Environmental Assessment
Route 11 – Glenwood Area to Miramichi Bypass
Northumberland County, New Brunswick
Regulator Draft

January 2017

New Brunswick Department of
Transportation and Infrastructure
Design Branch

Submitted by:
New Brunswick Department of Transportation and Infrastructure

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ACRONYMS

Acronym/Unit	Definition
˚C	Degrees Celsius
µg	Microgram
µg/m^3	Microgram per cubic metre
AADT	Average Annual Daily Traffic
AADTT	Average Annual Daily Truck Traffic
AASHTO	American Association of State Highway and Transportation Officials
AC CDC	Atlantic Canada Conservation Data Centre
ATV	All Terrain Vehicle
CCME	Canadian Council of Ministers of the Environment
CEAA	*Canadian Environmental Assessment Act*
CEAR	Canadian Environmental Assessment Registry
CEPA	*Canadian Environmental Protection Act*
cm	Centimetre
CO	Carbon monoxide
CO_2eq	Carbon dioxide equivalents
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRHP	Canadian Register of Historic Places
CWS	Canadian Wildlife Service
dB_A	Decibels on the A-weighted scale (measure of noise)
DFO	Fisheries and Oceans Canada
DWA	Deer Wintering Area
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMM	Environmental Management Manual
EMP	Environmental Management Plan
ESA	Environmentally Significant Area
FHWA	Federal Highway Administration
GCDWQ	Guidelines for Canadian Drinking Water Quality
GHG	Greenhouse gas
ha	Hectare
HADD	Harmful Alteration, Disruption, or Destruction
hr	Hour
HRIA	Heritage Resource Impact Assessment
km	Kilometre
km/h	Kilometres per hour
km^2	Square kilometre
L	Litre
L_{eq}	Equivalent sound pressure level

Acronym/Unit	Definition
L_n	Nightime sound pressure level
LOS	Level of Service
m	Metre
m^2	Square metre
MARI	Maritime Archaeological Resource Inventory
MBBA	Maritimes Bird Breeding Atlas
MBCA	Migratory Birds Convention Act
mg	Milligram
mm	Millimetres
N_2O	Nitrous oxide
NBESA	New Brunswick Endangered Species Act
NBCC	National Building Code of Canada
NBDAAF	New Brunswick Department of Agriculture, Aquaculture and Fisheries
NBERD	New Brunswick Department of Energy, Resources and Development
NBDTI	New Brunswick Department of Transportation and Infrastructure
NBELG	New Brunswick Department of Environment and Local Government
NEDB	National Earthquake Database
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxide
NSA	Noise sensitive area
NTU	Turbidity
NWPA	Navigable Waters Protection Act
O_3	Ozone
OMR	Operation, maintenance and rehabilitation
PAHs	Polycyclic aromatic hydrocarbons
PAR	Property access road
PDR	Project Development Right of Way
PM	Particulate matter
PM_{10}	Particulate matter less than 10 microns
$PM_{2.5}$	Particulate matter less than 2.5 microns
POL	Petroleum, oil or lubricant
ppm	Parts per million
PSW	Provincially Significant Wetland
RAU 110	Rural Arterial Undivided highway with design speed of 110 km/hr
RCMP	Royal Canadian Mounted Police
ROW	Right-of-Way
SARA	Species at Risk Act
SO_2	Sulphur dioxide
SSEPP	Site Specific Environmental Protection Plan
TAC	Transportation Association of Canada

Acronym/Unit	Definition
TOC	Total organic carbon
TRC	Technical Review Committee
TSP	Total suspended particulate
TSS	Total suspended solids
US EPA	United States Environmental Protection Agency
VEC	Valued Environmental Component
WAWA	Watercourse and Wetland Alteration
WHMIS	Workplace Hazardous Materials Information System
WMZ	Wildlife Management Zone
WPADO	Watershed Protected Area Designation Order

1.0 PROPONENT CONTACT

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2.0 THE UNDERTAKING

2.1 Project Overview

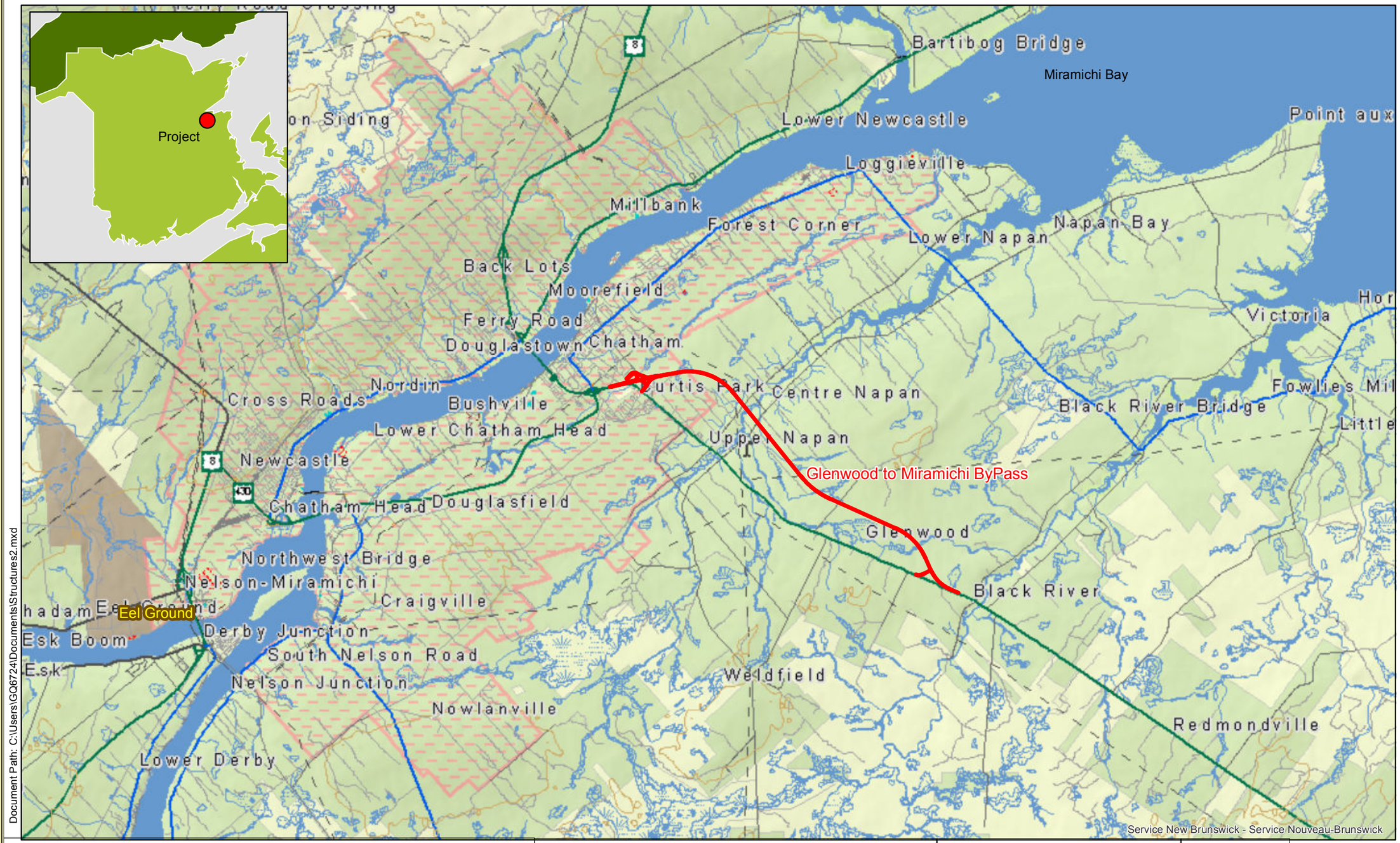
The New Brunswick Department of Transportation and Infrastructure (NBDTI) is proposing to construct a 12 km bypass of existing Route 11 between Glenwood and Miramichi. The proposed 2-lane section of highway (The Project) will begin just north of Black River (south of MacDonald Road) and continue north until it meets existing Route 11 between the intersections with King Street and University Avenue.

