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CEAA Screening-Level Environmental Assessment Report for Highway 103 Twinning

Twinning of Highway 103 from Upper Tantallon to Hubbards, Nova Scotia

FINAL REPORT

Report Prepared for:
Nova Scotia Transportation and Infrastructure Renewal

File: 121510257

September 2012

Executive Summary

Nova Scotia Transportation and Infrastructure Renewal (NSTIR) proposes to twin an existing 22 km two-lane section of Highway 103, which extends from west of Exit 5 at Upper Tantallon to approximately 2 km west of Exit 6 at Hubbards, Nova Scotia. The Project includes ramp configuration changes at Exit 6, one overpass and two multiplate underpasses along 16 km of access roads, and several watercourse crossings, as well as temporary ancillary elements. Construction is anticipated to begin in 2016 and will take approximately five years to complete. It is anticipated that the highway will be maintained and remain in operation indefinitely.

Highway 103 provides a vital link in the National Highway System, connecting communities in Metropolitan Halifax (including Halifax, Dartmouth, Bedford, Sackville, and Spryfield) to those along the South Shore (such as Boutilier"s Point, Ingramport, Chester, and Hubbards). The stretch of highway proposed for twinning is located within the Halifax Regional Municipality of Halifax County as well as the Chester District Municipality in Lunenburg County. Current traffic volumes along this stretch of Highway 103 are approximately 9,830 vehicles per day, which is approaching the 10,000 vehicles per day threshold at which two-lane highways become candidates for twinning. While total collision rates for this section of Highway 103 are comparable to the provincial average rates for two-lane controlled access highways, the fatal rate for Highway 103 is almost twice the provincial average and almost six times the average fatal collision rate on four-lane divided highways. This twinning project is important to the Province of Nova Scotia as it will increase safety and comfort for motorists traveling on Highway 103 and will facilitate transportation of large volumes of people and goods to and from the nearby communities of the South Shore.

This Project was subject to environmental assessment under the 1992 Canadian Environmental Assessment Act, which was repealed when the Canadian Environmental Assessment Act 2012 came into force. This document was been prepared to meet the Terms of Reference prepared by NSTIR with input from Nova Scotia Environment, Fisheries and Oceans Canada, Nova Scotia Natural Resources and Transport Canada for a screening level environmental assessmentat that time. Although environmental assessment for this Project is no longer required, all other applicable legislative, regulatory and constitutional requirements must still be fulfilled.

The assessment of potential Project effects on the environment considers biophysical and socio-economic effects on the following Valued Environmental Components (VECs):

- Atmospheric Resources
- Groundwater Resources
- Aquatic Environment

- Vegetation
- Wildlife and Wildlife Habitat
- Wetlands
- Land Use
- Archaeological and Heritage Resources

These VECs were selected based on the Terms of Reference, knowledge of the existing environment and professional judgment of the study team. These VECs were also selected for the assessment of potential cumulative effects in consideration of other past, present and likely future projects in the area.

The existing environment has been heavily influenced by past and present projects and activities, including, but not limited to, the existing Highway 103 lanes, hydroelectric facilities, an electrical transmission corridor, quarrying operations, and forestry activities. There are approximately 43 watercourses (lakes and streams) and 108 wetlands in the Study Corridor which will likely require some form of alteration (*e.g.*, culvert installation, infilling, etc) during Project construction. Several rare or uncommon plant and animal species were found during field surveys of the Study Corridor, including two bird species which are listed on Schedule 1 of the Species at Risk Act (Canada Warbler (Wilsonia canadensis) and Rusty Blackbird (Euphagis carolinus).

In order to assess Project related environmental effects, the Project activities were grouped into the following categories:

Construction

- Site preparation
- Roadbed preparation
- Watercourse crossing structure construction
- Surfacing and finishing

Operations and Maintenance

- Project presence
- Infrastructure maintenance
- Winter maintenance
- Vegetation management

Environmental effects (including cumulative effects) were evaluated for each VEC, with the consideration of mitigation and monitoring programs to reduce or eliminate potentially adverse effects for each VEC (refer to Table E.1 for summary). The significance of residual environmental effects (*i.e.*, after mitigation has been applied), including cumulative effects was also predicted for each VEC.

Table E.1 Summary of Mitigation, Monitoring and Follow-up

Potential Environmental Effect	Proposed Mitigation	Proposed Monitoring and Follow-up
ATMOSPHERIC ENVIRONMENT (Section 5.1)		
• Change in Air Quality (A) • Change in Sound Quality (A) • GHG Emissions (A)	• Follow Generic EPP and applicable guidelines and regulations • Apply dust suppressants where feasible • Follow equipment maintenance schedules • Preserve natural vegetation where practical • Minimize activities that generate large quantities of dust during high winds • Environmental awareness sessions to include vehicle idling • Notify residents in advance of construction and provide contact information in event resident wants to file noise complaint	• Ambient monitoring of dust or noise conducted during construction as appropriate
GROUNDWATER (Section 5.2)		
• Change in groundwater quality (A) • Change in groundwater quantity (A)	• Preconstruction well survey • Preblast surveys as required • Ripping instead of blasting where practical near residential areas • Erosion and sediment control measures to reduce surface runoff • Remedial action as necessary to restore damaged wells and provide temporary potable water as needed • Follow Generic EPP (including Spill Contingency Plan) • Drainage and vibration controls • Follow Salt Management Plan • Minimize extent of clearing where practical	• Preconstruction well survey • Preblast surveys (if required)
AQUATIC ENVIRONMENT (Section 5.3)		
• Direct mortality (A) • Change in habitat (A) • Change in surface water quality (A)	• Maintain fish passage for all species that use the watercourses for life-cycle purposes • Follow Generic EPP and Standard Specifications, NSE Watercourse Alteration Specifications (1997), DFO (1998) draft document Guidelines for the Protection of Fish and Fish Habitat: The Placement and Design of Large Culverts, and DFO"s blasting guidelines (Wright and Hopky 1998) • Follow conditions of Water Approval • Erosion and sediment control measures • Limit area of clearing within 30 m of watercourses to the extent possible • Heavy machinery use during clearing will be kept a minimum of 10 m from watercourse banks • Minimize in-water work; work in the dry (or in isolation) where practical • Installation to occur from June 1 to September 30 where practical unless otherwise approved by DFO	• HADD authorization and compensation, if required • Monitoring during Construction to include TSS (based on precipitation events); regular inspection of erosion and sediment control measures; and inspection of hazardous materials storage areas

Table E.1 Summary of Mitigation, Monitoring and Follow-up

Potential Environmental Effect	Proposed Mitigation	Proposed Monitoring and Follow-up
	• Clean rock used below high water level for infilling (where required) • HADD Authorization application to DFO and preparation of compensation Plan if required • No storage of chemicals and POLs and no equipment maintenance and refuelling will occur within 30 m of a watercourse or wetland • Structure sizing should be equal to or greater than existing structures (and meet DFO guidelines for fish passage) • Proper design of ditching for infrastructure maintenance • Maintain buffer zone within 30 m of watercourse where practical during vegetation management • No herbicide use within 30 m of watercourse (or less if prescribed on herbicide label)	
VEGETATION (Section 5.4)		
• Change in habitat quality (A) • Change in habitat quantity (A) • Loss of Species of Conservation Concern (A)	• Project design (narrow median where practical to minimize footprint) • Limit Project-related off road activity • Follow Generic EPP • Employee environmental awareness training • Flagging and avoidance of Species of Conservation Concern • Transplanting of Species of Conservation Concern • Follow Wetland Alterations permit conditions • Erosion control measures • Minimize area of disturbance where practical • Ensure that culverts are properly sized and installed to prevent flooding or draining of wetlands • Adhere to Salt Management Plan • Modify mowing heights in areas where Species of Conservation Concern are present • Control of woody vegetation in wetland performed with , machines operated from outside of wetland or use of hand tools • Survey sections of Wetland 249 to determine distribution of southern twayblade prior to vegetation management	• Follow-up surveys to determine distribution and abundance of boreal felt lichen and southern twayblade (pre-construction)Prior to initiation of Project construction, conduct survey for plant Species of Conservation Concern along roadside shoulder to determine if species have continued to persist and whether mitigation measures for highway maintenance practices are still necessary • Monitor transplanted populations on semi-annual basis during year 3 and year 5 after construction and develop adaptive management plan as necessary
WILDLIFE (Section 5.5)		
• Change to Habitat Quality(A) • Direct Mortality (A)	• Limit Project-related off road activity • Follow Generic EPP • Clear outside of breeding bird season (May 1 to Aug 31 for most species) where practical. If clearing must take place during the bird breeding season, a contingency program	• Prior to construction, conduct Canada Warbler and Rusty Blackbird surveys between 17+600 and

Table E.1 Summary of Mitigation, Monitoring and Follow-up

Potential Environmental Effect	Proposed Mitigation	Proposed Monitoring and Follow-up
• Loss of Species of Conservation Concern (A)	(consisting of nest surveys and avoidance of active nests) will be undertaken to ensure compliance with the *Migratory Birds Convention Act.* • Employee environmental awareness training • Clear only the area required for the project • Keep activities to disturbed RoW where feasible • Ensure that culverts are properly sized and installed to prevent flooding or draining of wetlands • Consider replacement of pond habitat lost in Wetland 277 for Rusty Blackbird • Schedule construction activity in area between 17+000 and 19+000 m outside sensitive period of breeding season (early May to early June) for Rusty Blackbird, to extent practical • Consider use of artificial nests for Common Loon on Mill Lake prior to blasting • Conduct blasting near Mill Lake outside incubation period for Common Loon (early May to mid-July) to extent possible • Consider use of artificial nests for Barn Swallow approximately 50 m from construction area at Mill Lake and Little Indian Lake • If reinforced concrete deck supports are used at Mill Lake and Little Indian Lake crossings, consider adding shelves to provide suitable nesting sites for Barn Swallows • Consider placement of Tree Swallow nest boxes in forest habitat adjacent to Little Indian Lake, Mill Lake and Dorey Lake prior to construction • Consider modeling to identify areas of high potential for Long-eared Owl and reduce window for clearing in these areas (*i.e.*, no clearing from March 1 to August 31 in these areas) • Consider establishing 100 m buffer around nest site of Broad-winged Hawk when building access road near 0+600; if not possible, ensure clearing is done prior to breeding season • Schedule vegetation management for periods outside of the nesting season for most bird species (May 1 to August 31) • Schedule maintenance activities on Mill Lake and Little Indian Lake bridges outside of breeding season for Barn Swallows (mid-April to mid-September) where possible • Adhere to Salt Management Plan	19+000 m to assess species abundance and use of habitat, and refine mitigation if necessary • Prior to clearing, conduct Long-eared Owl modelling exercise to predict potential nesting sites and truncate clearing if necessary

Table E.1 Summary of Mitigation, Monitoring and Follow-up

Potential Environmental Effect	Proposed Mitigation	Proposed Monitoring and Follow-up
WETLANDS (Section 5.6)		
• Change in wetland quality (A) • Change in wetland quantity (A) • Loss of Wetland Function (A)	• Follow Generic EPP • Minimize work in and near wetlands • Narrow median design will reduce impacts in some areas along alignment • Design culverts to minimize wetland draining or flooding • Erosion control measures • Document location of and establish 30 m non-disturbance buffers for wetlands located south of existing highway • Flagging of wetland boundaries for avoidance • Use of clean, pH neutral, non-leaching, coarse fill materials within wetland areas • Employee awareness training • Use of silt fencing along roadbed toe of slope at Little Indian and Sawler Lakes to keep nesting snapping turtles out of construction sites • Adherence to mitigation described above for Common Loon and other bird Species of Conservation Concern • Adherence to Water Approval for Wetland Alteration conditions including wetland compensation • Cleaning of construction machinery prior to entering wetlands • Follow NSTIR Salt Management Plan • No herbicide use in wetlands	• Water Approval application for wetland alteration • Wetland habitat compensation and follow-up monitoring.
LAND USE (Section 6.1)		
• Change in Land Use (A)	• Temporary detours provided if necessary • Follow Generic EPP that includes guidelines for reducing noise and air emissions • Minimize dust through the application of water • Fair market value compensation for acquired properties • Maintain access to lands where possible • Construction of access roads to maintain access to forestry and NSPI operations • Reasonable accommodation to allow forestry operations access to adjacent lands during construction • Follow NSTIR Salt Management Plan	• No specific monitoring or follow-up recommended
ARCHAEOLOGICAL AND HERITAGE RESOURCES (Section 6.2)		
• Project related change in archaeological and heritage resources (A)	• Complete archaeological testing in high potential area (portion of Ingram Lake untested) or monitor during construction as necessary • Report any features, artifacts, or other cultural material to NSM prior to proceeding with construction activities • Archaeological Contingency Plan (Section 5.2 of the Generic EPP)	• Complete subsurface testing in high potential area • Pre-construction survey of areas for ancillary elements as required

In general, potential adverse effects, including cumulative effects, on these VECs can be effectively mitigated through technically and economically feasible methods recommended in this report. No significant adverse residual effects are therefore considered likely for all VECs during Project construction and operation. In addition to routine Project activities, the environmental effects of potential malfunctions and accidents were evaluated. These accidental events included consideration of spills, failure of erosion and sediment controls, fires, and vehicular collisions. It was determined that significant adverse effects on Atmospheric Resources (air quality) and the Terrestrial and Aquatic Environments are possible in the unlikely case of an accidental event resulting in a large fire or severe spill.

Effects of the environment on the Project were also evaluated (*e.g.*, potential effect of climate change and increasing severity of precipitation events). The Project will be designed to account for potential effects of the environment on the Project, therefore significant adverse effects on any VECs due to effects of the environment on the Project are not considered likely.

In summary, taking into account any proposed mitigation measures and best management practices there is not likely to be any significant adverse effects as a result of routine Project construction and operation activities, and the Project is predicted to result in considerable improvements to the safety and comfort of motorists travelling on Highway 103.

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1.0 INTRODUCTION

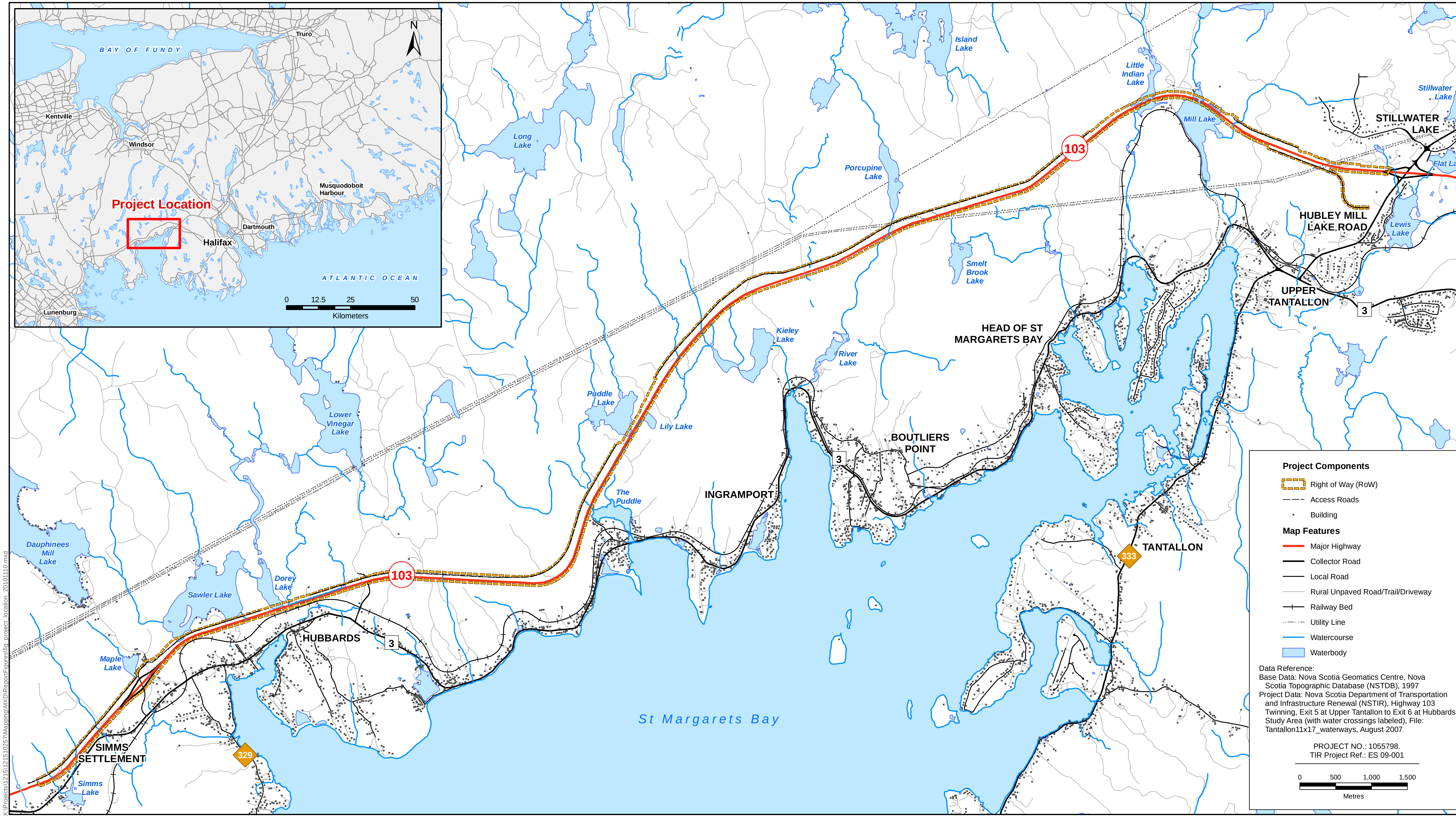
Nova Scotia Transportation and Infrastructure Renewal (NSTIR; the Proponent) proposes to twin an existing two-lane section of Highway 103, thereby upgrading it to a four-lane divided highway. Phase 3A and B of the Highway 103 twinning (the Project) extends from Upper Tantallon to Hubbards, Nova Scotia. This Project was subject to federal approval under the 1992 *Canadian Environmental Assessment Act* (*CEAA*) which has since been repealed when the *Canadian Environmental Assessment Act 2012 (CEAA 2012)* came into effect. Environmental assessment for this Project is no longer required, however all other applicable legislative, regulatory and constitutional requirements must still be fulfilled. This document has been prepared to meet the Terms of Reference prepared by NSTIR with input from Nova Scotia Environment (NSE), the Department of Fisheries and Oceans (DFO), Nova Scotia Natural Resources (NSDNR) and Transport Canada (refer to Appendix A) for a screening level environmental assessment (EA). This document has been prepared by Stantec Consulting Ltd. (Stantec) in association with RV Anderson Associates Limited (RV Anderson) and Terrain Group (now GENIVAR).

1.1 Project Overview

The proposed Project is Phase 3A and B of the Highway 103 Twinning Project, which extends from west of Exit 5 at Upper Tantallon to approximately 2 km west of Exit 6 at Hubbards, Nova Scotia (refer to Figure 1.1.1). The Project is the construction, operation and maintenance of approximately 22 km of two-lane controlled access highway to twin the existing Highway 103. The Project includes ramp configuration changes at Exit 6, one overpass and two multiplate underpasses along 16 km of access roads, and several watercourse crossings, as well as temporary ancillary elements. Construction will proceed in phases with construction of Phase 3A (from west of Exit 5 to Boutilier‟s Point) followed by construction of 3B (from Boutilier‟s Point to approximately 2 km west of Exit 6 at Hubbards). It is anticipated that the highway will be maintained and remain in operation indefinitely. A more detailed description of the Project is provided in Section 2.

