwest from the PDA and will not be affected by the Project.
- Site 04782001, 22 Emmerson Street: this Public Services and Procurement Canada site is located approximately less than 200 m North from the PDA. A Phase 1 ESA was conducted and determined that no further action to be required. This site will not be affected by the Project.

Service New Brunswick maintains an inventory of known contaminated sites in the province (Service NB 2018). There is one property near the PDA that contain known contaminated sites:

- PID 35265909, New Brunswick Department of the Environment and Local Government, Petroleum Storage Site Report: this property runs along the entire shoreline of the PDA and extends beyond it to the west, including the CN rail yard. This contaminated site is located outside of the PDA.

4.7 SULPHIDE-BEARING ROCK

Some bedrock contains minerals, such as pyrite and other sulphide-containing minerals, that can release sulphuric acid and metal oxides when exposed to water and oxygen; this process is called acid rock drainage (ARD). The acidic runoff created by ARD can lower the pH of watercourses and wetlands, and it can cause metals (such as iron and arsenic) to mobilize from the surrounding bedrock and be released into the surrounding environment, causing metal contamination (NSDLF 2017). Although this is a natural process, ground disturbance and excavation can expose sulphide bearing rock to the elements and cause ARD to occur at increased rates.

New Brunswick's geology and bedrock is diverse and complex (NBERD 2018a). Minor sulphide mineralization may be found in most lithographical bedrock; however, certain types of rock such as black shales and slates may have higher levels of sulphide mineralization. The type of mineralization impacts the degree of ARD when the bedrock is disturbed (NBDTI EMM). Based on NBDTI's experience with rock cuts in the area, there is low potential for ARD in the Project area (MacDonald, S., personal communication, 2019).

5.0 ASSESSMENT OF POTENCIAL EFFECTS OF THE ENVIRONMENT ON THE PROJECT

5.1 INTERACTIONS FOR EFFECTS OF THE ENVIRONMENT ON THE PROJECT

This section describes how the environment could interact with Project activities.

5.1.1 Potential Interactions of Effects of the Environment on the Project During Construction and Operation

5.1.1.1 Climate and Extreme Weather

Extreme precipitation has the potential to result in flooding, erosion, and other events such as access roads being washed out. Sedimentation could occur as a result of extreme flooding. Failures of erosion or sedimentation control structures could occur as a result of heavy precipitation events during construction.

Wet snow, freezing rain, and ice could potentially damage infrastructure and construction equipment, if ice builds to a point where structures are unable to withstand the weight. Extreme precipitation, storms and hurricanes could cause a delay in the receipt of construction materials, result in additional effort for

snow clearing and removal, result in the inability for workers to access the site, or could cause an interruption to Project operation.

Increases in warm temperatures in the spring can result in high freshet flows in the Saint John River and its tributaries (GNB 2018b; CBC News 2018). This results in the break-up and movement of winter ice cover, potentially causing ice jams which can lead to flooding. If temporary trestles are used during the 3-year construction period and left in the river during the winter months, the potential for ice jams could increase. This potential was assessed through an ice study commissioned by NBDTI.

Fog (reduced visibility) could cause difficulties with maneuvering equipment and other Project-related activities, as could high winds (due to blowing snow, dust or debris).

The Project will be designed and constructed to meet engineering codes, standards, and best management practices, which includes applicable building, safety, and industry codes, as well as standards for weather variables associated with climate. These standards and codes provide factors of safety regarding effects of the environment and Project-specific activities and events. Project design and construction will consider normal and extreme weather conditions that may be encountered and will include measures for climate adaptation.

5.1.1.2 Contaminated Sites

Ground disturbance during construction, such as excavation, could expose contaminated soils or potentially move contaminated soils from one area to another. The newly resurfaced contaminants could be exposed to weather and spread to other areas within the PDA or the Saint John River by rain (runoff) or by high winds.

5.1.1.3 Sulphide-Bearing Rock

Exposing sulphide bearing rock to the elements may result in ARD when the surface of the rock interacts with water and oxygen. The potential for sulphide bearing rock to be present within the PDA is being investigated as part of the design process by NBDTI. NBDTI considers sulphide bearing rock during all phases of their projects and has mitigation measures listed in their EMM (see Section 5.2.1).

5.2 MITIGATION FOR EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Interaction of the environment with Project activities will be managed through use of mitigation measures, including adherence to NBDTI's EMM. Measures which will be employed to mitigate interactions with the environment are presented in Table 1.

Table 2 Mitigation Measures Applicable to Effects of the Environment on the Project

Project Component	Potential Interactions	Sections Outlining Applicable Standard Mitigation from NBDTI's EMM	VC-Specific Mitigation not Included in DTI EMM
Construction including: • substructure • approaches and Canadian Port of Entry Modification • superstructure including bridge deck • removal of existing bridge	• Flooding, erosion, and/or sedimentation • Altered/restricted access to land, affecting land use and activities • Damage to infrastructure and/or equipment • Delay in receipt of construction materials • Inability for workers to access site	• 5.5 Detouring • 5.7 Erosion and Sediment Management • 5.17 Temporary Ancillary Facility Management • 5.20 Waste Management • 5.22 Work Progression • 5.23 Working Near Environmentally Sensitive Areas • 5.24 Working Near Pipelines and Other Underground Services	• An allowance for delays due to poor weather will be included in the construction schedule. • An ice study was commissioned by NBDTI to determine appropriate mitigation measures should ice jamming occur during construction or operation, which could include modifying the temporary trestles or removing the structures during the winter, and/or monitoring water levels during spring freshet.
	• Disturbance of sulphide bearing rock	• 5.25 Sulphide Bearing Rock and Acid Rock Drainage Management	No additional mitigation recommended
Operation and maintenance including: operation of infrastructure (including snow and ice removal), preservation and maintenance of structures.	• Interruption to Project operation • Increase in cost of snow clearing and removal • Damage to infrastructure and/or equipment	• 5.16 Summer Highway Maintenance • 5.21 Winter Highway Maintenance	No additional mitigation recommended

5.3 CHARACTERIZATION OF RESIDUAL PROJECT-ENVIRONMENTAL INTERACTIONS FOR EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Effects of the environment, including extreme weather conditions, climate change, flooding, erosion and mass wasting, contaminated sites and sulphide bearing rock will be considered and incorporated into the planning, design, construction and operation of the Project, which would reduce the potential for damage to infrastructure and/or equipment, and changes to construction and operation of the Project. An allowance for delays due to poor weather will be included in the construction schedule. Maintenance programs will prevent the deterioration of Project infrastructure and will help the Project comply with the applicable design criteria, best management practices/standards/codes, and will maintain the reliability of the Project. Therefore, residual effects from effects of the environment are anticipated to be generally low and infrequent.

6.0 SUMMARY AND RECOMMENDATIONS

Project construction techniques, best practices, scheduling and design codes account for effects of the environment, such as extreme weather as a result of potential future climate change. Therefore, with the implementation of mitigation and environmental protection measures as described in the EMM and in this assessment, it is not anticipated that there will be substantial adverse effects of the environment on the Project.

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