The Project is primarily located on privately owned land within Northumberland County, New Brunswick, and its general location is shown in Figure 1.1. Property required to accommodate project elements (*e.g.,* main alignment, property access roads, interchange, etc.); will be acquired from private land owners in the area. The Project consists of the construction of:

- a new two lane bypass,
- a parclo interchange at King Street,
- a 1.8 km-long parallel property access road,
- a 700 m-long service road that will provide access underneath the highway near the parclo interchange and connect to the property access road,
- highway underpasses at the following locations:
    - east of the interchange to accommodate the service road mentioned above
    - North Napan Road
    - South Napan Road
    - O'Donnell Road
- an at-grade "T" intersection at the southern end of the Project,
- a 600 m-long section of road that will connect existing Route 11 to The Project at the "T" intersection,
- a bridge over Napan River, and
- approximately 15 minor watercourse crossing structures involving 7 watercourses.

The project will be a Level I access controlled, two lane Rural Arterial Undivided (RAU) facility with a design speed of 110 km/h (RAU 110). Figures 1.2A and 1.2B provide an overview of the project and show the area assessed as part of the environmental field surveys (Project Area).

This environmental impact assessment report (EIA Report) is intended to meet the requirements of the New Brunswick *Environmental Impact Regulation 87-83* (NB *EIA Regulation*) of the New Brunswick *Clean Environment Act.*



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New Brunswick Department of Transportation and Infrastructure
Date: 12/20/2016
Projection: NB Stereographic

0 2,500 5,000 10,000 Meters
1:100,000

Project Area
Route 11 Glenwood Area to
Miramichi Bypass Project

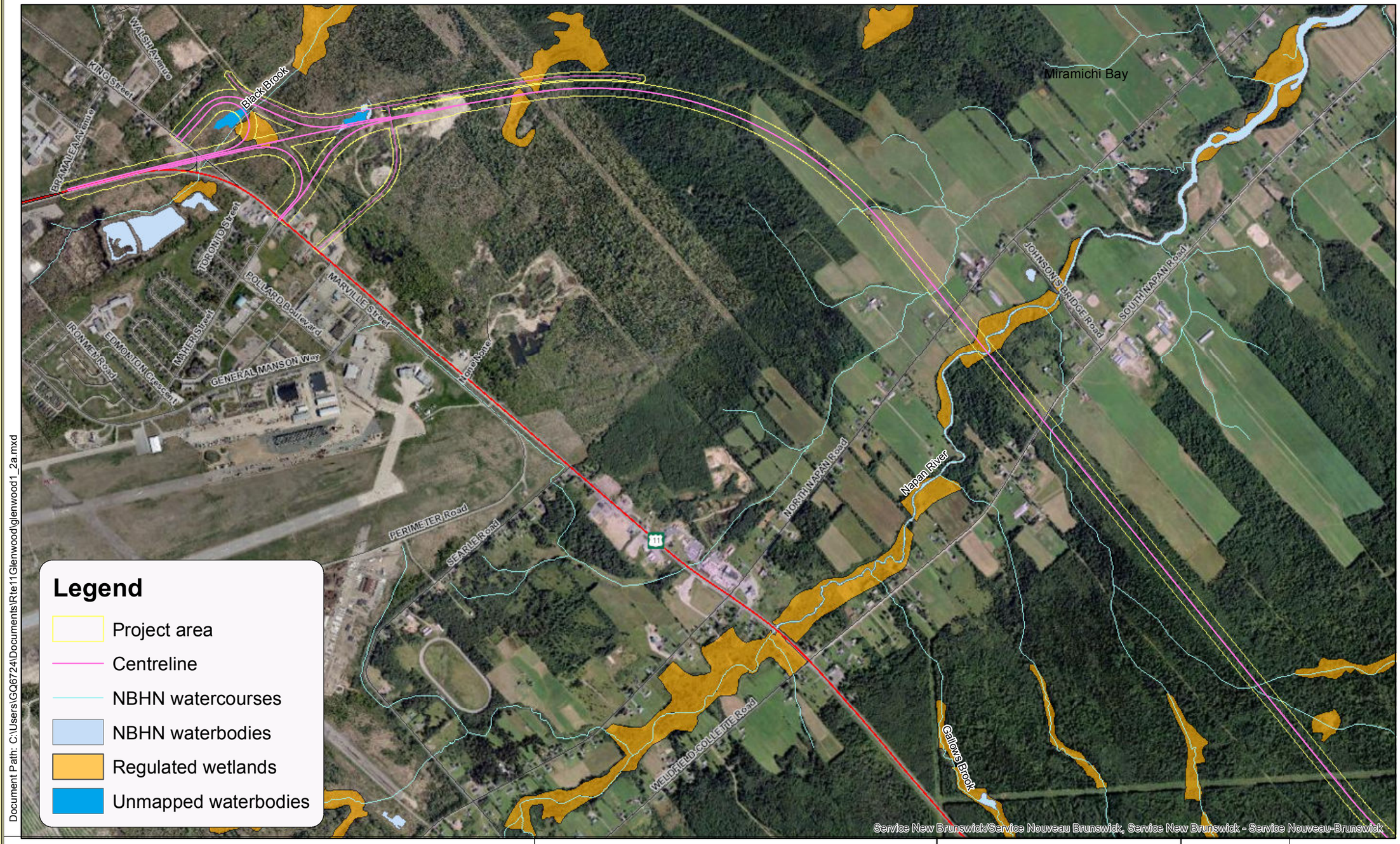
Locational Map
Proposed Alignment

Drawn by:
GMQ

Figure No.: 1.1

Checked:
GAP, EMT

N



Legend

- Project area
- Centreline
- NBHN watercourses
- NBHN waterbodies
- Regulated wetlands
- Unmapped waterbodies

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New Brunswick Department of Transportation and Infrastructure
Date: 1/31/2017
Projection: NB Stereographic

0 375 750 1,500 Meters
1:15,000

Project Overview
Route 11 Glenwood Area to
Miramichi Bypass Project

Western Half
Proposed Alignment

Drawn by: GMQ

Checked: GAP

Figure No.: 1.2a

N

Miramichi Bay

O'DONNELL Road

MACDONALD Road

11

Service New Brunswick/Service Nouveau Brunswick, Service New Brunswick - Service Nouveau-Brunswick

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Legend

- Project area
- Centreline
- NBHN watercourses
- NBHN waterbodies
- Regulated wetlands

New Brunswick Department of Transportation and Infrastructure

Date: 1/31/2017

Projection: NB Stereographic

0 375 750 1,500 Meters

1:15,000

Project Overview
Route 11 Glenwood Area to
Miramichi Bypass Project

Eastern Half
Proposed Alignment

Drawn by: GMQ

Figure No.: 1.2b

Checked: GAP

N

2.2 Purpose and Need for the Project

The purpose of the proposed undertaking is to address and improve current and projected deficiencies in highway safety and capacity on Route 11 in the Miramichi Region, south of the Miramichi River. On Page 1 of exp Services Inc.'s Infrastructure Canada Business Case (2014) for the project, the following is stated:

> (The Project) will improve highway safety by diverting the through traffic from the development, accessed at-grade, along the existing two-lane Route 11 (57 residential and commercial driveways and 10 intersecting roadways) to the new fully access-controlled two-lane bypass.

Upgrading of the northern trade corridor is a central component of the government's economic self-sufficiency strategy. Strong regions are critical components for provincial economic growth to be maximized. Upgrading of Route 11 to present day standards for arterial highways will enable increased efficiency in the regional production chain. Lower transportation costs and higher productivity play a key role in supporting future economic development activities. Route 11 is the primary highway in the eastern and northern coastal areas of the province and is the critical link between the cities of Campbellton, Bathurst, Miramichi and the Greater Moncton area. Over its entire length, the route serves a population base of 281,000 people. This represents about 38 percent of the total labour force in New Brunswick. Over the years, roadside development has increased along this route to the point where traffic flow is impeded. The section of existing Route 11 to be bypassed has posted speed limits ranging from 60 to 90 km/h.