1.2 Proponent Information

Name of Project:	Highway 103 Phase 3A and B Twinning, Upper Tantallon to Hubbards		
Name of Proponent:	Nova Scotia Transportation and Infrastructure Renewal		
Postal Address:	PO Box 186 Halifax NS B3J 2N2	**Street Address:**	Johnston Building 1672 Granville Street Halifax, NS B3J 3Z8
Proponent Contact:	Sylvie Colomb		
Tel:	(902) 424-8143		
Fax:	(902) 424-7544		
Email:	colombsl@gov.ns.ca		



DATE: February 08, 2011

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA Transportation and Infrastructure Renewal

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

FIGURE NO.: 1.1.1

PROJECT LOCATION

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1.3 Purpose and Need for the Project

Highway 103 provides a vital link in the National Highway System, connecting communities in Metropolitan Halifax (including Halifax, Dartmouth, Bedford, Sackville, and Spryfield) to those along the South Shore (such as Boutilier‟s Point, Ingramport, Chester, and Hubbards). The stretch of highway proposed for twinning is located within the Halifax Regional Municipality (HRM) of Halifax County as well as the Chester District Municipality in Lunenburg County. Current traffic volumes along the stretch of Highway 103 proposed for the Phase 3A and B twinning are approximately 9,830 vehicles per day (vpd), which is approaching the 10,000 vpd threshold at which two-lane highways become candidates for twinning. This twinning project is important to the Province of Nova Scotia as it will increase safety and comfort for motorists traveling on Highway 103 and will facilitate transportation of large volumes of people and goods to and from the nearby communities of the South Shore.

1.3.1 Traffic Volumes

NSTIR has collected traffic volume information at a permanent traffic counter installation at the Halifax / Lunenburg County Line towards the west end of the study section since 1970. Regression analyses of historical count data indicate that traffic volume growth rates are about 1.7 % per year in the Assessment Area.

Projected 2010 and 2020 Annual Average Daily Traffic (AADT) volumes for Highway 103 in the Assessment Area were calculated. Projected 2010 volumes on Highway 103 are 10,400 vpd. If this growth rate continues, the ADDT volume can be expected to increase to approximately 12,200 vpd by 2020. Existing and projected volumes are high for a two-lane highway since a volume of 10,000 vpd generally indicates the need for a four-lane highway.

Daily volumes fluctuate from one time of year to another, with volumes typically higher in the summer and lower in the winter. NSTIR maintains a permanent traffic count station on Highway 103 at the Halifax / Lunenburg County Line towards the west end of the study section. The monthly AADT volumes for the twelve months of 2009 have been used to estimate the seasonal variation of average daily volumes for three time periods of year indicated in Table 1.1. Using the seasonal variation percentages and the projected 2010 AADT volume of 10,400 vpd, typical winter average daily volumes will be approximately 8200 vpd and typical summer average daily volumes will be approximately 12,800 vpd.

Table 1.1 Seasonal Variation in Average Daily Volumes

Season	Average Daily Volume as a Percentage of AADT
Winter (December, January, February, March)	79%
Spring / Fall (April, May, October, November)	98%
Summer (June, July, August, September)	123%

Source: Calculated using 2009 count data provided by NSTIR for the Hubbards Permanent Counter at the Halifax / Lunenburg County Line.

1.3.2 Traffic Safety

The relative safety of a section of highway is evaluated by comparing the collision rates for the 22 km long section in the assessment area to the average collision rates for all similar highways in the Province. Collision rates are expressed as number of collisions per hundred million vehicle kilometres (HMVK). NSTIR periodically publishes collision statistics that include five-year average collision rates by severity and highway class. *Motor Vehicle Collision Rates for Numbered Highways and Sections 2000 to 2005* (NSTIR 2006), the most recent publication, indicates that the study section of Highway 103 experienced 124 collisions during the five year period, including 76 property damage only (PDO) collisions, 42 injury collisions and six fatal collisions.

The relative safety of a section of highway is evaluated by comparing study section collision rates to average collisions rates for all similar highways in the Province. Collision rates are expressed as number of collisions per hundred million vehicle kilometres (HMVK). Average collision rates for the section of Highway 103 in the assessment area, as well as five-year average collision rates for all „100 Series Full Access Control‟ highways and all „Four-Lane Divided Full Access Control‟ highways in Nova Scotia, have been extracted from *Motor Vehicle Collision Rates for Numbered Highways and Sections 2000 to 2005* and are tabulated in Table 1.2. While PDO, injury, and total collision rates for the study section of Highway 103 are comparable to the provincial average rates for two-lane controlled access highways, the fatal rate for Highway 103 is almost twice the provincial average and almost six times the average fatal collision rate on four-lane divided highways.

Table 1.2 Collision Rates

Road Sections or Road Class	Collision Rates by Collision Severity (Collisions per 100 Million Vehicle – Kilometres)			
	PDO[1]	Injury	Fatal	Total
Study Section – Highway 103	21.2	11.7	1.7	34.7
Average Rate for Two-Lane Controlled Access	21.5	11.2	0.9	33.6
Average Rate for Four-Lane Controlled Access	18.1	9.3	0.3	27.7

Source: NSTIR *Nova Scotia Motor Vehicle Collision Rates on Numbered Highways 2000 to 2005*;
NOTES: 1. PDO = Property Damage Only

1.4 Regulatory Framework

As the Project proponent, NSTIR is required to conduct an environmental assessment if the proposed work or project activities trigger relevant provincial or federal legislation such as the provincial Environmental Assessment Regulations under the *Environment Act*, or applicable federal requirements under *CEAA*.

Under current provincial regulations, a Provincial Class I Environmental Assessment Registration Report is not required for the project unless it is determined that >2 ha of a wetland are to be impacted by the Project. This environmental assessment was conducted under the regulation of the 1992 Canadian Environmental Assessment Act (S.C. 1992, c. 37) which was repealed when the Canadian Environmental Assessment Act 2012 came into force (see Appendix I). Environmental assessment for this Project is no longer required, however all other applicable legislative, regulatory and constitutional requirements must still be fulfilled.

The Department of Fisheries and Oceans (DFO) has developed the Policy for the Management of Fish Habitat (1986), which applies to all projects and activities, in or near water, that could alter, disrupt, or destroy fish habitats by chemical, physical, or biological means. The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats. The Policy for the Management of Fish Habitat is regulated by the following sections of the *Fisheries Act*: Section 20, 21, 22, 30, 32, 35, 37, 40 and 43, which are administered by DFO. Under the terms of a Memorandum of Understanding with Environment Canada, the Minister of Fisheries and Oceans continues to be legally responsible to Parliament for all sections of the *Fisheries Act*. However, for Sections 36 to 42, Environment Canada administers those aspects dealing with the control of pollutants affecting fish.

With respect to culvert installations and extensions, the *Fisheries Act* (Section 20) requires safe fish passage in all watercourses that bear fish. This is administered by DFO in close collaboration with NSE through the Water Approval process (formerly Watercourse Alteration Permit) under the provincial Activities Designation Regulation. This application process applies to new culvert installations and existing culverts which may require extensions and upgrading. DFO encourages all owners or occupiers to inspect existing culverts and upgrade these fishways, if necessary, to ensure adequate fish passage. Upgrades and new culvert installations will be completed as per the criteria presented in Conrad and Jansen (1994) and Guidelines for the Protection of Fish and Fish Habitat: the Placement and Design of Large Culverts (DFO 1998), or updates.

Transport Canada has determined that authorization under the *Navigable Waters Protection Act* (*NWPA*) will be required for this Project for navigable watercourses. A navigability inquiry conducted by NSTIR for the Project resulted in identification of the Ingram River, Little Indian Lake, Mill Lake, Puddle Lake, Sawler Lake, Dorey Lake, the Puddle and an unnamed brook as navigable waters likely to require authorization under NWPA.

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

- Nova Scotia *Environment Act;*
- Nova Scotia *Endangered Species Act;*
- Nova Scotia *Dangerous Goods Transportation Act;*
- Nova Scotia *Occupational Health and Safety Act;*
- Nova Scotia *Special Places Protection Act;*

- Nova Scotia *Wildlife Act;*
- *Fisheries Act;*
- *Migratory Birds Convention Act, 1994 (MBCA);*
- *Species at Risk Act (SARA);*
- *Canadian Environmental Protection Act (CEPA);*
- *Canada Water Act;*
- *Navigable Waters Protection Act;* and
- *Canada Wildlife Act.*

In addition to regulatory requirements, the Project will also be subject to the applicable federal and provincial guidelines.

1.5 Table of Concordance

Table 1.3 below presents the scope of work for the EA and the corresponding document section where the information is found.

Table 1.3 Concordance Table

NSTIR Environmental Assessment Scope of Work		Environmental Assessment Scope of Work Report Section Reference
1.0	Description of the Project	Section 2.0 Project Description
1.1	Project History and Purpose	Section 1.3 Purpose and Need for the Project
1.2	Alternatives to the Project	Section 2.6 Project Alternatives
1.3	Highway Corridor Location	Section 2.1 Project Scope and Location
1.4	Scope of Work	Section 4.2 Issues Scoping and Selection of Valued Environmental Components (VECs)
2.0	Description of the Environment	Section 5.0 Biophysical Environmental Effects Assessment; Section 6.0 Socio-Economic Environmental Effects Assessment
2.1	General Description of the Corridor	Section 5.0 Biophysical Environmental Effects Assessment; Section 6.0 Socio-Economic Environmental Effects Assessment
2.2	Regulatory Environment	Section 1.4 Regulatory Framework
2.3	Area Geography and Local Topography	Section 5.2 Groundwater Resources
2.4	Bedrock, Surficial Geology, and Soils	Section 5.2 Groundwater Resources
2.5	Air Quality	Section 5.1 Atmospheric Environment
2.6	Surface Water Quality and Quantity	Section 5.3 Aquatic Resources
2.7	Groundwater Quality and Quantity	Section 5.2 Groundwater Resources
2.8	Habitat Identification	Section 5.0 Biophysical Environmental Effects Assessment – Various VECs
2.8.1	Vegetation	Section 5.4 Vegetation

Table 1.3 Concordance Table

NSTIR Environmental Assessment Scope of Work	Environmental Assessment Scope of Work Report Section Reference
2.8.2 Wetlands	Section 5.6 Wetlands, Appendix H Wetland Evaluations
2.8.3 Fish and Fish Habitat	Section 5.3 Aquatic Resources
2.8.4 Wildlife, Including Migratory Birds	Section 5.5 Wildlife and Wildlife Habitat
2.9 Existing and Anticipated Land Uses	Section 6.1 Land Use
2.10 Traditional Land Use	Section 6.1 Land Use; Appendix D Mi'kmaw Knowledge Study
2.11 Historical, Paleontological and Archaeological Resources	Section 6.2 Archaeological and Heritage Resources
2.12 Social, Economic and Recreational Aspects of the Community	Section 6.1 Land Use
2.13 Noise and Vibration	Section 5.1 Atmospheric Environment; Section 5.2 Groundwater Resources
2.14 Transportation	Section 1.3 Purpose and Need for the Project; Section 2.3 Project Activities
3.0 Environmental Effects and Proposed Mitigation Measures	Section 5.0 Biophysical Environmental Effects Assessment; Section 6.0 Socio-Economic Environmental Effects Assessment
3.1 Corridor Selection	Section 3.0 Consultation
3.2 Regulatory Compliance	Section 1.4 Regulatory Framework
3.3 Geological Impacts	Section 5.2 Groundwater Resources; Section 7.0 Effects of the Environment on the Project
3.4 Air Quality	Section 5.1 Atmospheric Environment
3.5 Impacts on Surface Water, Runoff and the Aquatic Habitat	Section 5.3 Aquatic Resources
3.6 Impacts on Groundwater	Section 5.2 Groundwater Resources
3.7 Impacts on Habitat	Section 5.0 Biophysical Environmental Effects Assessment – Various VECs
3.7.1 Impacts on Vegetation	Section 5.4 Vegetation
3.7.2 Impacts on Wetlands	Section 5.6 Wetlands and Appendix H Wetland Evaluations
3.7.3 Impacts on Fish and Fish Habitat	Section 5.3 Aquatic Resources
3.7.4 Impacts on Wildlife, Including Migratory Birds	Section 5.5 Wildlife and Wildlife Habitat
3.9 Transportation Impacts	Section 1.3 Purpose and Need for the Project; Section 2.3 Project Activities
3.10 Impacts on Land Use	Section 6.1 Land Use
3.11 Impacts on Traditional Land Use	Section 6.1 Land Use; Appendix D Mi 'kmaw Knowledge Study
3.12 Impacts on Historical, Archaeological, and Paleontological Resources	Section 6.2 Archaeological and Heritage Resources
3.13 Social Economic and Recreational Impacts	Section 6.0 Socio-Economic Environmental Effects Assessment
3.14 Noise Impacts	Section 5.1 Atmospheric Environment
3.15 Remediation/Compensation Plans	Section 9.0 Environmental Management and Monitoring

Table 1.3 Concordance Table

NSTIR Environmental Assessment Scope of Work	Environmental Assessment Scope of Work Report Section Reference
4.0 Possible Malfunctions or Accidents	Section 8.0 Malfunctions and Accidental Events
5.0 Effects of the Environment on the Project	Section 7.0 Effects of the Environment on the Project
6.0 Cumulative Environmental Effects	Section 5.0 Biophysical Environmental Effects Assessment; Section 6.0 Socio-Economic Environmental Effects Assessment
7.0 Monitoring and Follow-up Requirements	Section 5.0 Biophysical Environmental Effects Assessment; Section 6.0 Socio-Economic Environmental Effects Assessment; Section 9.0 Environmental Management and Monitoring
8.0 Determination of Significance, Decision and Rationale	Section 5.0 Biophysical Environmental Effects Assessment; Section 6.0 Socio-Economic Environmental Effects Assessment
9.0 Schedule	Section 1.1 Project Overview
10.0 Proponent Contact	Section 1.2 Proponent Information
11.0 Expert Department Consultation	Section 3.2 Regulatory Consultation
12.0 Public Information Program	Section 3.0 Consultation
13.0 Supporting Information	Appendices A - H inclusive

2.0 PROJECT DESCRIPTION

2.1 Project Scope and Location

Highway 103 serves as a key connection between eastern and southern Nova Scotia. It is a feeder route part of the National Highway System and extends from Halifax to Yarmouth. The highway is used for commuting, for business, as a route of access to the South Shore and Metropolitan Halifax, and for pleasure and personal use. It is currently a four-lane twinned highway from Beechville (Exit 2) to Upper Tantallon (Exit 5); the remainder of the highway is two-lane, uncontrolled access highway.

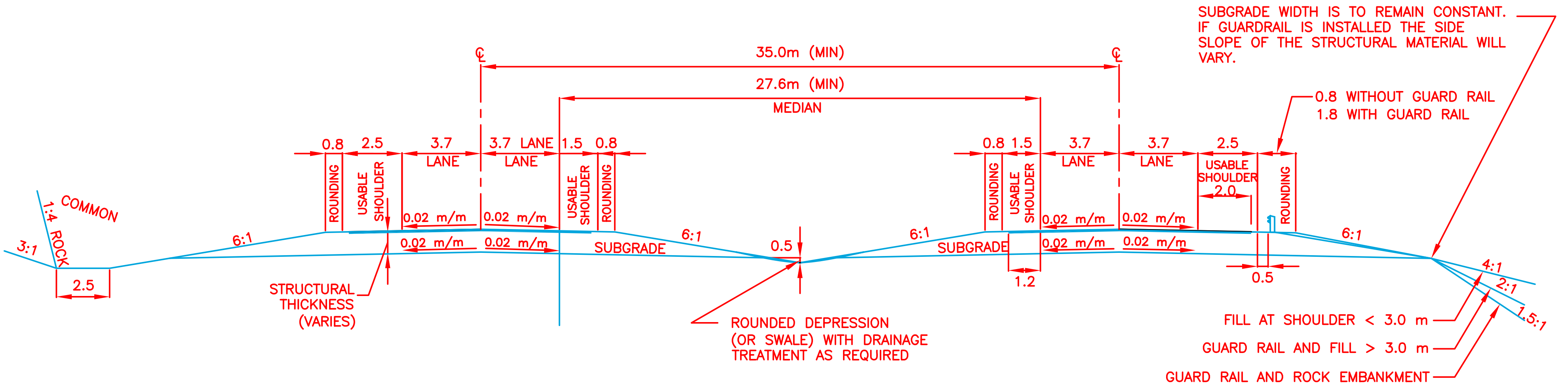
NSTIR proposes to twin a section of the two-lane, two-way section of Highway 103 from Upper Tantallon to Hubbards to a four-lane divided highway. The Project includes the construction, operation and maintenance of approximately 22 km of two-lane controlled access highway to extend west of Exit 5 to 2 km west of Exit 6 on Highway 103 (Figure 1.1.1) in the HRM and Chester District Municipality in Lunenburg County. The twinning will upgrade the current two-lane two-way highway to a four-lane divided highway. The proposed twinning will facilitate transportation between the province‟s South Shore and Metro Halifax. Metro Halifax is an important area of business and post-secondary education for many residents along the South Shore. In addition, tourism is an important component of the economies within the South Shore and Metro Halifax.

Traveling west, the new lanes will parallel the current roadway on the north side of the existing lanes from the end of the existing four-lane section of highway west of Exit 5. The lanes will remain on the north side and end near Simms Settlement.

The highway design for the Project will upgrade the existing 22 km of two-lane highway from Upper Tantallon to Hubbards to a controlled access, four-lane divided 27.6 m wide median facility with a design speed of 120 km/hr and a proposed centerline spacing of 35 m. It is noted that sections of 5.6 m narrow (Jersey or cable barrier) median with a proposed centerline spacing of 13 m will also be incorporated into the twinning as necessary to reduce potential impacts of highway construction and operation. NSTIR also proposes to widen out the curve on the existing Highway 103 lanes in the vicinity of about 15+100 to 15+800 to improve horizontal geometry and allow for a speed posting of 110 km/h. The proposed RoW width is approximately 100 m, where necessary, with additional width for parallel property access roads. Figures 2.1.1 and 2.1.2 show the standard design for the wide and narrow median facilities, respectively.

Construction of a new interchange and connector road are proposed to provide access from Highway 103 to St. Margaret‟s Bay Road (Trunk 3) at Ingramport; the specific location and construction schedule for this infrastructure have not yet been determined. It is noted that construction of the interchange and connector road is not included within the scope of the current Project and is therefore not assessed in this EA other than as an activity which could result in cumulative effects with the Project.