2.2.1 Project Alternatives

Null "Do Nothing" Scenario

Maintaining the status quo on the existing section of highway is not being considered as an acceptable alternative due to the need to improve current and projected deficiencies in highway safety and capacity in the project area.

The area has only one main thoroughfare, that being Route 11. Residents and businesses located along this section of the existing highway will continue to experience noise, the risk of accidents, and traffic delays.

The proposed bypass is expected to lead to an improvement in highway safety due to the fact that traffic aiming to travel past the developed area on existing Route 11 will not be mixing with slower traffic using this area. "The Route 11 bypass upgrade project is projected to reduce the

total number of collisions within the Project Limits by 229 over the 20 year analysis period." (exp Services Inc., p.10, 2014).

Alternative Alignments

Various alignments were considered during the conceptual planning phase of this project. A corridor for the new bypass was identified using an iterative process combining NBDTI requirements to meet design and operating standards while minimizing adverse environmental impacts. Known environmental constraints were mapped and alternative alignments were assessed based on their impact on the constraints, benefits to users, and estimated costs given the topography and geology along the alignment.

2014 Alignment 1

This initially-proposed alignment included a diamond interchange which was further east from King Street than the currently proposed parclo interchange. This proposed alignment also involved cul-de-sacs at South Napan and O'Donnell Roads on either side of the highway. A property access road from the southern end, and east of, the proposed project (the South PAR) would have been required to maintain access to properties that are currently accessed from O'Donnell Road.

2014 Alignment 2

Upon presenting 2014 Alignment 1 to the City of Miramichi and at a Public Information Session in April 2014, NBDTI received many comments from businesses, City officials and the public requesting that the interchange be moved closer to King Street. The main reason for this request was to allow for traffic travelling on the new highway to better be able view the commercial retailers on King Street while they have an opportunity to exit. This would have been especially true for northbound traffic on the new highway as they would have passed the northbound exit ramp before any signage for retailers on King Street would have been visible. Additionally, for southbound traffic, it was thought that by reducing the "backtracking" distance between the southbound exit and King Street, travelers would be less likely to be dissuaded from visiting this area. As a result of this request, the originally proposed diamond interchange was changed to a parclo interchange and moved closer to King Street.

2016 Alignment 1

This proposed alignment followed the same highway centerline as 2014 Alignment 2, however it was decided that rather than cul-de-sacs on either side of the highway at South Napan and O'Donnell Roads, underpasses would be provided to maintain existing access. This meant that the South PAR was no longer required, as the properties to which it would have provided access could continue to be accessed from O'Donnell road.

Preferred Alignment

The location of the proposed alignment was modified during the preliminary design and environmental field studies stage to accommodate the location of a small population (8-10 individuals) of Southern Twayblade (Listera australis) identified adjacent to the centerline between O'Donnell Road and existing Route 11.

The proposed new alignment will be an improvement over the existing highway as it incorporates the following changes:

- improved design to meet and exceed the minimum standards for a 100 km/h highway;
- removal of through traffic from commercial and residential sections of existing Route 11 (King Street) thus reducing the travel time;
- reduction of accidents; and
- wider lanes and shoulders to provide vehicles that stray from the travel lanes an opportunity to recover control.

Additional details regarding the project are provided in Section 2.6 – Project Description.

2.3 Environmental Impact Assessment Methodology

This environmental impact assessment (EIA) meets the requirements of the New Brunswick *EIA Regulation 87-83.* The objective of this report is to:

- consider the potential for both positive and negative changes on the environment;
- assess potential environmental effects:
- outline mitigation and impact management measures; and
- identify monitoring needs associated with the highway project.

This assessment focuses on those issues directly relevant to highway planning, construction and operation, maintenance and rehabilitation (OMR) in general and the proposed project in particular. The assessment progresses through the following stages:

- Description of the Project;
- Scoping of the Issues;
- Identification of Valued Environmental Components (VECs);
- Establishment of Boundaries (spatial and temporal);
- Description of the Existing Environment;
- Assessment of Environmental Effects;

- Proposed Mitigation Measures; and
- Proposed Monitoring and Follow-up Programs.

2.4 Regulatory Context

The Project requires registration under the New Brunswick *EIA Regulation 87-83* per Schedule A, items (j) and (v) in the Guide to Environmental Impact Assessment in New Brunswick (New Brunswick Department of Environment 2005). The proposed highway bypass involves a significant length of new highway alignment therefore the EIA regulation is triggered.

Project activities will be conducted in accordance with applicable federal and provincial Acts and regulations, and may include the following:

- *New Brunswick Highway Act;*
- *New Brunswick Clean Environment Act;*
- *New Brunswick Clean Water Act;*
- *New Brunswick Fish and Wildlife Act;*
- *New Brunswick Endangered Species Act;*
- *New Brunswick Forest Fires Act;*
- *Federal Policy on Wetland Conservation;*
- *Fisheries Act;*
- *Species at Risk Act (SARA);*
- *Migratory Birds Convention Act (MBCA);*
- *Navigable Waters Protection Act (NWPA);*
- *Canadian Environmental Protection Act (CEPA);*
- *Canada Water Act; and,*
- *Canada Wildlife Act.*

The construction of the Project will adhere to the most recent versions of the NBDTI, Department of Fisheries and Oceans (DFO), and DELG guidelines and specifications.

2.5 NBDTI Requirements

In addition to regulatory requirements, NBDTI has developed environmental protection policies and guidelines regarding environmental protection. NBDTI commits to following the environmental protection measures as outlined in the NBDTI Environmental Management Manual (EMM). The EMM contains practices, standards and policies to minimize environmental impacts in a manner consistent with federal and provincial environmental regulations.

The NBDTI EMM is a comprehensive document that identifies the environmental protection (mitigation) measures and procedures to be implemented during the planning, design, construction, and operation, maintenance and rehabilitation (OMR) phases of the project, including potential monitoring. The EMM does not cover all project specific aspects related to construction, operation, and maintenance activities associated with highway development. It is meant to be used in conjunction with other documents, including the Environmental Management Plan (EMP) in order to more fully address the potential impacts of the project on the surrounding environment. The EMM is the primary mechanism for ensuring that mitigation is implemented, as required by applicable agencies; through permitting processes; and as determined through the Environmental Assessment process.

In addition to NBDTI's EMM, the Department's Standard Specifications also include environmental protection measures (NBDTI 2015).

2.6 Project Description

The New Brunswick Department of Transportation and Infrastructure (NBDTI) is proposing to construct a 12 km bypass of existing Route 11 between Glenwood and Miramichi. The proposed 2-lane section of highway (The Project) will begin just north of Black River (south of MacDonald Road) and continue north until it meets existing Route 11 between the intersections with King Street and University Avenue.

The Project is primarily located on privately owned land within Northumberland County, New Brunswick, and its general location is shown in Figure 1.1. Property required to accommodate project elements (e.g., main alignment, property access roads, interchange); will be acquired from private land owners in the area.

2.6.1 Project Schedule

Construction of the Project will begin within 3 years of the approval of the EIA, with an anticipated construction start date of 2018, with clearing potentially beginning in late 2017. The proposed alignment is expected to be maintained and to remain in operation indefinitely.

2.6.2 Project Elements

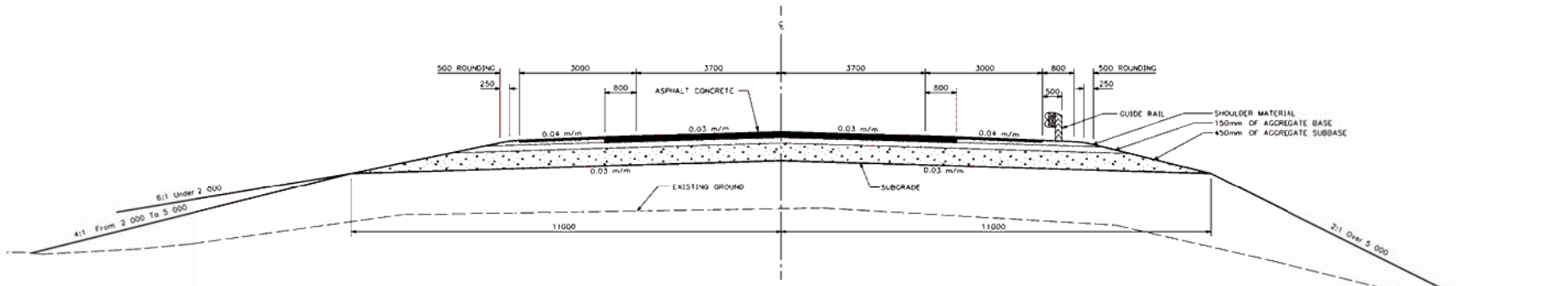
The Project consists of the construction of:

- a new two lane bypass,

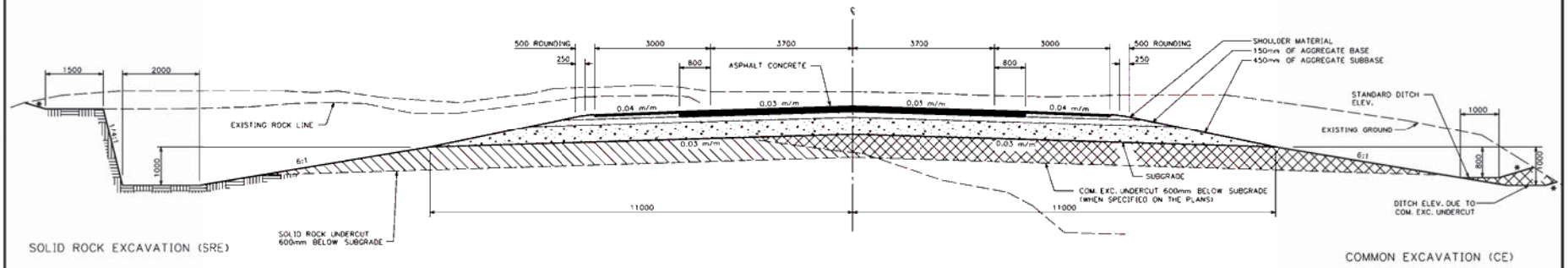
- a parclo interchange at King Street,
- a 1.8 km-long parallel property access road,
- a 700 m-long service road that will provide access underneath the highway near the parclo interchange and connect to the property access road,
- highway underpasses at the following locations:
    - east of the interchange to accommodate the service road mentioned above
    - North Napan Road
    - South Napan Road
    - O'Donnell Road
- an at-grade "T" intersection at the southern end of the Project,
- a 600 m-long section of road that will connect existing Route 11 to The Project at the "T" intersection,
- a bridge over Napan River, and
- approximately 15 minor watercourse crossing structures involving 7 watercourses.

Typical sections for the highway, property access roads and watercourse crossing structures are provided in Figures 2.1 to 2.5.

RAU 110



FILL SECTION



NOTE: DITCH WIDTH TO BE 3000 WHEN DEPTH OF SOLID ROCK CUT IS GREATER THAN 10 metres.

CUT SECTION

NOTE: * SLOPE TYPICALLY 3:1

THE BASIC UNIT OF DIMENSIONING IS MILLIMETRES

MARK	REVISIONS	DATE

	Completion	Drawing
Made By		
Checked by		
Approved by		

DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE

Figure 2.1

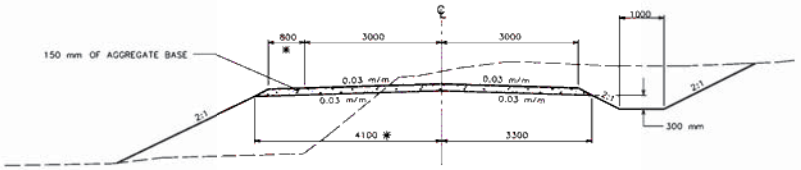
TYPICAL SECTIONS

Not to scale

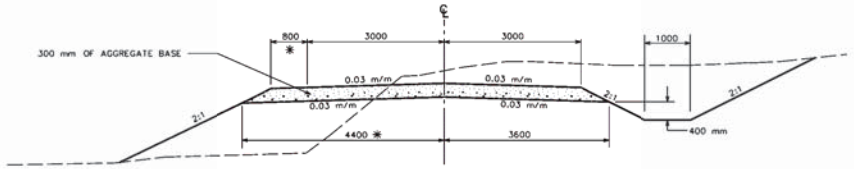
File No. | Date

Contract No.

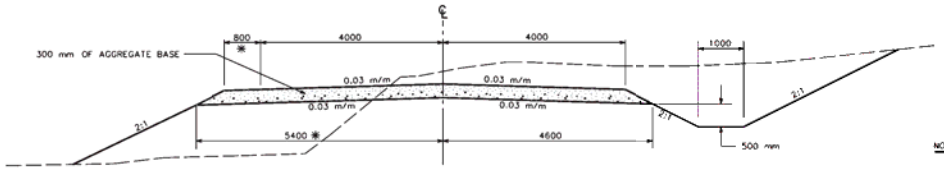
DWG. OF



PROPERTY ACCESS ROAD
STANDARD #1



PROPERTY ACCESS ROAD
STANDARD #2



PROPERTY ACCESS ROAD
STANDARD #3

NOTES: 1 BACKSLOPES IN SOLID ROCK CUTS ARE 1/4:1 WITH A 1000 mm BENCH AND THEN A 2:1 BACKSLOPE IN COM. EXC.

2 * EXTRA 800mm WIDTH WHERE GUIDE RAIL IS REQUIRED IN FILLS OVER 3 m.

THE BASIC UNIT OF DIMENSIONING IS MILLIMETRES

MARK	REVISIONS	DATE

	Compilation	Drawing
Made By		
Checked by		
Approved by		

DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE

Figure 2.2

TYPICAL SECTIONS

Not to scale

File No. | Date

Contract No.