Figure 2.1.1 Standard Cross Section for 35 m Wide Median



NOTES:

1. THE SUBGRADE WIDTH IS DEPENDENT UPON THE DEPTH OF STRUCTURAL MATERIAL AS DETERMINED BY PAVEMENT DESIGN.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED

Manager Highway Planning and Design

Director Highway Engineering Services

Executive Director Engineering and Construction

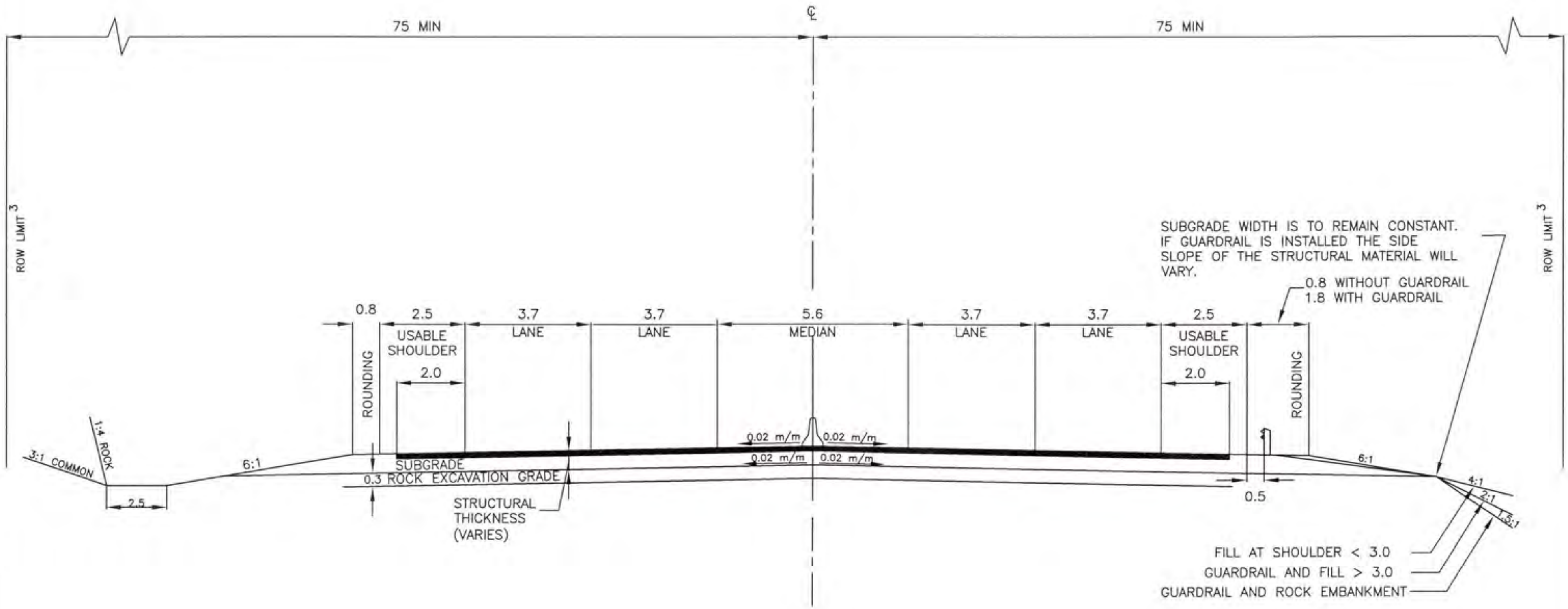
NOVA SCOTIA
Transportation and Public Works

No.	REVISION

Scale : N.T.S.
Drawn by : M. LaBreche
Checked by : K.BODDY
Date of Plan : FEB_06
File No. : S–2006–002

STANDARD CROSS SECTION
FREEWAY OPEN 35 metre WIDE MEDIAN

Figure 2.1.2 Standard Cross Section for Jersey Barrier Median



NOTES:
1. THE SUBGRADE WIDTH IS DEPENDENT UPON THE DEPTH OF STRUCTURAL MATERIAL AS DETERMINED BY PAVEMENT DESIGN.
2. REFER TO STANDARD DRAWING: S-2009-022 JERSEY BARRIER.
3. TO BE ADJUSTED TO ALLOW FOR MINIMUM OF 5.0m BEYOND DAYLIGHT LOCATION OR EXCEPTIONALLY 3.0m MAY BE ACCEPTABLE.
4. DIMENSIONS ARE MEASURED PERPENDICULAR TO CENTERLINE.
5. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.

Manager Highway Planning and Design

Director Highway Engineering Services

Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION

Scale :	N.T.S.
Drawn by :	M.ANDERSON
Checked by :	K.BODDY
Date of Plan :	AUG2009
File No. :	S-2009-004

STANDARD CROSS SECTION
FREEWAY JERSEY BARRIER MEDIAN

Excluding Exit 5 and Exit 6, there are currently no grade separated structures planned for intersecting roads along the twinning. While Exit 6 will be maintained, it is expected that the ramp configurations will be modified to improve traffic flow and safety. The only structures planned for this section are water conveyance structures required to accommodate several watercourse crossings along the alignment, approximately half of which will require fish passage. In addition, to accommodate access to properties that would be severed by the twinning, one overpass, two multiplate underpasses and approximately 16 km of access roads are planned. Construction of access roads will require some infilling of Puddle, Dorey and Sawler lakes.

The majority of land required for the Phase 3A and B twinning right-of-way (RoW) is currently owned by NSTIR, who is working to identify the best placement of the proposed lanes within the RoW that meets the needs of both the local community and the province, while minimizing effects on the natural environment.

The area for assessment is specific to the environmental component being assessed. Socio-economic effects tend to be considered on a local level while environmental effects tend to consider the effects within and immediately adjacent to the Project footprint. Mapping and text in the VEC sections provide the specific details of the area assessed.

Once the Project has been released from the environmental assessment (EA) approval process, NSTIR will proceed with a detailed field survey and geometric design, and acquisition of the remaining portions of the RoW will occur. Construction is planned to occur following completion of the Ingramport interchange project, when funding is available, and is expected to be carried out over a period of approximately five years pending availability of funding. It is anticipated that the highway will be maintained and remain in operation indefinitely.

2.2 Project Components

In addition to the twinning lanes as described above, the Project includes the following components:

- Upgrades to the Exit 6 ramp configurations;
- Approximately 16 km of access roads;
- Overpass (1) and multiplate underpass (2) structures;
- Several watercourse crossings; and
- Temporary ancillary elements.

Temporary ancillary elements that may be required for the Project include:

- Materials and equipment (transportation, storage and handling);
- Petroleum storage areas;
- Temporary access roads;
- Mobile asphalt plants; and
- Borrow and disposal sites.

2.2.1 Interchanges and Grade Separation Structures

The existing interchanges at Exit 5 and 6 along Highway 103 will be maintained. The Project will however require modification of the ramp configuration for the grade separation structure at Exit 6 to improve safety and traffic flow. To accommodate access to private land that would be otherwise severed by the Project, an overpass structure and two multiplate underpasses will be constructed along with 16 km of access roads. It is noted that although the planned interchange and connector road to link Highway 103 and the St. Margaret‟s Bay Road at Ingramport connect with the alignment, they are not part of this Project; they will, however, be considered in the cumulative effects assessment.

2.2.2 Access Roads

Temporary and permanent access roads will be required to accommodate access to construction areas and to ensure appropriate access to property is maintained during and following construction of the highway. Access roads will adhere to relevant NSTIR standards identified in the 1997 Standard Specifications and updates (the Standard Specifications).

Permanent access roads will be constructed along the south side of the RoW near Exit 5 and at various locations along the north side of the RoW from approximately 2 km west of the start of the Project up to approximately 0.25 km from Maple Lake near Exit 6 (see Figure 1.1.1). A total of six access roads will be constructed to accommodate property access.

Final temporary access road locations, if required to accommodate construction, are yet to be determined but would be located within the Assessment Area assessed in this report.

2.2.3 Watercourse Crossings

Several watercourse crossings have been identified along the twinning RoW. DFO identified 20 watercourses during a field review in 2007. During the 2009 and 2010 field surveys, 43 watercourses were identified with almost half (19) confirmed through electrofishing to be fish-bearing watercourses. Many of the smaller watercourses are tributaries of the larger streams. Water crossing structures will range from 900 mm diameter corrugated steel pipe (CSP) to large multiple spans. Some crossings will require the extension of existing culverts; minor structures, including the lengthening of box culverts, will also be required. Where necessary, improvements to fish passage will be undertaken. Adequate hydraulic design considering both present day and future hydraulic conditions will be carried out for new structures. Where required, culvert extensions will be conducted as per the criteria presented in Conrad and Jansen (1994), or updates.

Some infilling of the following waterbodies will be required to accommodate construction of the new lanes:

- Mill Lake Backwater Pond;
- Mill Lake;
- Little Indian Lake;
- Puddle Lake;
- Dorey Lake; and
- Sawler Lake.

In addition to infilling for the lanes, some infilling of Dorey and Sawler Lakes will be required to accommodate access road construction.

2.2.4 Temporary Ancillary Elements

Temporary ancillary elements that may be required for the Project include: materials and equipment, petroleum storage areas, temporary access roads, mobile asphalt plants, borrow areas, and disposal sites. The locations of these elements will be identified as part of the contractors‟ bid and have not yet been established. The locations and operations of these facilities will be subject to approval by NSTIR and any applicable regulators and will be sited and operated in accordance with NSTIR standards, including adherence to NSTIR‟s July 2007 Generic Environmental Protection Plan (EPP) for 100 Series Highways (NSTIR 2007).

Environmental effects, issues and mitigation for temporary ancillary elements frequently parallel those discussed under the construction and operation activities for the Project.

2.3 Project Activities

Project activities considered in this assessment include construction, and operation and maintenance of the twinned highway. The decommissioning of the Project is not assessed as the highway is intended to operate in perpetuity.

2.3.1 Construction

Initial construction activities following surveying of the RoW relate mainly to site preparation activities such as clearing and grubbing and include installation of environmental controls.

In general, construction activities will include the following:

- Site preparation includes activities associated with preparing the site for road and structure development (including access roads and interchanges), such as surveying, clearing, grubbing, and installation of erosion and sediment controls;
- Temporary ancillary elements include development and removal of temporary ancillary structures and facilities (*e.g.*, disposal areas);
- Roadbed preparation includes the activities associated with preparing the roadbed to base elevation (including access roads and structures), such as blasting, excavation, placement of fill material, and stormwater management;
- Construction of watercourse crossing structures includes permitting and installation of culverts, bridges, and causeways; and
- Surfacing and finishing includes activities such as paving, line painting, and installation of signs, signals and guide rail.

Construction of the twinning lanes may have effects on traffic. Project-related construction activities that could result in a change in level of service include site preparation, roadbed preparation, watercourse crossing structures, and surfacing and finishing.

During the construction phase, a variety of activities will require the movement of equipment, material and personnel to and from the construction site via the existing Highway 103 and local access points. Anticipated construction site accesses can be expected to use existing streets and roads at the two interchange areas in the Assessment Area, Trunk 3, and at the existing construction sites both east and west of the Assessment Area. The Construction phase will generate traffic associated with the Project, which will result in additional traffic on the road transportation network. The majority of the vehicular traffic will be trips to and from the site by construction workers in the morning and evening peak hour travel period. Truck traffic would be distributed throughout the workday. Construction traffic is not, however, expected to cause any substantial delays to normal traffic flows. Level of service may be affected on the local access roads and existing Highway 103, where twinned sections connect to the existing highway, for short durations. Temporary short detours may be required.

Project-related construction activities that could result in a change in traffic safety include site preparation, roadbed preparation, watercourse crossing structures, and surfacing and finishing. The construction phase will result in additional traffic, including automobiles, light trucks, and heavy trucks, on the existing road transportation network. An overall increase in traffic volume could potentially lead to an increase in collision occurrence. Road work may also require temporary speed limit reductions during construction, which, coupled with an increase in overall traffic volumes, could potentially lead to an increase in collisions during the construction phase. Normal traffic signage regarding construction activity preceding and at the Project entry points will alert motorists and reduce likelihood of vehicular collisions during construction.

2.3.1.1 Clearing and Grubbing

Prior to initiating construction, clearing of trees and shrubs will be required to accommodate site preparation activities such as installation of erosion and sediment controls, grubbing and grading. It is anticipated that a clearing width of approximately 30 m (15 m each side of the centerline) will be needed for construction of the two twinning lanes. In areas of deep cuts and fills, or where additional space is required for equipment access or work areas, widths may vary (*i.e.*, 4 m from the toe of slope or top of cut). Limits of clearing will be clearly indicated on the contract drawings and in the field (*i.e.*, surveyed and marked with flagging tape).

NSTIR preferentially undertakes clearing of the RoW in winter to minimize potential for soil rutting and erosion and to avoid most interactions with birds. Soil erosion and subsequent sedimentation may be detrimental to wetlands and watercourses. Harvesting will be conducted using conventional harvesting techniques and equipment and in accordance with the Standard Specifications (1997 and revisions). Trees will be cut to within 0.3 m of the ground. Merchantable timber (minimum butt diameter of 100 mm and a length of 2.5 m) will be delimbed and removed from the site, while non-salvageable material will be chipped within the RoW and left in place.

Clearing activities will preferentially be conducted outside of the breeding season for birds (*i.e.*, no clearing between May 1 and August 31); if this is not practical, alternative mitigation will be implemented, in consultation with a qualified biologist, to minimize potential disturbance to nests and nestlings. Potential mitigation measures may include nest surveys and avoidance buffers around active nests. Where possible, clearing operations will be conducted during winter months on frozen ground to reduce damage to soils and the vegetative mat. Hand-clearing will be conducted where ground conditions are not suitable for heavy equipment access (*e.g.*, within watercourse and wetland buffer zones).

Grubbing for roadway construction involves the removal of all organic material and unsuitable soil above the underlying soil. It also consists of the removal and disposal of all stumps, roots, downed timber, embedded logs, humus, root mat and topsoil from areas of excavations and embankments or other areas as directed by the Project Engineer. All areas where fills are less than 1.5 m or where excavation is planned must be grubbed. Grubbing is usually not required under fills greater than 1.5 m in depth, unless a structure (*e.g.*, bridge, culvert or retaining wall) is to be constructed, or where there is a significant layer of compressible soil that could cause a future settlement problem. To minimize environmental risks associated with erosion and sedimentation, grubbing within 30 m of a watercourse will be conducted only after the installation of culverts and required erosion and sediment controls (*e.g.*, sediment fence, settlement ponds, *etc.*).

2.3.2 Operation and Maintenance

2.3.2.1 Project Presence

The presence of the Project is anticipated to result in a change of level of service during operation within the Assessment Area of the Project. Traffic volumes are not expected to change as a result of Project operation, however, traffic performance on Highway 103 will be improved due to upgrading the through lanes from a two-lane two-way arterial highway to a four-lane divided freeway with increased posted speed limit. Traffic performance on the interchange ramp at Exit 6 will also be improved because the ramp configurations will be modified to improve traffic flow and safety.

The presence of the Project is anticipated to result in a change in traffic safety during the operation phase. The average collision rate on all four lane divided highway sections in Nova Scotia during 2000 to 2005 was 18.1 collisions per hundred million vehicle kilometres (HMVK), which is considerably safer than the existing collision rate of 21.2 collisions per HMVK on much of the section of Highway 103 within the Assessment Area. The Project will improve traffic safety along Highway 103 by improving the highway standards, resulting in lower collision rate. Overall, collision occurrence within the Assessment Area will be reduced throughout the operations phase, in perpetuity.

The following is a description of operation and maintenance activities typical of 100 series highways. The description of operation and maintenance activities has been divided into three categories:

- Infrastructure maintenance;
- Winter maintenance; and
- Vegetation management.

2.3.2.2 Infrastructure Maintenance

General highway maintenance activities retain roadways at a reasonable level of service, comfort and safety and typically take place during the summer months. The rate of degradation of the pavement surface will be determined by the volume of traffic, proportion of heavy trucks, certain vehicle characteristics (*e.g.,* radial tires), structure and quality of pavement. The repair of the asphalt concrete surface may involve excavation or removal of the existing pavement and sub-grade, patching and leveling, grading and gravelling, surface treatment and asphalt concrete overlays. In general, the effects of maintenance activities are similar to those experienced at the construction stage. These effects are generally similar to construction effects and would generally include ground disturbance and exposed soils as well as management of hazardous materials and Project waste. Potential effects and associated mitigative measures are discussed in the applicable sections as well as in Section 2.5.

Typically, well-designed four-lane highways with controlled access, like the Project, present more opportunities to avoid or reduce traffic flow disruptions for maintenance activities due to the addition of lanes to the overall network. Infrastructure maintenance activities associated with the Project may result in temporary changes in level of service as portions of the alignment may be narrowed to one lane in either direction. This typically occurs during periodic resurfacing and is of short duration. If it is determined that level of service will be reduced to an unacceptable level as a result of infrastructure maintenance activities, then temporary detours will be put in place to reroute traffic.

Infrastructure maintenance activities with the Project may result in a temporary change in traffic safety due to sudden slowed or stopped traffic near areas of maintenance activities. If it is determined that traffic safety on the highway will be reduced to an unacceptable level as a result of infrastructure maintenance activities, then appropriate signage and/or temporary detours can be put in place to reroute traffic. These incidents would be infrequent and temporary.

Periodic maintenance of roadway drainage systems may be required. This may involve the replacement or repair of culverts and re-establishment of the drainage ditches.

Other highway maintenance activities include shoulder grading, localized pavement repair, bridge maintenance and line repainting. Disruption to the public from these repairs will be temporary and infrequent in nature.

2.3.2.3 Winter Maintenance

Winter highway operations activities generally involve snow removal and ice control to reduce traffic disruptions and safety hazards. Snow removal involves plowing services provided by, or contracted out and supervised by, local NSTIR Maintenance employees.

Road ice is controlled by the application of salt and sand. Salt is applied to roads to retain clear driving lanes within a reasonable time after a storm. Sand is applied to roads surfaces to provide traction on snow-packed or icy roads.

Each year, NSTIR applies approximately 300,000 tonnes of road salts and 100,000 tonnes of winter sand and uses approximately 400 plows for winter maintenance, including graders, trucks, and four-wheel drive vehicles (NSTIR 2009).

NSTIR already has several initiatives underway to help manage the use of road salts. These initiatives include:

- Construction of several additional salt/sand storage structures to increase covered storage capacity;
- Operation of 40 road weather information system (RWIS) sites around the province;
- New winter maintenance standards to provide a consistent and measurable level of service for ice and snow removal to all areas of Nova Scotia; and

- Upgrading of the salt spread truck fleet through the installation of computerized salt controls, infrared pavement temperature sensors, and retrofitting of some trucks with pre-wetting capability.

In September 2004 Environment Canada enacted a Code of Practice for the Environmental Management of Road Salt. In accordance with the Code, all road agencies were required to develop a Salt Management Plan prior June 30, 2005. NSTIR has developed a Salt Management Plan (SMP). The SMP provides a mechanism through which NSTIR can commit to implementing best management practices while fulfilling its obligation to providing safe, efficient, and cost effective roadway systems.

Winter maintenance activities (*e.g.*, salting, plowing) will improve traffic safety during periods of inclement winter weather.

2.3.2.4 Vegetation Management

Regrowth of vegetation within the RoW may interfere with the lines of sight required for safe use of the highway. Clearing along the RoW is part of NSTIR‟s regular maintenance to maintain sight lines and may involve both manual and mechanized cutting. Vegetation management may also include use of species that require minimal management in the Project environment.

Vegetation management techniques will be employed where feasible to promote sustainable growth along the highway; however, if herbicide application is required for the control of noxious weeds, the application will be carried out by trained personnel who will apply the herbicide in accordance with an approval issued by the NSE pursuant to the *Pesticide Regulations* under the Nova Scotia *Environment Act*.

2.3.3 Decommissioning

The highway is planned operate in perpetuity and will be maintained as necessary for an indefinite period of time. Decommissioning, if required in the future, will be undertaken in compliance with relevant laws, regulations and guidelines current at that time.

2.4 Project Schedule

The twinning of Highway 103 will be constructed following regulatory approval, detailed field survey and geometric design, and acquisition of additional RoW where required to accommodate access roads. Project construction (*i.e.*, Phase 3A and B) is anticipated to begin in 2016 and will take approximately five years to complete. Construction will proceed in phases with construction of Phase 3A (from west of Exit 5 to Boutilier‟s Point) followed by construction of 3B (from Boutilier‟s Point to approximately 2 km west of Exit 6 at Hubbards)

Scheduling of Project activities such as clearing and grubbing, and installation of watercourse crossings, will take into account sensitive time periods for migratory and breeding birds as well as aquatic species to minimize potential interactions with the Project.