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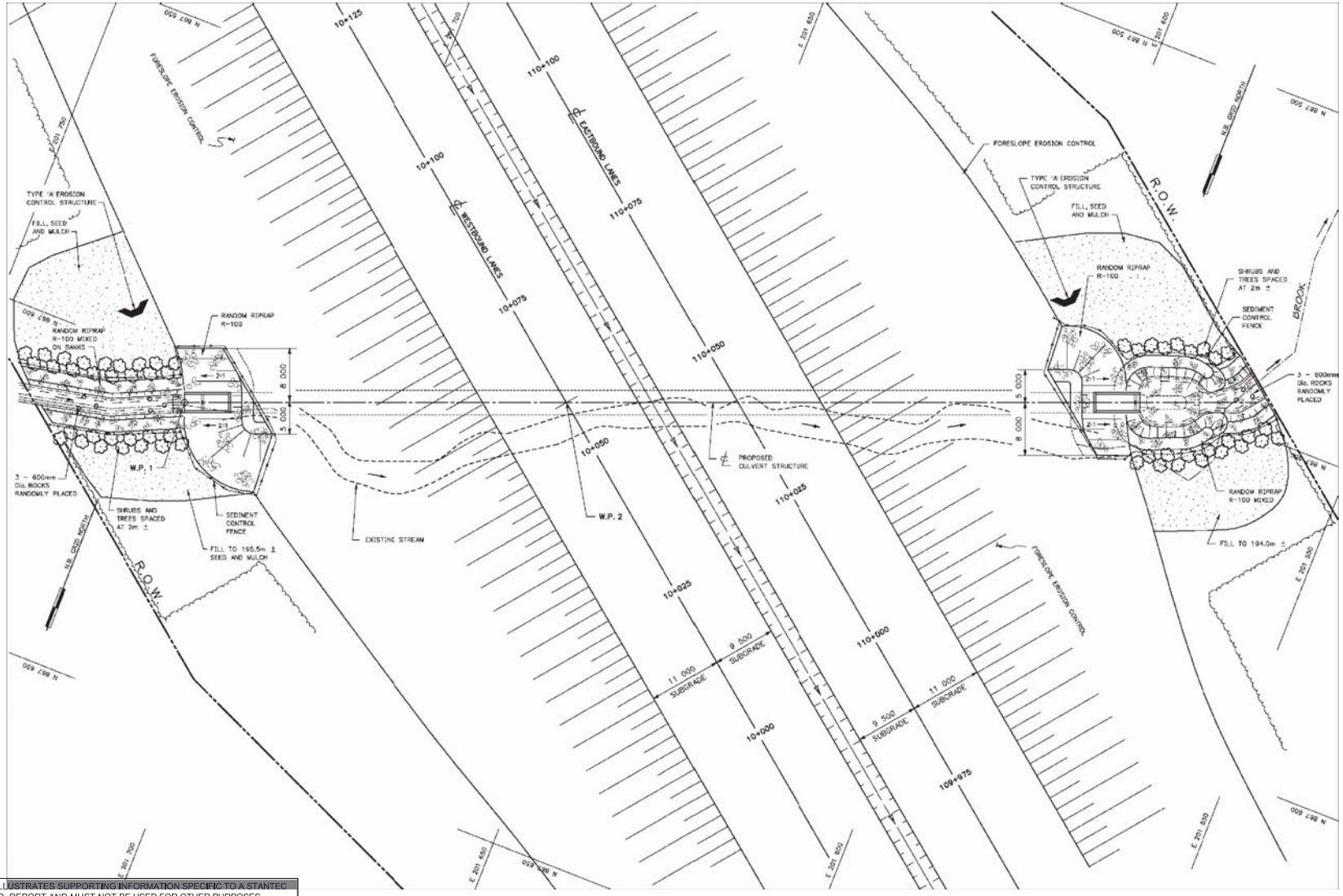
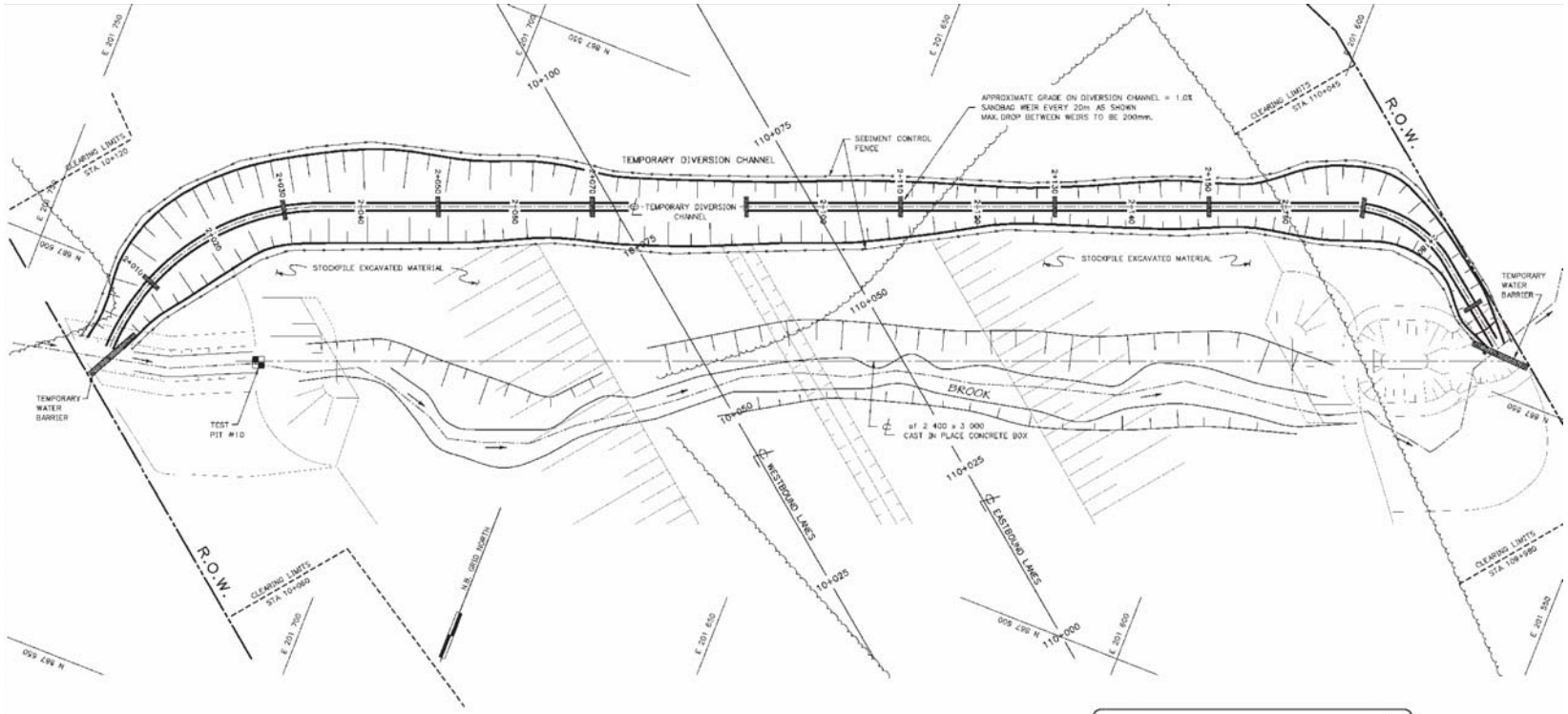
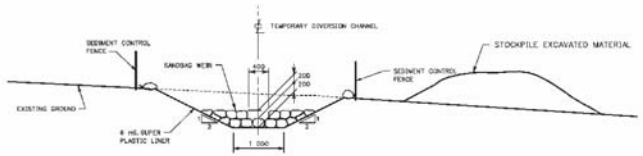


NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

Reference:				Fig. No.:	
DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE		Location: TYPICAL	PLAN VIEW OF TYPICAL WATERCOURSE CROSSING	2.3	

R:\NEW\105xxxx\105245\3\TYPICAL WATERCOURSE PLAN.dwg





TYPICAL SECTION THRU TEMPORARY DIVERSION CHANNEL

N.T.S.

DRAINAGE AREA = XX km²

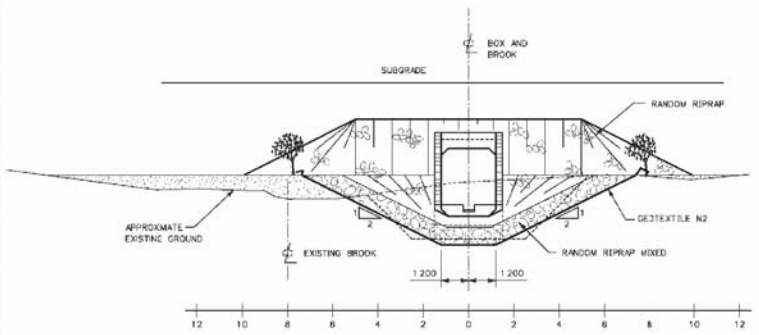
TYPICAL CONSTRUCTION SEQUENCE

The following sequence of work shall be followed, unless otherwise directed by the Engineer. The Owner shall be receptive to alternative approaches to temporary water and sediment control procedures.

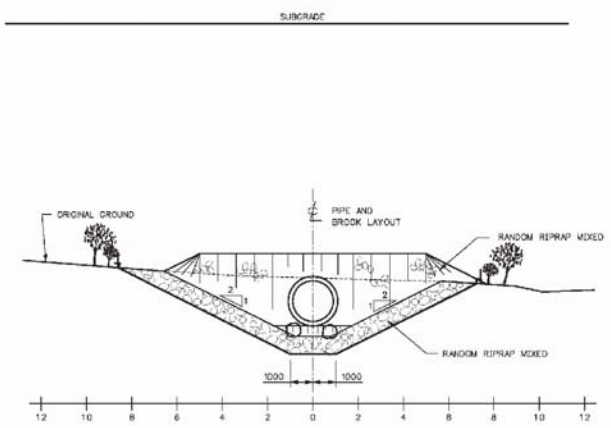
1. Mulch all exposed soils as work progresses.
2. Construct Temporary Diversion Channel complete with sandbag weirs, then install Sediment Control fence in as shown.
3. Install Temporary Water Barriers and divert stream flow, and rescue fish from bypassed channel.
4. Install new culvert and construct Downstream Pool and Upstream Channel, Plant Trees.
5. Remove Temporary Water Barriers to open new channel, and rescue fish from Temporary Diversion Channel.
7. Fill and Mulch areas which have been disturbed.
8. Place remainder of fill to design grade, Hydroseed areas which have been disturbed.