2.5 Hazardous Materials

Potentially hazardous materials could be present during the proposed Project activities, including fuels and lubricants for Project equipment. All will be handled in a manner consistent with currently accepted best practices. Lubricants and other petroleum products will be stored according to provincial regulations, and waste oils will be disposed of in accordance with provincial regulations. Any hazardous materials will be transported according to applicable legislation, and any requiring disposal will be disposed of at an approved facility. Particular care is required to prevent spills of hazardous materials into the aquatic environment.

2.6 Environmental Management Planning

Environmental protection measures have been developed by NSTIR and compiled in the Generic EPP to guide the Project through construction and operation in compliance with legislative requirements and to minimize potential Project interactions with the environment. The Generic EPP will be supplemented by a site specific plan that includes mitigation for Project specific issues or areas of special concern.

In addition to the EPP there are also consultations, permits, authorizations or approvals required by the following regulatory agencies:

- Transport Canada;
- DFO;
- Nova Scotia Environment (NSE); and
- Nova Scotia Department of Natural Resources (NSDNR).

NSTIR worked with these departments in development of the Project Terms of Reference for the environmental assessment and will continue to work toward regulatory compliance through implementation of the Generic EPP. Advice from these regulators will be included in the mitigation proposed in the EA document to minimize potential environmental effects and reduce potential for significant environmental effects from Project activities. Specific follow-up and monitoring programs will be developed in consultation with the appropriate or agreed upon departments as required.

This Project will comply with the Generic EPP that is current at the time of Construction and Operation. Section 7 of the Standard Specifications also includes provisions for environmental protection. In addition, the NSTIR Salt Management Plan will apply to this Project.

2.6.1 Design and Construction

Project design will take into consideration environmental elements and mitigation identified during the EA process (*e.g.,* environmentally sensitive areas), and will apply mitigative measures during construction. Technically and economically feasible methods for achieving standards and meeting regulatory requirements will be implemented.

NSTIR highways are constructed under contract through a public tendering process. The contract documents contain a description of the work, the standards under which it is to be carried out, and the results expected to be attained. Construction specifications not only provide design details, but also refer to management practices and contain environmental protection measures, as outlined in the Generic EPP and Project-specific EPP measures. All contractors will be qualified to do the work and will receive environmental awareness training.

Construction will follow the Generic EPP, as well as the environmental section of the Standard Specifications, which will provide mitigation on a number of design and Construction-related environmental concerns normally associated with highway construction. Other applicable standards and guidelines to be employed during Construction include but are not limited to:

- Geometric Design Guide for Canadian Roads, Transportation Association of Canada (TAC 1999);
- Guidelines for the Protection of Fish and Fish Habitat – The Placement and Design of Large Culverts (DFO 1998);
- Erosion and Sediment Control Handbook for Construction Sites (NSDOE 1988); and
- Temporary Workplace Traffic Control Manual (NSTPW 2007b).

To ensure compliance with environmental standards and regulations, regular inspections and monitoring will be performed by the contractor through consultation.

Environmental protection control measures employed during construction will be inspected regularly. NSTIR Environmental Services Section staff will also conduct periodic inspections of construction sites and environmental control measures. Improperly installed or damaged environmental controls will be corrected in accordance with the Generic EPP.

Machinery will be inspected regularly to ensure it is properly maintained and minimize petroleum, oil, or lubricant (POL) leaks and drips. Employees and subcontractors will be required to implement appropriate control measures to prevent POL leaks during Construction activities.

Emergency situations involving the accidental release of hazardous materials to the environment, discovery of historic resources, *etc.*, will follow the contingency and emergency response procedures provided in Section 5 of the Generic EPP.

2.6.2 Operations and Maintenance

Environmental protection procedures and measures will be observed and employed throughout the life of the proposed Project, as outlined in NSTIR Standard Specifications. NSTIR will be responsible for installation, maintenance, and inspection and monitoring of environmental protection control measures during the operation and maintenance phase.

2.7 Project Alternatives

2.7.1 Alternatives to the Project

Alternatives to the Project are defined as functionally different ways of achieving the same end (CEA Agency 1994). Alternatives to the Project include: the “do nothing” scenario (null alternative) or other modes of transportation *(i.e.,* rail).

The objective of the Project is to undertake upgrades to this vital link in the National Highway System to increase the safety and efficiency of transportation of large volumes of people and goods to and from the nearby communities of the South Shore. No alternatives to the Project (alternative forms of transportation) exist. Therefore, no further consideration is given to alternatives to the Project. Alternative means of carrying out the Project are discussed below.

2.7.2 Alternative Means of Carrying out the Project

Alternative means of carrying out the Project include alternate alignments that will maintain the overall objective of upgrading this stretch of highway to improve road safety and performance.

2.7.2.1 Alignment Selection

The alignment of the proposed twinning of Highway 103 parallels the existing alignment and incorporates lands previously acquired by NSTIR. As is often the case, development occurs along an existing highway and limits land available immediately adjacent. To select an alternative alignment would require acquisition of land elsewhere and would add significantly to the cost of the twinning making an alternative infeasible from a financial perspective.

2.7.2.2 Alternatives within the Right-of-Way

A standard median width (22.6 m), which is the typical median width of 100 series highways in Nova Scotia, has been proposed for this Project. Where particularly environmentally sensitive features have been identified, a narrow median width (5.6 m) has been proposed for the Project. A previous version of the current alignment included a narrow median design from chainage 17+500 m to Exit 6. Following results of field surveys, NSTIR revised the design to extend the narrow median to chainage 15+200 m in order to minimize environmental effects on wetlands and rare species in this area.

Alternative locations could be selected for the access roads, however given that the access roads are closely tied to land owned by NSTIR, it would likely be cost prohibitive to try to acquire additional lands outside of the RoW for access. In addition, location of the access roads immediately adjacent to the RoW reduces the amount of land disturbance required for access road development.

3.0 CONSULTATION

While highway projects are typically undertaken to improve transportation infrastructure and public safety, it is important to consider the needs, concerns and benefits of the public to be served by the Project, as well as area residents who may be affected by Project activities. Key issues identified by the public are subsequently considered during the environmental assessment and design processes and where possible, economically and technically feasible approaches can be taken to address concerns.

3.1 Public and Stakeholder Consultation

Opportunities have been or will be provided for the public to receive information and express their concerns with respect to the various phases of the proposed Highway 103 Twinning Project. In 2007, NSTIR initiated communication with various stakeholders such as businesses, non-governmental organizations (NGOs), and community groups, in the context of an internal preliminary environmental screening process for the Project. In June 2010, a public meeting was held in Boutilier‟s Point to gather public input regarding an NSTIR proposed interchange and connector road in the community that would link Route 3 to Highway 103. At that meeting issues related to the Highway Twinning were also raised. NSTIR held a Project-specific public open house in March 2011 to share Project details and provide an opportunity to gather public feedback.

As part of the NSTIR highway planning process, a preliminary environmental screening is conducted with the cooperation of various municipal, federal and provincial regulators as well as community groups and stakeholders. Many comments received through this process from NGOs and community groups as well as various stakeholders have centered around the proposed interchange and connector road. The scope of the Highway 103 Twinning Project assessed in this EA does not include construction of the interchange and connector road as that project is the subject of separate EA process.

3.1.1 Preliminary Environmental Screening

In 2007, NSTIR undertook a preliminary environmental screening of the highway corridor. The screening was conducted to inform early stages of Project planning by identifying issues that may restrict the alignment or require specific mitigation or other measures to be incorporated into the design. NSTIR forwarded the proposed route for the Highway 103 twinning, from Exit 5 at Upper Tantallon to Exit 6 at Hubbards, Nova Scotia, to various stakeholders and requested site-specific data for the proposed Project area as well as comments on specific potential constraints and/or general potential issues of concern.

The NSTIR environmental screening requests input from a variety of government departments at federal, provincial and municipal levels to identify potential constraints or concerns in the vicinity of the proposed construction. Mapping and written correspondence are sent to these departments to gather information such as the location of habitat supportive sensitive species, location of other infrastructure such as communication towers, areas of archaeological or heritage significance, location of potential claims, *etc.* The input received from these departments is reviewed for consideration in the planning process and is incorporated into the scope of work for the environmental assessment as appropriate.

Various branches of several municipal, provincial, and federal government departments were contacted for general comment during the preliminary environmental screening conducted for the Project in 2007. Government departments consulted included the following:

- HRM;
- Municipality of the District of Chester;
- Municipality of the District of Lunenburg;
- Nova Scotia Environment;
- Nova Scotia Department of Natural Resources (NSDNR);
- Nova Scotia Tourism, Culture, and Heritage;
- Sport Nova Scotia;
- Nova Scotia Department of Fisheries and Aquaculture;
- Nova Scotia Department of Agriculture;
- Transport Canada;
- Industry Canada;
- Environment Canada‟s Canadian Wildlife Service (CWS);
- Public Works and Government Services Canada;
- Indian and Northern Affairs Canada;
- Treaty and Aboriginal Rights Research Centre of Nova Scotia;
- Kwilmu‟kw Maw-klusuaquqn Negotiation Office (KMKO);
- Department of Fisheries and Oceans Canada (DFO); and
- Parks Canada.

Constraints identified by the various levels of government during the preliminary environmental screening process have been incorporated throughout this EA report as applicable. It is noted that a specific Mi‟kmaw Knowledge Study has been commissioned for this Project.

As previously noted, in addition to regulators, stakeholders such as Nova Scotia Power Incorporated (NSPI), Eastlink, CN, and Bowater Mersey were consulted during the preliminary environmental screening conducted in 2007. Concerns raised by commercial stakeholders through this process included concerns around the potential for water levels to change and affect functioning of the dams in place to support NSPI generating stations for the Mill Lake powerhouse.

In response to NSTIR"s screening inquiry, the Rails to Trails Association requested a meeting with NSTIR and the St. Margaret"s Bay Stewardship Association to discuss the Associations" concerns with the proposed Project. In addition, both the Stewardship Association and the Trails Association sent letters to NSTIR outlining their concerns (dated November 28, 2007 and December 9, 2007, respectively). A meeting was held on December 10, 2007 in Halifax, Nova Scotia with five people in attendance: one representative from the Trails Association and two representatives each from the St. Margaret"s Bay Stewardship Association and NSTIR. Concerns raised at the December 2007 meeting centred largely on the proposed connector road. However concerns were also raised around potential effects on Ingram River and Keily Lake Brook and the associated wetlands as well as impacts to local trails and, in general whether the Project could result in development that may not be consistent with the Municipal Planning Strategy to occur in the area.

3.1.2 NSTIR Public Open Houses

As a means of gathering public input on the proposed Highway 103 twinning Project, NSTIR held a public open house in March 2011. The purpose of the open house was to allow NSTIR to present information on the Project and obtain feedback from the public on the proposed functional design and/or construction of the Project. Community members were contacted and representatives from the HRM, Lunenburg and Chester District Municipality were briefed prior to the open house. Advertisements were published in local newspapers prior to the session. At the open house, large Project maps were on display and NSTIR staff and consultants were present to answer questions and discuss concerns. Guests were encouraged to complete a comment form.

On June 9, 2010, NSTIR was invited to attend a public meeting hosted by Chester-St. Margaret's MLA Denise Peterson-Rafuse at Black Point in Hubbards, Nova Scotia at which area residents and other stakeholders and interested parties held discussions around potential issues associated with the proposed interchange and connector road project. Although the focus of that meeting was outside the scope of the current Project, stakeholders also expressed opinions on issues related to Highway 103.

The meeting included participation from the Minister of Transportation and Infrastructure Renewal; NSTIR environmental analysts; highway engineers, planners, and technicians; traffic experts; the MLA for Tantallon-Chester; and a facilitator, among others. More than 250 stakeholders were in attendance at the meeting.

Meeting participants emphasized the importance of improving highway safety, questioned whether the twinning can proceed without a connector, and discussed the best way to provide highway access to the north side of Highway 103 following the twinning Project. It was determined that the connector will not necessarily be required as a result of the twinning and that there was some question around whether the connector would be built. NSTIR stated that feasible alternative suggestions for providing access to the north side of the twinned highway would be considered.

3.1.3 Property Owner Notification

Prior to the initiation of field studies conducted in support of this EA, property owner notification letters were sent to landowners in the vicinity of the proposed RoW in September 2009. These letters introduced the proposed Project and briefly described the various environmental field investigations and surveys that would be required during the EA process. Although the primary purpose of the correspondence was to obtain landowner permission to access potential environmental field work sites, the letters also included NSTIR and Stantec contact information and invited property owners to share their questions or concerns regarding the proposed environmental field studies and/or the proposed highway twinning Project.

Several letter recipients contacted NSTIR and/or Stantec with general questions about the Project (*e.g.*, which side of the highway would be twinned; whether any land expropriation would be necessary; how access to private property would be affected by the twinning; *etc.*). The most common environmental concerns raised by landowners related to potential Project interactions with aquatic habitat (*e.g.*, Sawler Lake and Dorey Lake) and associated species, as well as terrestrial habitat and associated species. Concerns were also mentioned with respect to potential effects of the Project on recreational use and enjoyment of trails and lakes in the area.

One landowner was particularly worried about potential noise impacts resulting from the twinning and requested that baseline noise monitoring take place on her property. Following confirmation of the suitability of the site, noise monitoring station 3 (refer to Figure 5.1.1) was established on the property in question to address this concern.

Many landowners expressed interest in additional Project information as well as opportunities for official consultation and the provision of public comments. These individuals, as well as all other landowners who raised questions or concerns, were advised that there will be an opportunity to participate in an upcoming public open house.

3.2 Regulatory Consultation

Several provincial and federal regulatory agencies were contacted during the preliminary environmental screening to provide input into the Terms of Reference prepared by NSTIR for the EA Report (Appendix A). In addition, select regulatory agencies with a potential interest in the Project werecontacted by NSTIR to discuss the proposed scope of assessment and potential issues of concern.

3.3 Aboriginal Involvement

In addition to contact initiated through the preliminary environmental screening process, NSTIR commissioned the completion of a Mi'kmaq Ecological Knowledge Study (MEKS) for the Highway 103 Twinning Project. The MEKS involves archival research and interviews on current Mi'kmaq land and resource occurring within "living memory" and addresses current Mi'kmaq land and resource use sites, plants of significance to Mi'kmaw communities. Information on plants of significance to Mi'kmaq was collected through random sampling of the vegetation along the existing highway corridor (refer to Appendix D for MEKS report).

It is anticipated in addition to the preliminary environmental screening and the MEKS, that additional consultation with First Nations will be undertaken by NSTIR.

4.0 EFFECTS ASSESSMENT METHODS AND SCOPING

4.1 Environmental Assessment Methods

The methodical approach employed in this EA provides an integrated evaluation of Project-related and cumulative environmental effects following the methodological framework described by Barnes *et al.* (2000).

The approach uses the following seven basic steps to assess environmental effects, including the consideration of cumulative environmental effects, in an integrated way.

1. Identify the issues through scoping and select Valued Environmental Components (VECs) on which to focus the EA.
2. Establish boundaries for the EA and residual environmental effects rating criteria (“thresholds of significance”) for determining the significance of environmental effects, including cumulative environmental effects, for each VEC.
3. Identify those past, present and likely future projects that could result in environmental effects in combination with the Project.
4. Identify environmental effects of Project activities, by Project phase, including those resulting from interaction of the Project with the environmental effects identified for past, present and future projects that will be carried out, and also the changes to the Project caused by the environment.
5. Evaluate environmental effects, including cumulative environmental effects, using the significance criteria identified in Canadian Environmental Assessment Agency guidance documentation (CEA Agency 1994) in light of proposed mitigation.
6. Analyze the environmental effects and predict their significance by applying the residual environmental effects rating criteria.
7. Outline monitoring and follow-up measures, as required.

This integrated approach to cumulative effects is one of two possible ways identified by the Agency in “Addressing Cumulative Effects, A Reference Guide for the *Canadian Environmental Assessment Act*” (the “Reference Guide”) (CEA Agency 1994). The following describes the above noted steps that are followed for this EA.

4.1.1 Step 1 - Scoping of Issues and Selection of Valued Environmental Components

Scoping involves consultation with all stakeholders, including the general public,, regulatory agencies (provincial and federal), and the Aboriginal community to identify the issues that need to be addressed in the EA. It also involves the application of professional judgment by the authors of the EA report, including the consideration of baseline studies undertaken for the Project.

A key objective during the issues scoping process is to identify the best way to organize or "package" issues into VECs that make sense for the focused analysis of potential environmental effects.

For the biological and physical environment, VECs may represent "key" or "indicator" species, communities, species groups, or ecosystems, as well as "pathways" (*e.g.*, air, water), which act as media for the transfer of environmental effects. VECs may also reflect issues that are socially, culturally, or economically of value. The ultimate decision on what should be the VEC or VECs must reflect an informed understanding of the potential Project-environment interactions, the importance of components to ecological integrity, their sensitivity to the planned perturbations, and the values of society. Regardless, practitioners must use their good professional judgment in consideration of all or many of these factors, including the opinions expressed to them by the various participants during the scoping process.

4.1.2 Step 2 - Boundaries and Residual Environmental Effects Rating Criteria

4.1.2.1 Boundaries

An important aspect of the EA process is the determination of boundaries because they focus the scope of work, allowing for a meaningful analysis of potential environmental effects associated with the Project. The setting of boundaries also aids in determining the most effective use of available resources. There are two distinct types:

- Temporal and spatial boundaries of the Project and the VEC; and
- Administrative and technical boundaries of the assessment.

The first type of boundary is defined by the temporal and spatial characteristics of the Project and various VECs. For example, ecological, socio-cultural, economic, health, heritage, traditional land use, and Project boundaries are of this type. These boundaries encompass those periods and areas during, and within which, the VECs are likely to interact with, or be influenced by, the Project. These boundaries may extend well beyond physical Project limits, even the limits of potential direct interactions between the Project and the VECs, particularly in the case of migratory species, or regional or national socio-cultural and economic systems.

The second type of boundary addresses the limitations on the scope of, or approach to, work during the assessment of environmental effects. These boundaries are referred to as administrative boundaries and technical boundaries to the assessment, and are imposed by such factors as finite resources of data, time, cost, and labour, as well as technical, political, or administrative reasons or jurisdictions.

Administrative boundaries refer to the temporal and spatial dimensions imposed on the EA for political, socio-cultural, and economic reasons. Technical boundaries represent the technical limitations on the ability to evaluate or predict potential environmental effects of the Project. For example, it may be difficult to measure or predict the number of individuals of any particular species that might be affected by the Project. Where such technical boundaries exist, it is important that they are acknowledged, and alternative strategies used to characterize the VEC and/or environmental effects are described.

4.1.2.2 Residual Environmental Effects Rating Criteria

Fundamental to the approach described by Barnes *et al.* (2000) is the determination of significance. The determination of significance is central to decision-making. Rating criteria are specifically defined for each VEC to provide the threshold for determining the significance of residual environmental effects. These “residual environmental effects rating criteria” or “significance thresholds” are established based on information obtained during issues scoping, available information on the status and characteristics of the VEC, and professional judgment.

The evaluation criteria recommended by the CEA Agency (1994) to assist in the determination of significance are used to frame specific definitions for the determination of significance, as appropriate. These significance thresholds determine at which point the VEC would experience environmental effects of sufficient geographic extent, magnitude, duration, frequency and/or reversibility to affect its integrity (each of these are described in more detail in Step 5). These Agency evaluation criteria help to frame significance thresholds that reflect the sensitivity of the VEC to perturbation and its ability to recover.