Reference:		Client:		Fig. No.:	
DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE		Location: TYPICAL	TYPICAL WATERCOURSE TEMPORARY OPEN CHANNEL OPTION	2.4	

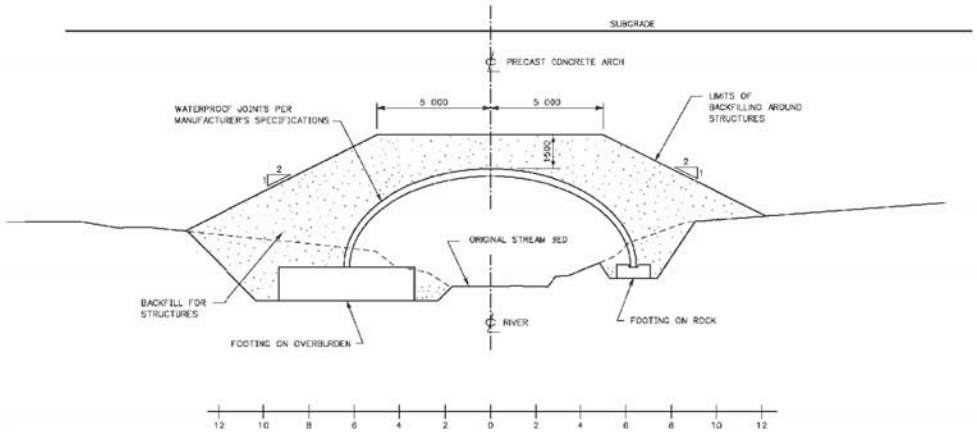
R:\NEW\105xxx\105245\3\ TYPICAL WATERCOURSE TEMPORARY.dwg



SECTION THRU OUTLET POOL
BOX CULVERT OPTION



SECTION THRU OUTLET POOL
ROUND PIPE OPTION



SECTION
ARCH OPTION

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

R:\NEW\105xxx\10524S3\ TYPICAL WATERCOURSE PERMANENT.dwg

Reference:				Fig. No.:	
DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE		Location: TYPICAL	PROFILE OF TYPICAL PERMANENT WATERCOURSE CROSSINGS	2.5	

2.6.3 Project Activities – Construction

The proposed highway construction will require cut and fill operations to achieve a blend of horizontal and vertical alignment characteristics to fulfill NBDTI's Specifications and the Transportation Association of Canada (TAC) guidelines for highway design.

The following construction activities will be considered in the environmental assessment:

Clearing and Grubbing
The limits of clearing are flagged prior to clearing activities (*e.g.*, during surveying) to limit the amount of clearing to what is required for construction of Project elements including temporary access roads. The clearing width for the main lanes will vary depending on the location of the toe of slopes. Merchantable timber on private and Crown land is harvested and sold to mills. Landowners may harvest the merchantable timber from lands being acquired by NBDTI prior to or as a condition of their sale. Harvesting would be conducted using conventional harvesting techniques and equipment typically used in New Brunswick, following guidelines set out in Section 5.3 of the NBDTI EMM and the Watercourse and Wetland Alteration Technical Guidelines (NBENV 1995). NBDTI plans to conduct clearing activities during the fall/winter, which is outside of the breeding season for migratory birds.

Grubbing for roadway construction involves the removal and disposal of all stumps, roots, felled timber, embedded logs and root mat from areas of excavations and embankments or other areas as directed by the Resident Engineer. If the grubbed material is to be removed from the site, track-mounted excavators are sometimes used to load the material onto dump-trucks and will be disposed of in accordance with the guidelines set out in Section 5.11 of the NBDTI EMM and with Item 947 (Disposal Areas) of NBDTI Standard Specifications.

Sediment and Erosion Control Measures
The primary environmental concern once grubbing has commenced or is completed is to minimize ground disturbance that may result in the erosion and sedimentation of wetlands and watercourses. To minimize environmental risks associated with erosion and sedimentation, a 30 m buffer is typically left between the construction area and watercourses until required erosion and sediment controls (*e.g.*, sediment fence, settlement ponds) are in place and watercourse crossing structure is installed.

Standard erosion and sediment control measures as identified in the NBDTI EMM (Section 5.7 – Erosion and Sediment Management) and Division 600 (Environmental) of the NBDTI Standard Specifications will be implemented.

Excavation
The removal of material for the construction of subgrade may involve one or more methods of excavation, including common excavation, unclassified excavation (a combination of both common and/or solid rock) and rock excavation. Common excavation is the removal of overburden, including till, smaller boulders, and topsoil. Unclassified excavation is the excavation of material classified as neither common excavation nor solid rock excavation but composed of a mixture and variable distribution of both. Rock excavation is the excavation of rock, which is considered to be bedrock or single pieces greater than one cubic metre in size. Cuts in "soft" rock can be accomplished using ripper blades attached to larger heavy equipment, breaking up the rock so that it can be loaded onto trucks with an excavator or loader. This procedure tends to be successful in softer rock such as a shale and/or sandstone, and in areas where the bedrock surface is highly weathered and/or fractured.

Blasting
The use of blasting for rock excavation is dependent upon the competency of the rock. Wherever possible, rock excavation will be performed by ripping rather than blasting.

Blasting operations are governed by federal and provincial regulations. If blasting is deemed to be necessary, blasting operations will be conducted in accordance with the applicable regulations and guidelines.

Drainage and Water Crossings
The development of a drainage system and installation of culverts is generally conducted during the earthwork operation. Roadside ditches and cross culverts will direct surface water away from the highway and into natural drainage systems. Approximately seven (7) watercourses will be crossed by the proposed alignment.

Subgrade and Embankment Construction
Subgrade is the layer, whether in a cut or a fill, prepared to support the pavement structure. Subgrade, in a cut situation is constructed by removing the material in the cut down to the specified elevation. Depending on the type of material encountered at the subgrade elevation, a further undercut may be required to provide strength and stability to the pavement structure. Subgrade in a fill situation (embankment construction) is constructed by spreading acceptable fill, either from cuts or borrow source, in layers of specified thickness using moisture control procedures, and compacted to a specified density. Subsequent layers are added until the desired elevation is reached.

Where feasible, as determined by suitability of the material and hauling costs, material excavated from the ROW is used elsewhere on the project for embankment construction. If the excavated material is determined to be unacceptable for use as road building material along the alignment, materials will be obtained from nearby borrow sources.

Subbase and Base Construction
Once the subgrade has been prepared, structural granular aggregates known as subbase and base is prepared. The subbase layer (gravel or crushed rock) is placed immediately above subgrade and consists of high quality granular aggregate. The base course, also high quality aggregate, is placed immediately above the subbase to provide structural integrity and good drainage beneath the asphalt concrete surface.

Paving
Conventional asphalt-concrete will be used in the construction of this project. This material is made by mixing petroleum-based liquid asphalt with coarse and fine aggregate (crushed stone or crushed gravel) in an asphalt plant. The hot mix is easily transported, spread and rolled to provide a smooth surface that can be used almost immediately. Paving will be conducted in accordance with NBDTI Standard Specifications and with the appropriate permits and approvals.

Shouldering
Shouldering requires the placement of aggregate next to the pavement edge. This material not only supports the pavement edge, but makes a more gradual transition from the paved driving surface to the side slopes, in the event of vehicle runoff. Shoulder material is generally placed using a shouldering machine, which conveys shoulder material from trucks to the shoulder area. The material is then graded and rolled.

Signing, Lighting and Guide Rail Installation
Signage will be installed once most construction activities have been completed. Signage installation involves localized disturbances within the finished project, and will require small amounts of excavation and placement of concrete footings for the erection of the signposts and signs. Guide rail installation involves posthole drilling, post installation and attachment of metal guide rail to the posts. Lighting and reflective devices will also be installed, where necessary. Lighting is typically used near intersections and interchanges.