In developing residual environmental effects rating criteria, one first needs to define which population, stock, community, or ecosystem is represented by the VEC, or in the case of abiotic biophysical components like air quality, which airshed(s) are affected. For socio-cultural and economic VECs, one must determine the people, groups of people, or communities that are affected.

The challenge in determining whether or not environmental effects are significant is that some considerable degree of professional judgment is normally needed to evaluate whether the predicted environmental effects, including cumulative environmental effects (*e.g.,* loss of habitat, mortality, change in land use), will exceed the designated threshold of significance. In most cases the significance is obvious when compared to the criteria in light of the various data and information contained in the analysis. However, in some instances, lack of previous experience, insufficient data, or the use of predictive tools may cast sufficient uncertainty that it may be difficult to apply the criteria with a high degree of certainty. This is a technical limitation or boundary of the EA. A precautionary approach to mitigation or the crafting of significance criteria that incorporate some appropriate margin of safety to compensate for the level of uncertainty can assist in dealing with this potential methodological challenge should it arise.

4.1.3 Step 3 - Identification of Past, Present and Likely Future Projects

A crucial component of assessing cumulative environmental effects includes the identification of past, present and likely future projects and activities that could interact in combination with the Project. These are preferably identified during the scoping stage of the EA. Once identified, these projects or activities are listed in tables, which include relevant information such as location and, in the case of likely future projects, their status. Past and present projects also help to establish the existing conditions or status for each VEC for environmental effects analysis.

4.1.4 Step 4 - Identification of Project Environmental Effects

This step involves the identification of VEC-specific Project related environmental effects (*e.g.,* Project-VEC interactions) and a description of issues and concerns regarding key interactions. Table 4.1 presents a breakdown of the Project activities required to complete the Project components described in Section 2.

Table 4.1 Description of Project Activities and Physical Works

Project Phase	
Activity Category	**Project Activities and Physical Works**
Construction	
Site Preparation	Includes all Project-related activities associated with preparing the RoW for access and road construction. Activities include: • surveying; • clearing and grubbing; and • sediment and erosion control measures.
Roadbed Preparation	Includes all Project-related activities that are associated with roadbed preparation. Activities include: • blasting; • excavation; • placement of fill; • grading; • ditching and drainage management; and • grade separation structure construction.
Watercourse Crossing Structure Construction	Includes all Project-related activities required to install the watercourse crossing structures. Activities include: • site preparation; • stream diversion (if applicable); • culvert installation/extension; and • site restoration.
Surfacing and Finishing	Includes all Project-related activities that are associated with surfacing and finishing. Activities include: • paving; • signage, lighting and guide rail installation; and • highway marking.
Operation and Maintenance	
Project Presence	Includes all Project-related aspects that will be present for the life of the Project, including: • presence of the highway; and • presence of vehicle traffic.

Table 4.1 Description of Project Activities and Physical Works

Project Phase	
Activity Category	**Project Activities and Physical Works**
Infrastructure Maintenance	Includes all Project-related activities that are required to maintain the Project infrastructure, including: • pavement maintenance; • shoulder maintenance; • watercourse crossing structure maintenance; • highway marking; and • signage, lighting, and guide rail maintenance.
Winter Maintenance	Includes all Project-related activities that are required for the safe operation of the Project during adverse winter weather conditions including; • salting; • sanding; and • plowing.
Vegetation Management	Includes: • mowing; • vegetation removal; and • planting.
Decommissioning and Abandonment	
No plans for decommissioning identified within the planning horizon (lifespan of the facility)	N/A

In order to standardize this step and in keeping with standard practice, a Project activity-environmental effects interaction matrix is used for each VEC (Table 4.2). It describes the scope of the EA for each VEC and is limited to only those interactions identified through scoping, as reflected in the Terms of Reference (Appendix A). The cumulative environmental effects and the changes to the Project caused by the environment are also assessed.

Table 4.2 Project Activity – Environmental Effects Interaction Matrix for [Name of Environmental Component]

Potential Interactions Between Project Activities, Including Other Projects and Environmental Effects Valued Environmental Component: NAME OF ENVIRONMENTAL COMPONENT			
Project Activities and Physical Works†	**Potential Environmental Effects**		
	Effect 1	**Effect 2**	**Effect 3**
Construction			
Site Preparation			
Roadbed Preparation			
Watercourse Crossing Structure Construction			
Surfacing and Finishing			
Operation and Maintenance			
Project Presence			
Infrastructure Maintenance			

Table 4.2 Project Activity – Environmental Effects Interaction Matrix for [Name of Environmental Component]

Potential Interactions Between Project Activities, Including Other Projects and Environmental Effects Valued Environmental Component: NAME OF ENVIRONMENTAL COMPONENT			
Project Activities and Physical Works†	Potential Environmental Effects		
	Effect 1	Effect 2	Effect 3
Winter Maintenance			
Vegetation Management			
Other Projects and Activities			
Existing and Planned Linear Features			
Residential and Commercial Land Use			
Resource Land Use (forestry)			
Recreational Land Use			
Industrial Land Use			
Quarrying			

† See Table 4.1 and Section 2.3 for list and details of specific activities and works.

4.1.5 Step 5 - Evaluation of Environmental Effects

The next step in the assessment process consists of the evaluation of potential residual environmental effects of the Project, by Project phase, in consideration of proposed specific mitigation and the evaluation criteria for determining significance described by the CEA Agency (1994). The purpose of this step is to evaluate the interactions between Project activities and the VECs and to determine the nature and extent of residual environmental effects, *i.e.,* those environmental effects that may persist after all mitigation strategies have been implemented. As most projects involve at least some kind of environmental effect, it has become a practice to evaluate the significance of those. The significance of environmental effects is determined in Step 6, on the basis of the evaluation conducted in Step 4 and Step 5.

The evaluation of environmental effects, including cumulative environmental effects, takes into consideration:

- The potential interaction between Project activities, for each of the Project phases, and their environmental effects in combination with those of other past, present and likely future projects (as described in Step 4);
- The mitigation strategies applicable to each of the interactions; and
- The Agency"s evaluation criteria for determining significance (CEA Agency 1994) and any other evaluation criteria established by the study team to further characterise the nature and extent of the environmental effects, where required.

An environmental effects assessment matrix template is used to summarize the analysis of environmental effects, by Project phase (Table 4.3). This allows for a comprehensive analysis of all Project-VEC interactions in a matrix format. Supporting discussion in the accompanying text highlights particularly important relationships, data, or assessment analysis, but does not necessarily address all items noted in the table.

Table 4.3 Environmental Effects Assessment Matrix for [Name of Environmental Component]

Environmental Effects Assessment Matrix Valued Environmental Component: NAME OF ENVIRONMENTAL COMPONENT							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** **(A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Construction							
Site Preparation							
Roadbed Preparation							
Watercourse Crossing Structure Construction							
Surfacing and Finishing							
Operation and Maintenance							
Project Presence							
Infrastructure Maintenance							
Winter Maintenance							
Vegetation Management							

Key

Magnitude*:
1 = Low: *e.g.,* specific group, habitat, or ecosystem localized one generation or less, within natural variation
2 = Medium: *e.g.,* portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability
3 = High: *e.g.,* affecting a whole stock, population, habitat or ecosystem, outside the range of natural variation

Geographic Extent:
1 = <1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101 - 1,000 km^2
5 = 1,001 - 10,000 km^2
6 = >10,000 km^2

Duration:
1 = <1 month
2 = 1 - 12 months
3 = 13 - 36 months
4 = 37 - 72 months
5 = >72 months

Frequency:
1 = <11 events/year
2 = 11 - 50 events/year
3 = 51 - 100 events/year
4 = 101 – 200 events/year
5 = >200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or not adversely affected by human activity. area by
2 = Evidence of adverse environmental effects.

N/A = Not Applicable
(A) = adverse
(P) = positive

*These magnitude definitions are typical for the Vegetation VEC and are provided for illustrative purposes only.

4.1.5.1 Classifying Potential Environmental Effects

The concept of classifying environmental effects simply means determining whether they are adverse (A) or positive (P). This is indicated in Table 4.3 by the use of a bracketed “A” or “P”. The following includes some of the key factors that can be considered for determining adverse environmental effects, as per CEA Agency guidelines (1994):

- Negative environmental effects on the health of biota;
- Loss of rare or endangered species;
- Reductions in biological diversity;
- Loss or avoidance of critical/productive habitat;
- Fragmentation of habitat or interruption of movement corridors and migration routes;
- Transformation of natural landscapes;
- Discharge of persistent and/or toxic chemicals;
- Toxicity effects on human health;
- Loss of, or detrimental change in, current use of lands and resources for traditional purposes;
- Foreclosure of future resource use or production; and
- Negative effects on human health or well-being.

4.1.5.2 Mitigation

Mitigation includes Project design, environmental protection strategies, and mitigation specific to the minimization or control of potential adverse environmental effects on a particular VEC. These measures must be technically and economically feasible. In the case of beneficial environmental effects, enhancement opportunities (*e.g.,* maximizing opportunities for local suppliers and subcontractors) are considered. The environmental effects analysis will be undertaken in consideration of the proposed mitigation and environmental effects predictions. Environmental effects remaining after mitigation will be determined to be residual environmental effects. Current NSTIR environmental management practices will be factored into the overall mitigation strategies that will be specifically included for the Project. Summaries of specific mitigation for each environmental effect are provided in the Environmental Effects Assessment Matrix as shown on Table 4.3.

4.1.5.3 Application of Evaluation Criteria for Assessing Environmental Effects

Several criteria are taken into account when evaluating the nature and extent of environmental effects. These criteria include (CEA Agency 1994):

- Magnitude;
- Geographic extent;
- Duration and frequency;
- Reversibility; and
- Ecological, socio-cultural, and economic context.

Each criterion has a numeric descriptor in the key of the environmental effects assessment matrix (Table 4.3) to simplify the presentation of results of the EA and reflect different levels at which the criterion applies. The key is modified as appropriate for each VEC.

4.1.6 Step 6 - Analysis and Prediction of the Significance of Environmental Effects

The analysis and prediction of the significance of environmental effects, including cumulative environmental effects, encompasses the following:

- Determination of the significance of residual environmental effects, including cumulative residual environmental effects, for each phase of the Project and for the Project overall, as well as for any predicted significant environmental effects;
- Establishment of the level of confidence for predictions; and
- Determination of scientific certainty and probability of occurrence of the predicted residual environmental effects.

For the analysis of cumulative environmental effects within this integrated methodological framework, a number of key elements are essential for the evaluation of the contribution of Project-related environmental effects. The following questions are asked.

- Are there Project-related environmental effects?
- Do identified Project-related environmental effects overlap with (*i.e.,* act in combination with) those of other past and present projects? This can be established through characterization of the existing baseline conditions of the VEC, reflecting any overlapping cumulative environmental effects of those past and present projects.
- What is the contribution of the Project to those overlapping cumulative environmental effects of past and present projects?
- Do the combined Project and cumulative environmental effects of past and present Projects overlap with those of any future projects that will be carried out?

These questions will be answered for each VEC to the extent that they are applicable within the environmental effects analysis conducted in Step 5. The EA will address the VECs for cumulative environmental effects when these are anticipated.

Upon completion of the evaluation of environmental effects in Step 5, the residual environmental effects, including cumulative environmental effects, are assigned an overall rating of significance for each of the Project phases (*e.g.,* Construction, Operation, decommissioning, and Accidents, Malfunctions, and Unplanned Events) and for the Project overall.

This overall determination considers all residual environmental effects, including Project and other-project cumulative environmental effects. As such, this represents an integrated residual environmental effects evaluation. These are presented in the residual environmental effects summary template (Table 4.4). This table provides a phase-by-phase and a Project overall residual environmental effects rating. Where significant adverse or positive residual environmental effects are predicted, a level of confidence and likelihood of occurrence rating are also given to each prediction.

Table 4.4 Residual Environmental Effects Summary Matrix for [Name of Environmental Component]

<table>
<tr><th colspan="5">Residual Environmental Effects Summary Matrix
Valued Environmental Component: NAME OF ENVIRONMENTAL COMPONENT</th></tr>
<tr><th rowspan="2">Phase</th><th rowspan="2">Residual Environmental Effects Rating, Including Cumulative Environmental Effects*</th><th rowspan="2">Level of Confidence</th><th colspan="2">Likelihood</th></tr>
<tr><th>Probability of Occurrence</th><th>Scientific Certainty</th></tr>
<tr><td>Construction</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Operation and Maintenance</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Project Overall</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Key

Residual Environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Level of Confidence
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence</td><td colspan="3">Probability of Occurrence: based on professional judgment
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence
N/A= Not Applicable</td></tr>
</table>

*As determined in consideration of established residual environmental effects rating criteria.

Taking into consideration the analyses conducted in Steps 4 and 5, phase-by-phase, and overall Project ratings of “significant” or “not significant” are assigned. A rating of positive may also be applied where the environmental effects are found to be positive rather than adverse. Specific thresholds for determining significance are developed for a VEC to reflect the distinction between those environmental effects that should or should not be collectively considered significant (Step 2).

The rating of significance is determined by the aggregate consideration of Project-related environmental effects and those of other past, present and likely future projects against the thresholds that have been established for the specific VEC, and within the defined EA boundaries established for that VEC. Significant environmental effects are those which are considered to be of sufficient magnitude, duration, frequency, geographic extent, and/or reversibility to cause a change in the VEC that will alter its status or integrity beyond an acceptable level. Significance criteria are established on the basis of professional judgment, but they are well defined, transparent, and take into consideration public, regulatory and Aboriginal consultation. In conducting this judgment, the accompanying text must highlight specifically how the cumulative environmental effects have been factored into the determination of the significance of residual environmental effects.

4.1.7 Step 7 - Monitoring and Follow-up

As part of the environmental effects analysis, appropriate monitoring and follow-up, are described. In developing monitoring and follow-up measures, the results of Steps 1 through 6 are helpful in focusing on important interactions, where there is a high level of uncertainty about environmental effects predictions, where significant environmental effects are predicted, or in areas of particular sensitivity. The contribution of the Project to overall cumulative environmental effects may influence decisions regarding the responsibility for monitoring of those cumulative environmental effects.

4.1.8 Effects of the Environment on the Project

In addition to the seven-step process for evaluating the environmental effects of the Project, including cumulative environmental effects, it is also necessary to consider those changes to the Project that may arise as a result of the environment. For example, natural phenomena like severe weather, forest fires, floods and earthquakes can result in environmental effects. These effects of the environment on the Project are addressed in a separate section at the end of the environmental effects analysis (Section 8).

4.2 Issues Scoping and Selection of Valued Environmental Components

4.2.1 Consultation

Consultation is the process by which interested parties are provided opportunity to contribute to the scoping of the Project and the EA as per Section 16(1) (c) of *CEAA*, and/or to contribute local knowledge or expert advice useful for conducting the EA. This process includes consultation with members of the public, stakeholders, and regulatory agencies and experts. Section 3 of this EA Report provides an overview of the public, stakeholder, and regulatory consultation undertaken for this Project, including issues raised and considered in Project planning and the preparation of this EA Report.

4.2.2 Scope Determination

A Terms of Reference (Appendix A) was developed in consideration of both the federal and provincial EA and permitting processes, and incorporating feedback from provincial and federal regulatory agencies.

4.2.2.1 Scope of the Project

The scope of the Project, as determined by the Terms of Reference, includes those Project components included in Table 4.1 for Construction and Operations and Maintenance activities. There are no plans for decommissioning within the planning horizon therefore Decommissioning/Abandonment was not considered to be applicable to the scope.

4.2.2.2 Scope of Factors to be Assessed

The EA shall consider accidents, malfunctions, and unplanned events related to Project activities to be identified in the EA.

Selected factors listed in the Terms of Reference are discussed below where there may be potential for interactions, given the location and type of Project. The following presents a consideration of factors, and the rationale for inclusion of the factors within the environmental assessment, as well as a rationale for the omission of others. The scopes of the factors to be considered in relation to the Project have been grouped by Valued Environmental Components (VECs) as presented in Table 4.5.

Table 4.5 Selected Valued Environmental Components

Valued Environmental Components	Factors To Be Considered
Atmospheric Environment	Air quality Sound quality (noise) Climate Global climate change (GHG Emissions)
Groundwater	Bedrock, surficial geology and soils Groundwater quality and quantity Water supply source
Aquatic Environment	Surface water quality and quantity Fish and fish habitat Aquatic species of special conservation concern Navigation
Vegetation	Terrestrial vascular plants Dominant plant communities Terrestrial plant species of special conservation concern
Wetlands	Wetland functions and area Use of wetlands by wildlife
Wildlife and Wildlife Habitat	Wildlife (including migratory birds) presence/absence Wildlife habitat Wildlife species of special conservation concern
Land Use and Community Character	Recreational, residential, industrial or commercial use of land (existing and anticipated land use) Identified current use of lands and resources for traditional purposes by Aboriginal

Table 4.5 Selected Valued Environmental Components

Valued Environmental Components	Factors To Be Considered
	persons Social, economic and recreational aspects of the community
Archaeological and Heritage Resources	Structures, sites, or things of historical, paleontological, archaeological, or architectural significance
Effects of the Environment on the Project	Climate change and storm events Extreme precipitation (including snow) Sea level rise Flooding Contaminated sites

The Project is not likely to have environmental effects on human health, other than those already considered in Table 4.5 (*e.g.*, air quality and noise on human receptors). Environmental effects of the project on navigation are taken into consideration as part of the EA only when the effects are indirect (*i.e.*, resulting from a change in the environment affecting navigation). Direct effects on navigation are not considered in the EA, but any measures necessary to mitigate direct effects will be included as conditions of the *Navigable Waters Protection Act* approval. Only direct effects were identified; therefore the effects of the Project on navigation are not addressed in this EA.

In addition to the factors outlined in Table 4.5, alternative means of carrying out the Project were also considered, including variations (*e.g.,* wide versus narrow median) in highway design that may be implemented (refer to Section 2.7).

4.2.3 Cumulative Effects Assessment Methods

4.2.3.1 Selection of VECs and Indicators

The assessment of the Project on cumulative environmental effects was done for all VECs. The spatial and temporal boundaries for these VECs were based on the available data. The level of cumulative environmental effects analysis was limited by the potential for adverse environmental effects, the geographic extent of the adverse environmental effects, the available data, and the importance of these VECs to regulatory agencies and the public (including First Nations as identified through the MEKS).

4.2.3.2 Identification of Past, Present and Future Projects and Activities

Past, present and future projects and activities that may have environmental effects or may possibly interact with those of the Project were selected based on public and regulatory consultation, and the professional observations and judgment of members of the Project team.

The cumulative assessment of environmental effects was based on VEC-specific environmental assessment boundaries. Also to an extent, the level of inclusion of these Projects and activities was limited by data availability and the degree to which the effects may overlap, or in conjunction with the current Project due to their proximity to each other.

For the purpose of this EA, selected past, present and future projects and activities that may potentially act in combination with the environmental effects of the Project have been grouped into the following categories:

- Existing and Planned Linear Features (*i.e.*, existing Highway 103 and proposed twinning, secondary roads, watercourse crossings, overpass and underpass structures, temporary ancillary elements, and potential Ingramport interchange);
- Residential and Commercial Land Use (existing and anticipated);
- Recreational Land Use (*e.g.*, walking trail and ATV use); and
- Industrial Land Use (predominantly Bowater Mersey Woodlands Operations, Nova Scotia Power Mill Lake Generating Station, and Interhabs).