Topsoil, Hydroseeding and Mulching
Topsoil will be salvaged during the stripping process and will be stockpiled and reused to dress foreslopes and backslopes. Hydroseeding is carried out as soon as possible after completion of surface preparation, generally within 30 days of opening up a work area. Areas to be hydroseeded shall be dressed or otherwise left in a loosened condition conducive to seeding. In dry conditions the use of mulch over the hydroseeding helps to retain moisture and promote germination of the seeds. In areas where the work area is too large to be completed and hydroseeded in a short period of time or in areas where exposed soil needs to be protected immediately, mulch will be used. Mulch generally consists of either straw or hay and can be sprayed onto the surface or hand applied.

Work Progression
The progression of Construction, as described in Item 946 (Work Progression) of the NBDTI Standard Specifications, will be carried out in a manner such that work in any work area proceeds continuously and diligently to promote an orderly progression of work and effective protection of the environment. In any given work area, the time between grubbing/cut/fill activities to stabilization is typically no greater than 30 days. Stabilization refers to hydroseeding and/or mulching, and includes completion of ditches and shaping of slopes as well as installation/maintenance of sediment and erosion control structures.

Construction Vehicle Operation
Vehicles used in subgrade construction typically include excavators, bulldozers, rollers, trucks, and graders. Most of these vehicles operate on diesel fuel and require some form of daily maintenance. The vehicles typically operate continuously for 12-hour shifts. Truck traffic during subgrade construction will primarily be confined to on-site operations and to transportation of material for cut and fill operations.

Vehicles typically used in base and pavement construction include pneumatic tire and steel drum rollers, graders, trucks, and asphalt concrete spreaders. If the asphalt concrete plant is located onsite and a suitable source of aggregate for the asphalt concrete and road base construction can be found onsite, truck traffic during this phase of construction would be limited to the delivery of prime, tack coat, asphalt cement and diesel fuel. If the asphalt concrete plant is located off-site and/or aggregate must be obtained from another source, the amount of truck traffic on the access roads would increase accordingly.

Construction Waste Disposal
The most desirable use of material excavated from the ROW during construction is use within the ROW (e.g., buried in the toe of the slope), assuming it conforms to NBDTI standards. Disposal of waste materials from the construction of the proposed undertaking will be in accordance with NBDTI requirements. Waste materials will not be placed in wetlands or other sensitive areas, nor adversely affect drainage patterns or adjacent properties. Disposal areas will also be stabilized to prevent erosion and have appropriate erosion and sediment control (ESC) measures to prevent siltation of streams and wetlands.

2.6.4 Project Activities – Operation, Maintenance and Rehabilitation

Operational activities refer to the movement of traffic and maintenance of the roadway, structures and ROW vegetation. The maintenance aspects of the operational phase can be divided into summer and winter maintenance activities and are outlined in Section 5.16 and 5.21 respectively in the NBDTI's EMM.

Summer Maintenance - General
Summer maintenance required on a regular or periodic schedule includes:

- Maintenance of the asphalt pavement (such as crack filling, line painting, pot hole repair, resurfacing every 10 to 15 years, and re-paving every 20 to 25 years);
- Maintenance of the shoulders and environmental control features;
- Maintenance of structures such as bridges, culverts and guide rails;
- Upkeep of ditches through weed control and re-ditching; and,
- Mowing and brush cutting of foreslopes and backslopes.

Winter Maintenance - General
Winter maintenance is primarily snow removal and ice control to ensure the required level of service and the safety of highway use. This combines plowing with the application of sand and/or road salt (sodium chloride). The rate of salt application will be in accordance with the NBDTI Draft Salt Management Plan. The Salt Management Plan aids in optimizing road salt use in New Brunswick through improved operational efficiency, newer technology, and the implementation of best management practices.

2.6.5 Decommissioning Activities

The decommissioning of the highway is not anticipated in the foreseeable future. Repair and maintenance is intended to support the operation of the highway indefinitely. Incremental replacement of structures and paving surfaces may be required for continued operation.

3.0 ENVIRONMENTAL IMPACT ASSESSMENT

The approach to this EIA is to focus on project-specific valued environmental components (VECs) in an approach consistent with NBEIA regulatory requirements. The EIA identifies VECs within the assessment area and determine the potential impacts resulting from the proposed project.

The value of using VECs is to address potential project impacts on a selection of the components of the environment, rather than attempting the unmanageable task of addressing every component and all their possible interactions with a proposed project.

In following the process outlined in “A Guide to Environmental Impact Assessment in New Brunswick”, the environmental attributes were reviewed to determine if they would potentially be affected by the proposed project.

The EIA must also demonstrate that suitable environmental management practices and mitigation will be provided to prevent significant adverse effects, where there is the potential for significant adverse impacts from the project. Environmental protection has now become an integral part of any responsibly designed project.

Table 3.1 outlines the VECs that were assessed as well as their location in this report.

Table 3.1 – Assessed VECs

VEC	Author	Location
Aquatic Environment	NBDTI	Appendix A
Archaeological & Heritage Resources (to be submitted at a later date)	NBDTI/Archaeological Services Unit	Appendix B
Atmospheric Environment	Amec Foster Wheeler	Appendix E
Groundwater		
Wildlife & Wildlife Habitat		
Wetlands & Vegetation		
Land Use & Economy		
Breeding Birds		

Each VEC is a standalone item and covers the following areas:

- Description of the existing conditions
- Potential effects assessment including accidents and malfunctions
- Mitigation measures
- Monitoring and follow-up

4.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Environmental effects that can potentially affect the proposed project are a combination of climatic and physical. The types of climatic and/or physical environmental effects that could have an environmental impact on the Project would likely include the following:

- Climate change;
- Climatic conditions (eg., wind and precipitation);
- Sea-level rise and flooding;
- Seismic activity;
- Natural forest fires; and
- Landslides

4.1 Climate Change

It is generally accepted that global warming and predicted climate change in Canada as well as New Brunswick will lead to wetter winters, hotter summers and more extreme climatic conditions e.g. more severe precipitation events. This could lead to an increased likelihood of damage and disruption from flood flows exceeding the capacity of existing infrastructure.

Although the project is located near the ocean, the footprint of the project is inland enough to not be affected by storm surges.

A number of planning, design, and construction methods and strategies will be implemented as part of the Project to minimize the potential effects of the environement on the Project, so that the risk of serious damage to the Project or interruption of service can be reduced to acceptable levels. Mitigation measures include, but are not limited to, designing structures to relevant codes, and scheduling of activities to accommodate weather interruptions. The nature of the Project, including the challenge of all Construction and Operation activities taking place outside, requires that climate conditions (including severe weather) be factored into the design, Cosntruction, and Operation of the Project.

Weather observations are perhaps the oldest and most reliable form of environmental monitoring. Typical and extreme weather events are well documented in New Brunswick as well as in Canada. In New Brunswick there are a number of weather stations that provide valuable documentation of historic, current, and predicted climate conditions and trends.

It is estimated that the overall mean annual maximum temperature increase projected for New Brunswick between year 2020 and 2080 range 1.7˚C to 5.0˚C (Lines et al. 2005). Annual precipitation increases projected for New Brunswick between years 2020 and 2080 range from 7% to 10% (Lines et al. 2005).

Although the temperature change will be gradual over the 60 year period, slight changes will affect precipitation types and patterns. Warmer temperatures in fall and winter could mean a later freeze up; wetter and heavier snow; more liquid precipitation; and possibly more freezing precipitation. Changes to precipitation patterns due to warmer weather could also lead to an increased spring runoff. Flooding events may be lessened as higher temperatures lead to less snow and ice build-up. There may, however, be more infrastructure damage due to more frequent mid-winter thaws causing more frequent ice-jams.

Effects of climate change on the construction phase of the project are not considered significant due to the time frame associated with climate change (long-term) relative to the short time frame for project construction (3-4 years). Effects of climate change on the operational phase of the project are considered possible based on projected warming and increased precipitation with the potential for increased flows a primary consideration. As noted in Section 4.0 of the NBDTI EMM, designs will take into consideration the effects of climate change, extreme weather and sea level rise.