5.0 BIOPHYSICAL ENVIRONMENTAL EFFECTS ASSESSMENT

5.1 Atmospheric Environment

5.1.1 Rationale for Selection as Valued Environmental Component

The Atmospheric Environment in the context of this project is the layer of air near the earth"s surface to a height of approximately 10 km. The Atmospheric Environment is typically characterized by three key aspects, as follows:

- Air quality, which is characterized by the chemical and physical properties of the air in the lower atmosphere, including gaseous and particulate air contaminants;
- Sound quality, which is characterized by the type, character, frequency, intensity, and duration of sound pressure levels or noise (unwanted sound) in the outdoor environment; and
- Climate, which is characterized by long-term trends in temperature, precipitation, sea level rise, and wind.

The Atmospheric Environment has been selected as a VEC due to the potential environmental effects of the Project on the local airshed, such as air contaminant releases and sound emissions, as a result of Project activities. The Atmospheric Environment has intrinsic importance to the health and well-being of humans, wildlife, vegetation, and other biota. The Atmospheric Environment is also an important pathway for the transport and eventual deposition of air contaminants to the freshwater, terrestrial and human environments.

In consideration of the scale of the Project, as defined in the Project Description (Section 2), the potential environmental effects of the Project on local climate are expected to be nominal. For example, microclimate issues such as cold air pooling along elevated sections of the Project and the potential for local crop damage are not expected to be a concern due to the relatively limited scale of the Project (*i.e.*, 22 km of twinning of an existing highway, and associated infrastructure) and because the Project is not expected to traverse any agricultural land use areas (refer to Section 6.1) that would be sensitive to cold air pooling (*i.e.*, crops). Microclimate issues therefore will not be considered further in this assessment. However, the potential effects of the environment on the Project, with respect to climatic and weather patterns such as extreme temperatures, wind, and precipitation, are considered in Section 7. Climate change as a result of the Project will be considered in the context of Project-related changes in greenhouse gas (GHG) emissions.

5.1.2 Environmental Assessment Boundaries

5.1.2.1 Spatial

The spatial boundaries (“Assessment Area”) for the characterization of potential environmental effects for each key aspect of the Atmospheric Environment are formed by the zone of influence associated with Project construction, and operation and maintenance. The potential environmental effects of Project-related activities on air quality and sound quality are generally not expected to extend beyond approximately 300 m of the centreline of the Project. This 300 m range generally provides for sufficient dispersion of emissions and dissipation of noise generated from Project-related activities, such as heavy equipment operation and vehicle traffic. As such, the spatial boundaries for the characterization of potential environmental effects of Project activities on air quality and sound quality are identified as this zone extending to approximately 300 m of the centreline of the Project.

The spatial boundary for the assessment of the environmental effects of GHG emissions on global climate change is, by definition, the global environment.

5.1.2.2 Temporal

The temporal boundaries for the assessment of potential environmental effects for each key aspect of the Atmospheric Environment include periods of construction and subsequent operation and maintenance of the Project in perpetuity. Residential areas are the most sensitive receptors for noise impacts at night. In residential areas, noise levels are often dominated during the day by traffic, property maintenance and recreational activities. At night, local traffic is greatly reduced so that noise from the nearest arterial roads and industry may be the most dominant perceived source. Other temporal issues include seasonal considerations when residents may be engaged in an increased number of outdoor activities and potentially subject to a greater amount of noise and dust.

5.1.2.3 Administrative and Technical

The technical and administrative boundaries for Atmospheric Environment and its key aspects pertain mainly to regulatory limits and standards for the emissions of air contaminants and noise in the Assessment Area, where such limits and standards exist. These limits are set by regulatory authorities to reflect environmental protection objectives, with the intent of being protective of air quality and human and environmental health.

Air Quality

Air quality will be assessed in the context of potential Project-related air contaminant emissions and the ground-level concentrations of these contaminants, as well as potential greenhouse gas emissions and the loss of carbon sinks in the Assessment Area. For the purposes of this EA, the Project-related air contaminants of interest consist of total suspended particulate matter (TSP) (including dust), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), sulphur dioxide (SO_2), nitrogen dioxides (NO_2), carbon monoxide (CO), oxidants – ozone (O_3), volatile organic compounds (VOCs), and polycyclic aromatic hydrocarbons (PAHs).

Ambient air quality in Canada is regulated by the provincial government. The federal government has set objectives for air quality which are taken into account by federal agencies in project review. These objectives form the basis for the air quality regulations of several provinces, including Nova Scotia. The Nova Scotia regulated limits correspond to the limit of the Maximum Acceptable category of air quality, which are set under the *Canadian Environmental Protection Act* (*CEPA*). These guidelines may also be used as reference by provincial or federal regulators. The air quality guidelines of “tolerable”, “acceptable”, and “desirable” levels, as defined under the *CEPA*, will be used in the evaluation of significance. The maximum “tolerable” level denotes a concentration beyond which appropriate action is required to protect the health of the general population. The maximum “acceptable” level is intended to provide protection against effects on soil, water, vegetation, visibility, and human wellbeing. The maximum “desirable” level is the long-term goal for air quality. Additional guidelines are under development by the Canadian Council of Ministers of the Environment (CCME), and ultimately this body will develop Canada-Wide Standards (CWS) that harmonize the regulations in all jurisdictions. These are supplemented, where required or available, by other standards and objectives from other jurisdictions, in order to provide some quantitative basis for comparison with ambient air quality monitoring results for the selected air contaminants. The National Ambient Air Quality Objectives and the Nova Scotia Ambient Air Quality Standards for specified contaminants of interest are presented in Table 5.1 for reference.

Table 5.1 Nova Scotia Air Quality Regulations (Environment Act) and Canadian Environmental Protection Act Ambient Air Quality Objectives

Pollutants and Units (Alternative Unit in Brackets)	Averaging Time Period	Nova Scotia	Canada			
				Ambient Air Quality Objectives		
		Maximum Permissible Ground Level Concentration	Canada Wide Standards (Pending)	Maximum Desirable	Maximum Acceptable	Maximum Tolerable
Nitrogen Dioxide µg/m³ (ppb)	1 Hour	400 (213)	-	-	400 (213)	1000 (532)
	24 Hour	-	-	-	200 (106)	300 (160)
	Annual	100(53)	-	60 (32)	100 (53)	-
Sulphur Dioxide µg/m³ (ppb)	1 Hour	900 (344)	-	450 (172)	900 (344)	-
	24 Hour	300 (115)	-	150 (57)	300 (115)	800 (306)
	Annual	60 (23)	-	30 (11)	60 (23)	-
Total Suspended Particulate Matter (TSP) µg/m³	24 Hour	120	-	-	120	400
	Annual	70	-	60	70	-
PM2.5 µg/m³	24 Hour, Based on 98th Percentile Over 3 Consecutive Years	-	30	-	-	-
PM10-2.5 µg/m³	24 Hour	-	--	-	-	-

Table 5.1 Nova Scotia Air Quality Regulations (Environment Act) and Canadian Environmental Protection Act Ambient Air Quality Objectives

Pollutants and Units (Alternative Unit in Brackets)	Averaging Time Period	Nova Scotia	Canada			
				Ambient Air Quality Objectives		
		Maximum Permissible Ground Level Concentration	Canada Wide Standards (Pending)	Maximum Desirable	Maximum Acceptable	Maximum Tolerable
Carbon Monoxide mg/m^3 (ppm)	1 Hour	35 (31)	-	15 (13)	35 (31)	-
	8 Hour	13 (11)	-	6 (5)	15 (13)	20 (17)
Oxidants - Ozone µg/m^3 (ppb)	1 Hour	160 (82)	-	100 (51)	160 (82)	300 (153)
	8 Hour, Based on 4th Highest Annual Value, Averaged Over 3 Consecutive Years	-	128 (65 by 2010)	-	-	-
	24 Hour			30 (15)	50 (25)	
	Annual				30 (15)	
Hydrogen Sulphide µg/m^3 (ppb)	1 Hour	42 (30)				
	24 Hour	8 (6)				

It should be noted that ground-level ozone is not emitted directly, but rather formed by secondary photochemical reaction between nitrogen oxides (NO_X) and VOCs in the atmosphere in the presence of strong sunlight. Although it is not expected that ground-level ozone levels in the Assessment Area will change substantially as a result of Project activities, it is useful to consider this contaminant in the assessment of existing conditions, since ozone is often considered an indicator of ambient air quality conditions in the environment. Therefore, ground-level ozone will be considered in this assessment solely as it pertains to the characterization of existing conditions in the Assessment Area.

Sound Quality

Sound quality will be assessed in the context of the potential environmental effects caused by increased sound pressure levels in the Assessment Area resulting from Project-related activities.

Sound quality is typically characterized in terms of the type, character, frequency, intensity, and duration of sound emissions. Since the human ear does not respond to sound on a linear scale, the intensity ambient sound pressure levels is characterized using a logarithmic decibel (dB) scale, with the A-weighted (dB_A) scale most commonly being used for environmental sound quality. Measured parameters for environmental sound or noise are generally expressed as an “equivalent sound level” (L_{eq}) over a specified period of time (*e.g.,* 1-hour or 24-hours).

Natural factors may influence the sound quality of the outdoor environment (*e.g.,* wind, waves, birds, animals) and human activities may also have an influence (*e.g.,* construction equipment, vehicle traffic). Weather conditions such as temperature, humidity, wind direction and wind speed may also affect the distance that sound may travel through the atmosphere. In addition, changes in the physical properties of the environment (such as a change in land cover, or the removal or construction of physical structures such as buildings) can also result in changes to sound propagation characteristics of the environment. Local topographical features such as hills or wooded areas may also serve to reduce sound levels.

A number of jurisdictions, including the Province of Ontario and the United States Environmental Protection Agency (US EPA), have established specific regulatory limits for sound pressure levels from industrial or construction activities. In the province, the Nova Scotia Environment (NSE) *Guidelines for Noise Measurement and Assessment* (NSDOE 1989) set sound pressure levels for the day, evening and nighttime. The criteria in these guidelines are:

- L_{eq} 65 dBA between 0700 h and 1900 h;
- L_{eq} 60 dBA between 1900 h and 2300 h; and
- L_{eq} 55 dBA between 2300 h and 0700 h.

These guidelines are intended to “facilitate the evaluation of noise pollution in the environment”, and are used here to that purpose. The guidelines were intended to apply to the environments where the members of the public “live, work and play”. It is noted in the guidelines that “transportation” is “excluded from the guideline”. These limits are adopted in this assessment, as in previous highway environmental studies, in lieu of regulatory limits or a formal noise policy of NSTIR.

Global Climate Change/GHG Emissions

There are currently neither air quality standards nor guidelines for GHG concentrations in ambient air (provincial or federal), nor are there any emission limits with respect to GHG releases (provincial or federal). In the absence of specific regulatory guidance, the latest guidance from the CEA Agency ("Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practioners”; CEA Agency 2003) was followed. As summarized in the introduction of that document, greenhouse gases as precursors to climate change constitute a global phenomenon rather than a local issue, and the science of this phenomenon is not yet developed to the stage where global contributions from a single project of this nature can be measured against the problem. This presents a technical boundary in that the contribution of the Project to global climate change is not ultimately knowable at this time, therefore the determination of the significance of the contribution of the Project to global climate change is not possible at this time. In consideration of this, the Climate Change General Guidance document (supported by the Canadian Environmental Assessment Agency) recommends that significance criteria not be set for the assessment of GHG within a *CEAA* environmental assessment. Instead, the step-by-step process outlined in the Climate Change General Guidance document serves to accomplish the assessment in lieu of significance criteria. Climate change as a result of the Project will be considered in the context of Project-related changes in greenhouse gas (GHG) emissions.

5.1.3 Residual Environmental Effects Rating Criteria

A **significant residual adverse environmental effect** of the Project on air quality is one that, after mitigation has been considered, causes the maximum Project-related emissions of the air contaminants of interest (those described in Section 5.1.2.3.1) to result in an exceedance of the Nova Scotia or Federal ambient air quality standards, as defined in Table 5.1.

A **significant residual adverse environmental effect** of the Project on sound quality is one that, after mitigation has been considered, causes either of the following to occur:

- A noticeable change in noise level (approximately 5 dBA) which results in exceedance of the NSE Noise Guidelines;
- A noticeable change in noise level (approximately 5 dBA) above existing noise levels in areas where the guideline levels are already exceeded; or
- A change in noise level of approximately 10 dBA above existing noise levels in areas where the guideline levels are not exceeded.

5.1.4 Baseline Conditions

There is a very limited number of industrial emission sources located near the Assessment Area, as the proposed corridor is located in a predominately forested region. As a result, the emissions associated with the highway will likely incur minimal cumulative effects. Emissions from consumer products such as home heating systems and motor vehicles, as well as air contaminants transported to the region by prevailing winds, are likely to be main contributors to ambient air contaminant concentrations in the Assessment Area. For these reasons, it is useful to review the regional and provincial climate, existing air contaminant emissions in the region and the province, and historical ambient air quality monitoring results at the nearest ambient air quality monitoring stations, to assist in the characterization of existing air quality conditions in the Assessment Area.

5.1.4.1 Climate

The Assessment Area is located in the central-east portion of Nova Scotia. The closest complete weather station is that at Shearwater, NS. Albeit, there is a smaller weather station closer in proximity to the Assessment Area in the Town of St. Margaret"s Bay.

Climate normals and weather extremes are available from the Environment Canada weather station operated in St. Margaret"s Bay from 1971-2000 (Environment Canada 2006). Wind normals are provided from the Shearwater site during this same period. These data are presented in Table 5.2.

Table 5.2 Summary of Climate Normals for Assessment Area

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature Normals for St. Margaret's Bay, NS (1971 - 2000)													
Daily Average (°C)	-5.7	-5.4	-1	4.2	9.3	14.1	17.5	17.6	13.6	8.1	3.6	-2.3	**6.1**
Daily Maximum (°C)	0	0.5	4.1	9.1	14.9	19.8	23.1	23.2	19.6	13.5	8.2	2.7	**11.6**
Daily Minimum (°C)	-11.3	-11.2	-6.1	-0.7	3.7	8.2	11.8	11.9	7.6	2.5	-1	-7.4	**0.7**
Precipitation Normals for St. Margaret's Bay, NS (1971 - 2000)													
Rainfall (mm)	100.9	71.5	101	99.1	110.7	100.7	99.4	84.6	97.9	116.8	128.5	113.9	**1224.9**
Snowfall (cm)	37.3	34.9	26.4	7.9	1.4	0	0	0	0	0.9	5.6	24.5	**138.9**
Precipitation (mm)	138.2	106.4	127.4	107	112	100.7	99.4	84.6	97.9	117.7	134	138.4	**1363.8**
Wind Normals for Shearwater, NS (1971-2000)													
Average Speed (km/h)	18.1	17.7	17.8	16.9	14	12.8	11.3	11.1	12.8	14.8	16.5	17.7	**15.1**
Most Frequent Direction	W	NW	NW	N	S	S	S	SW	SW	W	NW	W	**W**

Source: Canadian Climate Normals 1971-2000

Based on the climate normals described in Table 5.2, January is the coldest month in the Assessment Area, recording a minimum of -11.3ºC, and July and August are the warmest with maximum temperatures of 23.1ºC and 23.2ºC respectively. The average annual precipitation at the St. Margaret‟s Bay weather station is 1363.8.9 mm, of which approximately 90% is in the form of rain.

The average wind speed reported at the Shearwater weather station was approximately 16.4 km/h. The maximum wind speeds occur in March with average speeds of 17.8 km/h and the minimum speeds occur in August at an average of 11.1 km/h.

5.1.4.2 Air Quality

Air Contaminant Emissions

The existing air contaminant emissions from Nova Scotia sources assist in establishing a benchmark for comparison with Project-related emissions, and assist in the assessment of cumulative environmental effects. Existing air contaminant emissions are generally classified into two categories:

- Criteria air contaminants (CACs), including particulate matter and combustion gases such as sulphur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO); and
- GHGs, including primarily carbon dioxide (CO_2) but also including, to a lesser extent or magnitude, methane (CH_4), nitrous oxide (N_2O), hydro fluorocarbons (HFCS), perfluorocarbons (PFCS) and sulphur hexafluoride (SF_6).

A summary of estimated emissions of criteria air contaminants (CACs) in Nova Scotia for 2007, as presented in the Environment Canada 2007 CAC Emissions Summaries for Nova Scotia

(Environment Canada 2007a) and the Environment Canada GHG Emissions Inventory for 2007, is presented in Table 5.3. The emissions of CACs and GHGs include those from industrial, residential, transportation and other miscellaneous sources in Nova Scotia. These emission summaries represent the latest information available.

Table 5.3 Emissions of Criteria Air Contaminants and Greenhouse Gas Emissions Estimates for Nova Scotia

Contaminant	Estimated Emissions for NS (Year 2007) (tonnes)
Total Suspended Particulate Matter (TPM)	366,671
Particulate Matter less than 10 microns (PM10)	100,121
Particulate Matter less than 2.5 microns (PM2.5)	27,029
Sulphur Oxides (SOx as SO_2)	136.921
Nitrogen Oxides (NOx as NO_2)	77,666
Carbon Monoxide (CO)	239,075
Volatile Organic Compounds (VOCs)	277,487
Greenhouse Gases (GHGs) (CO_2-equivalent)	20,723,000*

* As reported to 2008 Environment Canada"s GHG program

In 2008, Nova Scotia contributed 20.8 Megatonnes (Mt) or 2.8% of Canada's total GHG emissions. The Energy Sector represents 94% of the provincial GHG total (Environment Canada 2008).

There are three industries in the Hubbards area: Nova Scotia Power Incorporated (NSPI), Bowater Mersey Company, and Interhabs. The NSPI industrial presence is limited to hydroelectric generation facilities, which produce negligible adverse air quality contributions. Bowater Mersey has forestry related facilities including a logging camp and Interhabs has a modular home production facility. These two operations may contribute to air contaminant emissions, but due to their small scale of operation it is believed interaction with the Project will be minimal. The Assessment Area is predominately forested with scattered, small residential communities. The other sources of CAC and GHG emissions would likely be from vehicles, home heating, and long range transport.

Ambient Air Quality

The Assessment Area and Nova Scotia in general, have good air quality due to the combination of relatively small population and limited industrial bases (NSDOE 1998). Climatic conditions provide good dispersion of air contaminants. The ambient air quality also benefits from the infusion of relatively clean polar and arctic air masses. Occasionally, however, long-range transport of air masses from central Canada or the eastern seaboard my transport contaminants into the area, causing poorer air quality.

NSE and Environment Canada operate a network of ambient air monitoring stations within the province to measure ambient concentrations of various air contaminants. The results from the Halifax, Kejimkujik National Park, Aylesford Mountain and Kentville monitoring stations, which are the closest to the Project location, are discussed briefly below to provide context with regard to regional ambient air quality. From the selected air contaminants listed in Section 5.1.2.3, $PM_{2.5}$, CO, SO_2, NO_2, and O_3 are monitored at the Halifax monitoring station. Ambient concentrations of O_3 are also monitored at the Kejimkujik National Park, Aylesford Mountain and Kentville monitoring stations.

Based on monitoring results from the National Air Pollution Surveillance (NAPS) Network ambient air quality monitoring reports for 2005 and 2006 (Environment Canada 2006), the following general observations can be made.

- The monitored concentrations of $PM_{2.5}$ at the Halifax monitoring station have generally been low, with the highest monthly average of 10 μg/m^3 reported in July;
- None of the monitored concentrations of CO exceeded the 1-hour or 8-hour objectives (34,600 μg/m^3 and 12, 700 μg/m^3 respectively) for carbon monoxide;
- None of the monitored concentrations of NO_2 exceeded the 1-hour or Annual objectives (400 μg/m^3 and 100 μg/m^3 respectively);
- None of the monitored concentrations of SO_2exceeded the 1-hour or 24-hour objectives (900 μg/m^3 and 300 μg/m^3 respectively); and
- The ground-level ozone monitoring results in 2005 and 2006 indicate that the 1-hour national ambient air quality objective of 82 ppb (161 μg/m^3) was achieved at all of the sites.

Given the rural nature of the Project, the low concentration of heavy industry in the region and the results of recent ambient air monitoring, the existing ambient air quality in the Assessment Area is generally expected to be good.

5.1.4.3 Sound Quality

Baseline Noise Monitoring

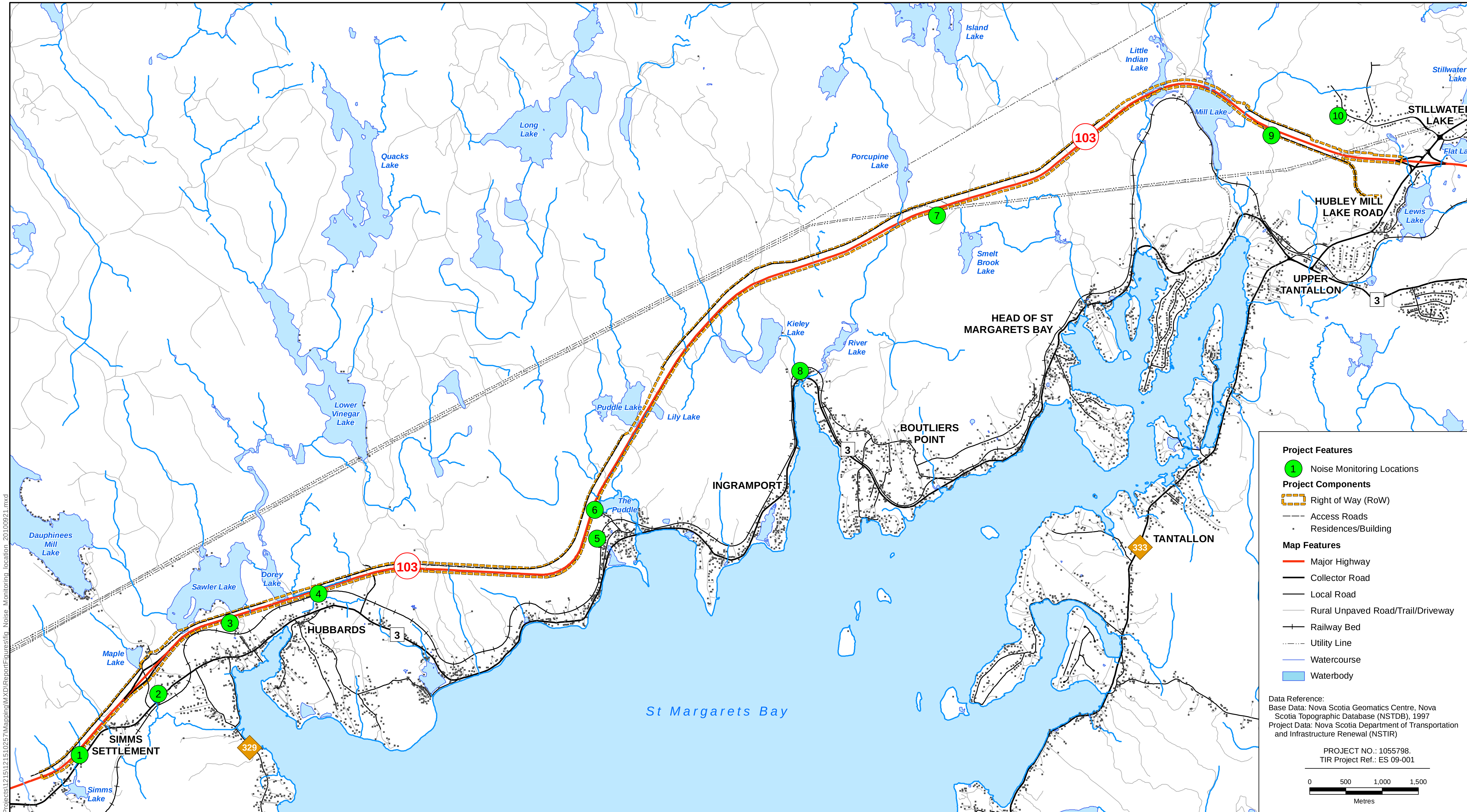
The sound quality in the Assessment Area is expected to be typical of rural and quiet residential areas. In order to characterize and confirm the sound quality in the Assessment Area, a baseline noise assessment was conducted. This baseline noise assessment consisted of measuring the sound pressure levels at noise receptor locations (*i.e.,* the nearest residential homes along the Project RoW), and comparing these to typical regulatory threshold values.

A description of land uses in the Assessment Area is provided in Section 6.1. The nearest residential receptor is located approximately 80 m from the proposed centreline. Aside from residential land uses there are no other noise sensitive receptors (*e.g.*, schools, hospitals, etc) along the proposed alignment. The nearest school (Shatford Memorial School) is located approximately 220 m south of the proposed RoW (south of existing eastbound lane of Highway 103 near Simms Settlement).

Ten noise receptor locations were selected based on their proximity to the RoW and they are considered representative of the greatest potential adverse environmental effects of the Project on sound quality. The geographic locations of the noise receptors are presented in Figure 5.1.1.

Ambient sound pressure level monitoring was conducted throughout the winter of 2009, using Type 1 integrating sound level meters (Larson Davis model 824). These instruments average the energy level of sound over a selected period of time and express this as L_{eq} in dB_A (A-weighted decibels). Equivalent sound pressure levels, L_{eq}, are the steady state sound levels that would produce the same amount of energy as the fluctuating sound actually occurring over a specific amount of time. Each measurement session comprised 1 minute L_{eq} readings and the monitoring was conducted over a 24-hour period at each noise receptor location to establish the variation over time for the ambient sound pressure levels. One-minute measurements were then used to calculate hourly L_{eq} values, which is the most common averaging period for the expression of L_{eq}. The collected data are representative of the existing conditions and include cumulative environmental effects due to contributions from traffic and any other substantive sources of noise at the baseline monitoring locations, including natural sources (*e.g.*, wind in trees, animals, *etc.*).

A summary of the 1-hour L_{eq} values for all ten monitoring locations is given in Table 5.4. Monitoring locations 1, 2, 3, and 6 were sampled from October 12-22, 2009 and 4, 7, and 9 were sampled on November 9-10, 2009. Site 5 was tested on December 8-9 while Sites 8 and 10 had to be remeasured on February 27-28, 2009 due to power failure of the sound meters while collecting the initial data set. Measurements that exceed the NSE Guideline are shown in bold.



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DATE: January 27, 2011	Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening	FIGURE NO.: 5.1.1
PREPARED BY: M. Huskins-Shupe		
NOVA SCOTIA Transportation and Infrastructure Renewal	**Atmospheric Study Map - Noise Monitoring Locations**	Stantec

Table 5.4 Baseline Noise Monitoring Hourly Summary for Each Noise Receptor Location

Time	Monitoring Location										NSE Guideline
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	
7:00	-	-	-	-	-	-	-	53.6	-	-	65
8:00	-	-	-	-	-	-	-	55.1	-	55.1	65
9:00	-	-	-	-	-	-	-	52.0	-	51.9	65
10:00	-	-	53.3	58.0	-	-	-	51.1	-	51.1	65
11:00	-	-	52.8	56.0	-	60.8	-	49.6	-	49.5	65
12:00	-	-	53.0	56.7	47.7	60.8	62.7	50.2	41.1	50.2	65
13:00	-	-	53.3	57.1	47.1	59.7	63.4	51.1	40.1	51.1	65
14:00	-	-	53.4	58.0	47.8	59.9	63.3	54.4	40.5	54.3	65
15:00	-	-	54.3	60.4	50.1	60.4	63.3	52.8	46.5	52.9	65
16:00	57.3	-	54.5	59.2	49.0	61.4	64.1	52.3	43.3	52.2	65
17:00	56	47.4	54.3	58.7	46.7	61.1	64.8	51.0	46.7	51.1	65
18:00	54.9	44.5	53.1	58.0	46.7	58.7	64.8	50.5	46.1	50.6	65
19:00	52.9	43.2	51.1	56.8	45.3	56.9	**63.1**	48.2	45.6	48.1	60
20:00	53.5	41.9	49.5	51.3	42.9	58.8	**62.2**	46.2	42.6	46.2	60
21:00	51.3	41.7	49.1	50.8	41.6	56.6	**61.3**	44.4	42	44.2	60
22:00	49.1	41.1	48.0	50.9	40.4	55.7	59.6	42.4	39.9	42.6	60
23:00	48.5	38.9	49.1	47.7	39.5	54.4	**58.1**	42.0	38	42	55
24:00	47.4	38.5	42.4	50.1	35.9	50.5	**56.9**	39.6	35.6	39.6	55
1:00	47.4	36.8	42.6	50.5	38.8	52.3	54.5	40.2	34.7	40.2	55
2:00	48.3	36.9	42.4	51.2	35.2	50.8	51.7	41.7	34	41.7	55
3:00	50.2	36.1	40.2	54.5	36.0	51.9	54.1	45.7	34.8	45.7	55
4:00	53	39.4	44.0	**58.2**	40.2	**55.3**	53.1	51.9	34.7	51.9	55
5:00	**57.2**	41.4	48.6	**57.7**	42.8	54.8	**57.7**	54.1	38.2	54.1	55
6:00	**57.8**	45.6	52.8	**57.8**	46.1	**60.1**	**59.9**	53.7	41	53.7	55
7:00	57.4	47.3	53.6	57.0	48.7	60.0	**65.1**	51.9	46	51.9	65
8:00	57.2	47.3	55.4	55.7	45.0	57.8	**65.3**	52.1	46.4	52.1	65
9:00	61.2	44.1	54.9	55.9	42.6	58.1	64.5	50.6	44.6	50.5	65
10:00	56.8	48.5	54.1	56.9	44.9	59.4	**65.1**	51.0	44.2	-	65
11:00	57.3	46.5	-	-	44.8	58.2	64.1	-	42.6	-	65
12:00	56.6	46.9	-	-	44.2	-	62.6	-	44.2	-	65
13:00	56.7	45.7	-	-	43.3	-	62.7	-	49.4	-	65
14:00	56.9	46.4	-	-	42.9	-	62.6	-	51.2	-	65
15:00	57.5	44.5	-	-	45.9	-	63.2	-	53.4	-	65

Baseline exceedances of NSE Guidelines are bolded.

Detailed results of the baseline noise monitoring study can be found in Appendix E.

Monitoring Sites 1, 4, 6, and 7 demonstrate effects of the existing highway. All of these locations exhibited sound pressure levels that are above the NSE Guidelines during all or at least some portion of the evening and night time periods (shown in bold in Table 5.4). The sound pressure levels logged for Sites 8 and 10 were close to the NSE Noise Guidelines over the full 24-hour sampling period, but did not exceed during the sampling period. Sites 2, 3, 5 and 9 were observed to be quieter sites and all fell within the Noise Guidelines for day, evening and night.

5.1.5 Potential Interactions, Issues and Concerns

This section evaluates the potential for Project-related activities to affect the atmospheric environment. Table 5.5 provides a summary of the potential environmental effects resulting from the Project-VEC interactions, which are discussed below.

Table 5.5 Project Activity – Environmental Effects Interaction Matrix for the Atmospheric Environment

Potential Interactions Between Project Activities, Including Other Projects and Environmental Effects Valued Environmental Component: ATMOSPHERIC ENVIRONMENT			
Project Activities and Physical Works†	Potential Environmental Effects		
	Change in Air Quality	Change in Sound Quality	GHG Emissions
Construction			
Site Preparation	✓	✓	✓
Roadbed Preparation	✓	✓	✓
Watercourse Crossing Structure Construction	✓	✓	✓
Surfacing and Finishing	✓	✓	✓
Operation and Maintenance			
Project Presence	✓	✓	✓
Infrastructure Maintenance	✓	✓	✓
Winter Maintenance	✓	✓	✓
Vegetation Management	✓	✓	✓
Other Projects and Activities			
Existing and Planned Linear Features	✓	✓	✓
Residential and Commercial Land Use	✓		✓
Recreational Land Use			
Industrial Land Use	✓	✓	✓
Resource Land Use	✓	✓	✓

† See Table 4.1 and Section 2.3 for list and details of specific activities and works.

5.1.5.1 Construction

Air Quality

During all construction activities, the operation of heavy equipment, such as earth movers, excavators, dump trucks and graders may potentially result in interactions between the Project and air quality. The potential exists for emissions of particulate matter (dust) during earth moving activities as well as the emission of greenhouse gases and combustion gases from construction equipment. Combustion gases may be released from heavy construction equipment (*e.g.,* trucks, front-end loaders, pavers, and other equipment) from the operation of internal combustion engines, which are typically diesel-fuelled.

Dust may be generated during construction from site preparation, sub-grade development, and construction of temporary ancillary elements. Grubbing operations generally create few dust problems since the exposed soil is usually moist, and the grubbed areas are seldom left exposed for extended periods. Handling of fill material, dumping, grading, compaction, pouring of footings and bridge/overpass piers, are potential sources of airborne dust that may affect air quality in the immediate vicinity of the Project.

Until the roadway is paved, the movement of construction vehicles on unpaved roadway sections, access roads, and construction/laydown areas may generate airborne dust, especially where these vehicles cross from the exposed area to a paved roadway. This type of dust is generally confined to the immediate vicinity of the Project site, and typically transported up to a distance of approximately 300 m from the point of origin.

Sound Quality

Sound quality may be affected by construction activities for the Project. Temporary and reversible changes in sound pressure levels could occur due to activities such as blasting, earth moving, and the operation of heavy equipment associated with site preparation, construction, roadbed preparation and the development of facilities.

GHG Emissions

The emissions of GHGs from heavy construction equipment (*e.g.,* trucks, front-end loaders, pavers, and other equipment) occurs from the operation of internal combustion engines, which are typically diesel-fuelled. The removal of carbon sequestered in soil and vegetation within the Assessment Area as part of Project may lead to small changes in the net balance of GHG in the local area.

5.1.5.2 Operation and Maintenance

Air Quality

Interactions between the Project and air quality during all phases of operation and maintenance may occur on a localized basis, primarily as a result of the emissions of combustion gases (including greenhouse gases) in the immediate vicinity of the Project. The Project is not intended to increase traffic in the area but rather to facilitate the movement of existing traffic. No additional interactions with air quality are expected from the Project presence, on an airshed basis.

During all maintenance activities, there will be operation of heavy equipment (possibly including paint striping equipment, vegetation control equipment, earthmovers, winter maintenance equipment and excavation and grading equipment). There is potential for environmental effects from dust generated due to some of the maintenance activities and from road salt application during winter, as well as the emissions of combustion gases, including some air contaminants from the equipment.

Sound Quality

Interactions between the operation and maintenance of the Project and sound quality may occur due to increased sound pressure levels from vehicle traffic and maintenance equipment on the Project route. The sound emissions from vehicle engines and tires on the road may be perceptible to occupants of nearby residences. Winter maintenance activities (such as snow plowing) and vegetation control activities may also create sound emissions. These maintenance activities are typically short-lived and infrequent in nature, while vehicle traffic associated with Project presence will persist in perpetuity.

GHG Emissions

Project presence is not expected to result in increased vehicle traffic but rather facilitate the movement of existing traffic. As such, no interactions with Global Climate Change are expected during operation.

During maintenance, there will be operation of mowing and vegetation control equipment, and heavy equipment (possibly including paint striping equipment, earthmovers, and excavation and grading equipment), that will release GHG emissions as the result of the combustion of fossil fuels.

It is also worth noting that the long-term vehicular emissions associated with the Project should decrease as technology is likely to continue to improve with respect to reduced GHG emissions. Emissions are therefore likely to improve over time. Furthermore, the smoother flow of the traffic with the increased highway capacity, and therefore less gear shifting, will cater to reduction of vehicle related GHG emissions.

5.1.6 Other Projects and Activities

Existing and Planned Linear Features

Existing linear features have associated air contaminant emissions and can increase sound pressure levels at nearby residences through vehicle use. The most obvious linear feature to interact cumulatively with the proposed Project is the existing Highway 103 lanes which will become eastbound lanes when the new westbound lanes are constructed. Nearby residences are already subjected to existing highway traffic noise although the cumulative effect of adding two additional lanes is not predicted to be significant since the overall volume of traffic is not expected to increase as a result of the twinning. Existing trails (informal and formal) through the area also generate intermittent noise and dust when used by all-terrain vehicles. It is possible that these existing emissions could interact cumulatively and cause adverse effects on sound levels and local air quality, particularly for residents living in close vicinity to both existing and planned linear features.

Industrial and Resource Land Use

A large envelope of resource land within HRM Planning District is owned by Bowater Mersey Paper Co Ltd, over 20,234 ha, where they operate a logging camp on these holdings at Sawler Lake. Interhabs, a modular home manufacturer, has a small production facility located south of the Project Area. The location is not a large scale facility, employing 30, and is sheltered in a forested area. These two resource based activities are not anticipated to contribute to any potential adverse effects on the Project primarily due to their small scale and proximity to Project.

In addition to forestry resources, the study area has numerous gravel pits along the existing Highway 103. Gravel pit operation can result in the generation of noise and air emissions that can interact cumulatively with the Project. However, it appears that the majority of the gravel pits in the area are currently inactive with only one active pit located north of the proposed RoW east of Porcupine Lake.

Furthermore, Nova Scotia Power operates a hydroelectric plant in the assessment area, at Mill Lake. This plant is not expected to contribute to measureable air or noise emissions that could potentially interact cumulatively with the Project.

5.1.7 Environmental Effects Assessment

This section provides an evaluation of key potential Project-VEC interactions as summarized in the environmental effects assessment matrix (Table 5.6).