4.2 Climatic Conditions

Extreme weather conditions (e.g., snow storms, ice, freezing rain, high winds and heavy rain) may result in delays during construction. The delay of construction activities does not create an adverse impact on air quality. Since possible construction delays are anticipated to be short in duration (i.e., less than a day or two), extreme weather is not anticipated to have a significant effect on construction of the Project. Average rainfall amounts near the project range from 10.2 mm in February to 101.6 mm in August for the years recorded, while the maximum snowfall was 72.5 cm. The proposed highway will be designed to move water away from the road surface to prevent hydroplaning conditions caused by pooling water. Ditching and culverts are designed to move water away from the highway to avoid flood conditions which may result in erosion of the roadbed and unsafe driving conditions. Design of new culverts to carry surface drainage from the project will include appropriate capacity to compensate for predicted increases in runoff that may result from climate change.

During the OMR phase, extreme weather may provide more impact to the Project than in the Construction phase. Ice and snow may interfere with the operation of vehicles on the highway. However, these conditions are mitigated through snowplowing, sanding, and salting of the roadways. Extreme weather is not anticipated to have a significant effect on Operation of the Project. Windy conditions during the winter can cause whiteout conditions (reduced visibility) and interfere with the operation of vehicles on the highway. Mitigation for these conditions may be a temporary closure of the highway until conditions improve or the installation of snow fence to reduce whiteout conditions and snow drifting. As a result, it is not likely that extreme weather will have a significant environmental effect on the Project.

The watercourse crossing structures will be monitored and maintained clear of debris, including beaver dams, to prevent flooding. NBDTI will use the 1 in 100-year flood event and add 20% to this flow (to account for increasing occurrences of flooding events due to climate change) as the design standard for all crossings. Based on this design, it is not likely that floods will have a significant impact on the Project.

4.3 Sea Level Rise and Flooding

Sea level has been steadily rising in most of Atlantic Canada for centuries due to warming trends and climate change. Most of Atlantic Canada is also experiencing subsidence in coastal areas, thus compounding the rise in sea level (Vasseur and Catto 2008). In the southern Gulf of St. Lawrence (which comprises the Northumberland Strait and into which watercourses crossed by the project drain), sea level is expected to rise 0.7 m by 2100, taking into account both the rise in sea level and crustal subsidence (Chouinard *et al.* 2004). At the current sea level, storm surges of 3.6 m are anticipated annually in the southern Gulf of St. Lawrence by 2100 (Parkes *et al.* 2006). Over the next 100 years storm surges in excess of 4.0 m are anticipated to occur once every 10 years (Vasseur and Catto 2008). It is generally accepted that a rise in sea level, coupled with more frequent and severe weather, are likely to bring about storm surges that could flood coastal areas.

NBDTI will use the 1 in 100-year flood event and add 20% to this flow (to account for increasing occurrences of flooding events due to climate change) as the design standard for all crossings. Based on this, it is not likely that sea-level rise, storm surge and floods will have a significant environmental effect on the Project.

4.4 Seismic Activity

The Geological Survey of Canada maintains a National Earthquake Database (NEDB) containing information on Canadian earthquakes. Historical information, including location and magnitude are maintained. Eastern Canada is located in a stable continental region within the North American Plate and has a relatively low rate of earthquake activity. Since 1996, there have been eight earthquakes reported for New Brunswick, none of which were intense enough to be considered damaging to structures.

The largest earthquake occurred in 1982 in with a magnitude of 5.7. Overall, most of New Brunswick is at moderate risk for earthquakes.

The Project will be designed to the applicable standard for earthquakes. As a result, seismic activities are not considered a significant factor with respect to Construction or OMR phase of the Project.

4.5 Natural Forest Fires

There is potential for a natural forest fire to interrupt Construction and OMR phases of the Project. A fire during construction could cause a delay while the fire is being extinguished, however, is not anticipated to have a significant effect on the Project. Fires near highways are quickly reported, the area is quickly cleared of vehicles, and flames extinguished without delay. New Brunswick has forest fire control programs in place to identify and control fires, minimizing the potential magnitude and extent of any forest fires and their environmental impacts on the Project. Fire mitigation is outlined in Sections 5.10 – Fire Prevention and Contingency and 5.23.3 – Forest Resources of the NBDTI EMM. As a result, it is not likely that fire will have a significant impact on the Project.

4.6 Landslides

Landslides are mass movements of soil and/or rock downslope and can be a major hazard for the motoring public. Natural Resources Canada maintains records of major landslides throughout Canada. Most landslides recorded in Canada have occurred in or west of Quebec. There are no reported occurrences of any major landslides in the project area. The topography of the area (low, flat and gently sloping) is not susceptible to landslides.

Rockfalls involve small rock mass that breaks apart and fall towards the road or potentially onto the road. The geology and competency of the rock are factors in the severity of rockfalls. It is not anticipated that there will be any large rock cuts on the Project.

Debris flows are small forms of landslides. They generally occur when a saturated mass of material moves down a steep slope. Debris flows are usually triggered by heavy rainfall. Massive deposits of this type of soil do not exist in the project area.

Standard design and construction practices will ensure slopes remain stable. Slopes will be stabilized utilizing hydroseed, erosion control products and riprap (if applicable). It is not likely that landslides will have a significant effect on the Project.

5.0 PUBLIC AND ABORIGINAL INVOLVEMENT

5.1 Public Consultation

April 2014

On April 3, 2014, a meeting was held between City of Miramichi Staff and NBDTI personnel to discuss the project. A public information session was held later that day to present 2014 Alignment 1 (discussed in Section 2.2.1). At the meeting and information session, NBDTI received many comments from businesses, City officials and the public requesting that the interchange be moved closer to King Street to ensure through traffic had a nearby opportunity to exit while commercial signage on King Street is visible. This was further discussed in Section 2.2.1.

July 2014

On July 31, 2014, another meeting with the City of Miramichi and public information session were held to present 2014 Alignment 2 (discussed in Section 2.2.1). As a result of comments that were received during and after the April 2014 meeting and public information session, the alignment option presented involved changing the originally proposed diamond interchange to a parclo interchange and moved closer to King Street.

At this information session there was also some concern raised over the fact that cul de sacs were proposed at South Napan and O'Donnell Roads. At South Napan Road, landowners west of the proposed highway alignment would have had to travel to existing Route 11 and take North Napan Road and Johnsons Bridge Road to access locations east of the proposed alignment, specifically, the Napan Elementary School.

At O'Donnell Road, landowners east of the proposed alignment and south of O'Donnell Road mentioned that they use this road to access their properties. It was also mentioned that this road was used as an access to local recreational trails.

As a result of these comments, NBDTI decided to add highway underpasses at South Napan and O'Donnell Roads.

Scanned versions of comments from the public, with commenters' names withheld, are included in Appendix C.

5.2 Aboriginal Engagement

In April 2014, a letter was sent to the Assembly of First Nations Chiefs in New Brunswick (AFNCNB) to notify that NBDTI was in the planning phase of the project. Project details and plan were provided as attachments to the letter. The letter mentioned that NBDTI was open to any questions, concerns and to meeting with any members of communities which may be affected by the project. Copied on the letter were all Mi'kmaq First Nations communities in New Brunswick, the Director of Aboriginal Affairs Secretariat, and representatives of Fisheries and Oceans Canada and Transport Canada.

In December 2014, a follow-up letter was sent to the same recipients to notify of slight modifications to the planned project (interchange movement mentioned in Section 5.1 above). It was mentioned in this letter that development of the project would continue and that NBDTI was still open to questions or meeting with any affected communities.

Copies of the letters are included in Appendix D. No feedback has been received to date regarding these letters.

6.0 SUMMARY

The presentation of potential effects and identification of mitigation is presented for each VEC in the associated Appendices. Based on the environmental screening presented, it is determined that significant adverse environmental effects of the project are unlikely, taking into account avoidance whenever feasible and implementation of the recommended mitigation measures during Construction and OMR phases of the Project.

7.0 REFERENCES

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8.0 APPENDICES

The following appendices contain the remaining VEC studies as summarized in the Table of Contents.