Table 5.6 Environmental Effects Assessment Matrix for the Atmospheric Environment

Environmental Effects Assessment Matrix Valued Environmental Component: ATMOSPHERIC ENVIRONMENT							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** **(A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Construction							
Site Preparation Road Preparation	• Change in air quality (A)	• Follow Generic EPP (Section 3.12) • Apply dust suppressants where feasible • Follow equipment maintenance schedules • Preserve natural vegetation where possible • Minimize activities that generate large quantities of dust during high winds	2	3	2/1	R	2
	• Change in sound quality (A)	• Follow Generic EPP (Section 3.13) including notification, muffling devices, machines in good working order, minimization of idling, and timing restrictions	2	3	2/1	R	2
	• Change in GHG emissions (A)	• Environmental awareness session to include vehicle idling • Follow equipment maintenance schedules	2	n/a	3/2	R	2
Watercourse Crossing Structure Construction	• Change in air quality (A)	• Follow Generic EPP (Section 3.12) and applicable guidelines and regulations • Apply dust suppressants where feasible • Follow equipment maintenance schedules • Minimize activities that generate dust during high winds	2	2	2/2	R	2
	• Change in sound quality (A)	• Follow Generic EPP (Section 3.13) including notification, muffling devices, machines in good working order, minimization of idling, and timing restrictions	2	2	2/2	R	2
	• GHG emissions (A)	• Environmental awareness session to include vehicle idling • Follow equipment maintenance schedules	2	n/a	2/2	R	2
Surfacing and Finishing	• Change in air quality (A)	• Follow Generic EPP (Section 3.12) and applicable guidelines and regulations • Apply dust suppressants where feasible • Follow equipment maintenance schedules • Minimize activities that generate dust during high winds	1	2	2/2	R	2

Table 5.6 Environmental Effects Assessment Matrix for the Atmospheric Environment

Environmental Effects Assessment Matrix Valued Environmental Component: ATMOSPHERIC ENVIRONMENT							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
	• Change in sound quality (A)	• Follow Generic EPP (Section 3.13) including notification, muffling devices, machines in good working order, minimization of idling, and timing restrictions	1	2	2/2	R	2
	• GHG emissions (A)	• Environmental awareness session to include vehicle idling • Follow equipment maintenance schedules	1	n/a	2/2	R	2
Operation and Maintenance							
Project Presence	• Change in air quality (P) • Change in sound quality (A) • Change in GHG emissions (A)	• No mitigation recommended	1	3	5/6	R	2
Infrastructure Maintenance	• Change in air quality (A)	• Follow Generic EPP (Section 3.12) and applicable guidelines and regulations	1	1	2/1	R	2
	• Change in sound quality (A)	• Use noise controls where possible (*e.g.*, mufflers)	1	2	2/1	R	2
	• GHG emissions (A)	• Follow equipment maintenance schedules	1	n/a	2/1	R	2
Winter Maintenance	• Change in air quality (A)	• Follow Generic EPP (Section 3.12) and applicable guidelines and regulations • Follow equipment maintenance schedules	1	3	2/2	R	2
	• Change in sound quality (A)	• Use noise controls where possible (*e.g.*, mufflers)	1	3	2/2	R	2
	• GHG emissions (A)	• Follow equipment maintenance schedules	1	n/a	2/2	R	2
Vegetation Management	• Change in air quality (A)	• Follow Generic EPP (Section 3.12) and applicable guidelines and regulations • Follow equipment maintenance schedules	1	3	1/1	R	2

Table 5.6 Environmental Effects Assessment Matrix for the Atmospheric Environment

Environmental Effects Assessment Matrix Valued Environmental Component: ATMOSPHERIC ENVIRONMENT								
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
	• Change in sound quality (A)	• Use noise controls where possible (*e.g.,* mufflers)	1	3	1/1	R	2
	• GHG emissions (A)	• Follow equipment maintenance schedules	2	n/a	1/1	R	2

Key

Magnitude:
1= Low: *e.g.,* within normal variability of baseline conditions
2 = Medium: *e.g.,* increase/decrease with regard to baseline but within regulatory limits and objectives
3 = High: *e.g.,* singly or as a substantial contribution in combination with other sources causing exceedances or impingement upon limits and objectives beyond the Project boundary

Geographic Extent:
1 = <1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101 - 1,000 km^2
5 = 1,001 - 10,000 km^2
6 = >10,000 km^2

Duration:
1 = <1 month
2 = 1 - 12 months
3 = 13 - 36 months
4 = 37 - 72 months
5 = >72 months

Frequency:
1 = <11 events/year
2 = 11 - 50 events/year
3 = 51 - 100 events/year
4 = 101 – 200 events/year
5 = >200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not Applicable
(A) = adverse
(P) = positive

5.1.7.1 Construction

Air Quality

Air quality may be affected during construction due to emissions associated with heavy equipment operation.

Dust will primarily be generated during construction from site preparation and sub-grade development activities, such as clearing, grubbing, grading and leveling. The grubbing operations as part of the Project should result in relatively few dust events since the exposed soil is expected to be moist, and the grubbed areas are not expected to be left exposed for extended periods. The handling of fill material, dumping, grading and compaction are potential sources of airborne dust that may affect nearby receptors. Until the roadway and crossing structure decks are paved, the movement of construction vehicles on unpaved roadway sections, access roads, and construction/laydown areas may generate airborne dust (suspended particulate matter), especially where these vehicles cross from the exposed area to a paved roadway.

All dust is expected to be generally confined to the immediate vicinity of the construction activity, and could typically be transported up to a distance of approximately 300 m from the point of origin. Dust emissions are expected to be short-lived, and will be minimized by following the Generic EPP (Section 3.12). Among the mitigation suggested in these documents are dust suppression measures, such as the application of water during periods of heavy activity and/or during dry or windy periods to minimize the generation and transport of airborne dust.

The emissions of combustion gases from heavy construction equipment (*e.g.,* trucks, front-end loaders, pavers, and other equipment) will occur from the operation of internal combustion engines, which are typically diesel-fuelled.

Table 5.7 summarizes the emissions estimates associated with typical construction equipment (*e.g.,* pavers, rollers, trucks, asphalt plant) to be used during Project construction, taking into account the scope of the construction activities.

Table 5.7 Total Estimated Construction Emission Estimates for the Project

Emissions	Project Construction Totals (tonnes)	2007 Nova Scotia Totals (tonnes)
TPM	1.92	366,671
PM10	0.73	100,121
$PM_{2.5}$	0.53	27,029
SOx	3.9	136.921
NO_x	10.1	77,666
CO	18.2	239,075
VOC	0.32	277,487
PAH	0.32	NA
GHGs (CO_2eq)	1894.03	20,723,000*

Sources: Environment Canada 2007; US EPA 2002; US EPA 2004; *GHG Reporting Program

Emission factors and methodologies published by the US EPA for non-road diesel vehicles (US EPA 2002) were used to estimate the emissions of selected air contaminants from the paving portion of the construction phase. Since most vehicles used during construction are powered with heavy-duty diesel engines with approximately similar engine displacements, it was assumed that the proportion of heavy-duty vehicles per km of highway construction would remain constant for all phases of construction. Total emissions for Nova Scotia (2007) are included as a point of reference.

Emissions associated with asphalt plant operations, including emissions of PAHs, were estimated using published emission factors (US EPA 2004) and assuming an asphalt tonnage requirement of 3,500 tonnes/km of two-lane highway, with a total highway length of approximately 22 km.

The number and distribution of heavy equipment during typical construction practices are not expected to result in substantive emissions to the local air shed and would not influence ambient air quality during most atmospheric conditions. The use of properly maintained vehicles and equipment during construction and adherence to the Generic EPP (Section 3.12) will minimize vehicle emissions, such that adverse environmental effects to ambient air quality are unlikely. The magnitude, frequency and duration of the construction activities are such that the applicable ambient air quality standards and objectives are unlikely to be exceeded.

Based on consideration of the potential environmental effects of the Project-related activities during construction, the proposed mitigation, and the residual environmental effects rating criteria, the residual environmental effects of construction of the Project on air quality are not likely to be significant.

Sound Quality

Highway construction vehicles will cause sound pressure levels along the road, within approximately 50 m, to approach 85 dB_A during peak passes, and levels of 60 to 70 dB_A averaged over each active working hour. These levels will decrease with distance, such that the sounds are approximately at background levels in a distance of 1 to 2 km, and likely not to be perceptible at 5 km. Certain equipment may exceed these levels, but it would be anticipated that this is very rare.

To reduce the sound pressure levels at the nearest residents to below the threshold of significance, a combination of mitigative measures will be employed, as described in the Generic EPP (Section 3.13) including notification of construction activities to landowners; use of muffling devices on equipment; keeping machines in good working order (*i.e.*, regularly maintained); minimization of idling; and time of day working restrictions.

To reduce the potential environmental effect of the sound pressure levels on human receptors, NSTIR will ensure that nearby residents are notified in advance of upcoming activities and will be provided contact information to use in the event that a resident wants to file a noise complaint. Any complaints received will be investigated promptly and addressed as required. After mitigation is applied the sound pressure levels during construction may still occasionally exceed 65 $dB_{A;}$ however, any exceedances are not likely to be frequent at any one residence (*e.g.,* less than 12 days per year).

Blasting may be required as part of the construction activities and could produce elevated sound pressure levels at the nearest residences, on a very short term and intermittent basis. Because the noise from blasting is very short lived (*i.e.,* almost instantaneous), it will only affect any given noise receptor for a brief period. Also, blasting will be conducted in accordance with the Generic EPP, as well as other applicable guidelines.

Occasional noise sources, such as the dumping of rock, may be louder than the working machinery (*e.g.,* tailgate slamming during dumping). However, these high sound levels attenuate quickly due to their impulsive nature (*i.e.,* short duration).

In general, mitigation measures may not bring levels to within the guidelines at all times, however, actual levels are expected to be lower than the maximum predicted most of the time, as construction activities will be moving locations and will not always be at the nearest point to any particular sensitive receptor. Therefore, the sound pressure levels are not expected to exceed the NSE Noise Guidelines over a sustained period or on a frequent basis.

Based on consideration of the potential environmental effects of the Project-related activities during construction, the proposed mitigation, and the residual environmental effects rating criteria, the residual environmental effects of construction of the Project on sound quality are not likely to be significant.

GHG Emissions

The removal of carbon sequestration sinks such as forested areas during construction may also lead to changes in the net balance of stored carbon in the local area. Carbon sequestration is usually presented in terms of the tonnes of carbon stored per year in a given forested area. Carbon is incorporated into the physical structure of trees and plants through photosynthesis, which removes CO_2 from the air. An estimation of the reduced carbon sequestration within the Assessment Area was completed based on the forested areas removed and their respective carbon sequestration potentials using methodologies developed by the United States Energy Information Administration (US EIA 2000) and Environment Canada (Gray 1995).

The estimated loss in carbon sequestration potential as a result of the Project is presented in Table 5.8.

Table 5.8 Estimated Loss of Carbon Sequestration due to the Project

Loss in Area of Carbon Sequestration Sources Resulting from Project (Hectares)	Loss of Carbon Sequestration in Assessment Area (tonnes CO_2/year)	Estimated Provincial Greenhouse Gas Emissions for 2008[1] (tonnes CO_2-equivalent/year)
122.9	826	20,889,000

[1]Environment Canada 2009. Greenhouse Gas Emission Summary. http://www.ec.gc.ca/ges-ghg/83A34A7A-DC0F-49FE-A9F7-5F331A7B4224/1990 to 2008 Summary.xls

It should be noted that carbon sink calculations were limited to forested areas or areas with general tree cover, due to the lack of standardized procedures for determining carbon sequestration by other sinks, such as water bodies. The area of forest or tree cover removed was determined using habitat type classification based on NSDNR land cover data (refer to Figures 5.4.1a-e and Table 5.50) assuming that a 170 m corridor will be cleared for the wide median twinning and 50 m corridor will be cleared for the narrow median twinning.

As shown in Table 5.8, the carbon sequestration lost due to the deforestation required for Project construction is negligible when compared to GHG emissions in the province. In addition, this loss could be partially offset by GHG emission reductions from improvements in vehicle traffic flow as a result of operation.

Employing a recognized standard for GHG analysis, the Project was reviewed against the Climate Change General Guidance document (CEA agency 2003) for potential GHG emissions and atmospheric impacts. In accordance to the guidelines the following steps were considered.

Step 1 from the document was to set the scope of the environmental assessment for GHGs. Using Annex A of the Climate Change Guidance Document, the Project was determined to have the following characteristics:

- Minimal loss of carbon sinks;
- Temporary source of elevated emissions during construction;
- No project-related emissions during operation due to change in traffic patterns; and
- Temporary and minimal GHG emissions during maintenance.

Step 2 was to consider regulatory/policy and to place the Project within typical industry profiles in relation to provincial and national inventories. The overall GHG emissions anticipated during construction are presented in Table 5.8. The emissions estimates are based on industry standards and US EPA methods.

Step 3 was to assess the environmental effects of the GHG emissions. In consideration of the emission levels, and the attributes identified from Annex A above, the Project was classified as having low emissions. If followed that the appropriate measures to manage the GHG considerations for the Project were to minimize the GHGs emitted during construction by following standard best practices, including regular vehicle maintenance to ensure that emissions controls are functioning properly. Although NSTIR has not formally adopted an Idling Policy at this time, construction vehicle idling will be discussed in an environmental awareness session with the contractor/developer.

Steps 4 and 5 (management and monitoring/follow-up), are only required for Projects with medium or high emissions and therefore were not required for this Project.

5.1.7.2 Operation and Maintenance

Air Quality

Air quality will be affected during operation due to air emissions from vehicle traffic and maintenance equipment including combustion gases and particulate matter. However, the Project will not cause an increase in vehicle traffic in the Assessment Area (and resulting air emissions), but rather is intended to facilitate existing traffic volumes and improve safety.

The magnitude, frequency and duration of the maintenance activities are such that related emissions are very unlikely to result in an exceedance of applicable ambient air quality standards or objectives within the Assessment Area. The use of properly maintained vehicles and equipment, and adherence to the EPP will help to mitigate any potential emissions from maintenance equipment during the operation and maintenance phase.

Based on consideration of the potential environmental effects of the individual activities required for the operation and maintenance phase of the Project, the proposed mitigation, and the residual environmental effects rating criteria, there are not likely to be any significant adverse residual effects on air quality from operation and maintenance of the Project.

Sound Quality

Motor vehicle and maintenance equipment traffic on the twinned highway may result in some environmental effects on sound quality at nearby receivers, as the sound from vehicle engines and tires on the road may be perceptible to occupants of nearby residences.

The Federal Highway Administration Traffic Noise Model can be used to predict sound pressure levels at nearby receivers due to existing traffic volumes in the area. The model predictions for traffic levels at varying distances from the highway, based on the FHWA model predictions for the Project, are presented in Table 5.9.

Table 5.9 Summary of Results from the Traffic Noise Model

Receiver Location - Distance from Center of Highway (m)	Predicted Worst Case 1-hour L_{eq} (dB_A)
10	72
20	66
40	61
50	59
75	56
100	53
150	50
200	47
250	45
300	44

The traffic noise model assumed a traffic volume of 9,800 vehicles per day. The predicted worse case scenario assumed 10% of the daily traffic in any given hour.

At approximately 40 m from the centerline of the highway, based on existing traffic volumes, sound pressure levels are below the NSE Noise Guidelines, for the daytime period, of 65 dB_A. Currently all residential dwellings are at distances greater than 40 m from the centerline of the existing highway. With increasing distance from the centerline of the highway sound pressure levels continue decrease. It should be noted that while the Project is predominately straight and has several hills, the deviation from the ideal model of a straight and consistent elevation highway produces anomalies. Hill climbing, especially in transport trucks, often results in downshifting, which equates to an increase in engine speed and therefore exhaust noise; potential for similar case occurs during preparation for a curve in the road. In these special case areas, the potential for Project noise exceedance is increased.

Infrastructure maintenance activities will typically be restricted to daylight hours, and will be of relatively short duration. Events of elevated sound pressure due to maintenance activities are not expected to affect any one receiver for a prolonged period of time or during nighttime hours. Adherence to the EPP, including the use of mufflers when appropriate on maintenance equipment and following regular maintenance schedules, will help to mitigate the effects of maintenance activities on sound quality in the Assessment Area.

Based on consideration of the potential environmental effects of the individual activities required for the operation and maintenance phase of the Project, the proposed mitigation, and the residual environmental effects rating criteria, there are not likely to be any significant adverse residual effects on sound quality as a result of Project operation and maintenance activities.

GHG Emissions

Project presence is not expected to result in increased vehicle traffic but rather facilitate the movement of existing traffic. As such, negligible interactions with Global Climate Change are expected during operation.

GHG emissions during maintenance will be temporary, short in duration, and small in magnitude. GHG considerations during maintenance will be managed as described for the construction phase in Section 5.1.5.

5.1.7.3 Assessment of Cumulative Environmental Effects

Other projects and activities presently in operation or planned for the immediate future, may result in interactions with air quality and sound quality. These other projects and activities, alone or in combination with the Project, may contribute to cumulative environmental effects in the Assessment Area. The potential cumulative environmental effects in the Assessment Area are primarily related to the air contaminant emissions of other existing or planned projects and activities, and the sound pressure levels due to existing and planned projects and activities in the area as well as the sound pressure levels due to existing vehicle traffic. Cumulative effects on the Atmospheric Environment are evaluated below.

Air Quality

Air contaminant emissions from the existing Highway 103 in combination with air contaminant emissions from the operation of the twinning Project are not expected to result in a noticeable increase in emissions in the Assessment Area, as existing traffic flow will just be facilitated and there will be no noticeable increase in overall traffic volumes through the Assessment Area. Air emissions from ATV traffic along nearby trails is expected to be negligible and therefore not likely to have a cumulative adverse effect on air quality.

Air contaminant and fugitive dust emissions from Bowater Mersey and Interhabs‟ operations near the Assessment Area are expected to be minor and are not thought to contribute noticeably to ambient air contaminant concentrations. Similarly, the single operational gravel pit is also considered to only contribute minimal air contaminants to the present ambient air quality.

Overall, in consideration of existing information, the cumulative environmental effects of the Project, in combination with other activities in the Assessment Area, with respect to air quality are not expected to be significant.

Sound Quality

The sound pressure levels associated with the Project cumulatively with existing linear features is expected to result in only slight changes in sound pressure levels to noise receptors in the Assessment Area as there will be no increases in vehicle traffic. ATV traffic noise will be intermittent and is not expected to occur in close vicinity of sensitive receptors therefore the cumulative effect of noise is anticipated to be negligible.

Due to the limited industrial land use in the area, there is not anticipated to be any cumulative adverse effects on sound quality for receptors in the Assessment Area.

Overall, in consideration of existing information, the cumulative environmental effects of the Project, in combination with projects in the Assessment Area, with respect to sound quality are not expected to be significant.

5.1.8 Determination of Significance

Table 5.10 evaluates the significance of potential residual environmental effects on the Atmospheric Environment resulting from any interactions with Project activities after taking into account any proposed mitigation. The table also considers the level of confidence of the Study Team in this determination.

In summary, adverse residual environmental effects on the atmospheric environment during Project Construction and Operation are not predicted to be significant.

Table 5.10 Residual Environmental Effects Summary Matrix for Atmospheric Environment

Residual Environmental Effects Summary Matrix Valued Environmental Component: ATMOSPHERIC ENVIRONMENT				
Phase	Residual Environmental Effects Rating, Including Cumulative Environmental Effects*	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Construction	NS	3	N/A	N/A
Operation and Maintenance	NS	3	N/A	N/A
Project Overall	NS	3	N/A	N/A
Key Residual Environmental Effect Rating:	Probability of Occurrence: based on professional judgment 1 = Low Probability of Occurrence 2 = Medium Probability of Occurrence			

Table 5.10 Residual Environmental Effects Summary Matrix for Atmospheric Environment

Residual Environmental Effects Summary Matrix Valued Environmental Component: ATMOSPHERIC ENVIRONMENT				
Phase	Residual Environmental Effects Rating, Including Cumulative Environmental Effects*	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty

S = Significant Adverse Environmental Effect NS = Not-significant Adverse Environmental Effect P = Positive Environmental Effect Level of Confidence 1 = Low Level of Confidence 2 = Medium Level of Confidence 3 = High Level of Confidence	3 = High Probability of Occurrence N/A= Not Applicable Scientific Certainty: based on scientific information and statistical analysis or professional judgment 1 = Low Level of Confidence 2 = Medium Level of Confidence 3 = High Level of Confidence N/A= Not Applicable

*As determined in consideration of established residual environmental effects rating criteria.

5.1.9 Follow-up and Monitoring

Measurable environmental effects to the Atmospheric Environment from dust and increased sound pressure levels will likely be localized to the specific areas within which the activities are taking place during construction and operation and maintenance. Provided the recommended mitigative actions are taken, additional monitoring of ambient air quality or sound pressure levels is not warranted.

Should complaints of excessive noise or airborne dust be received, the root causes of these complaints will be determined by NSTIR, and corrective action will be taken if warranted. Should it be determined to be necessary to identify the source or extent of such problems, ambient monitoring of dust or noise will be conducted as deemed appropriate.

5.2 Groundwater Resources

5.2.1 Rationale for Selection as Valued Environmental Component

Groundwater resources are included as a VEC because they provide potable water supply to approximately half of the total population of Nova Scotia, and to all of the un-serviced residences adjacent to the proposed highway corridor. The potential for the disruption or contamination of the groundwater drinking supply for nearby residents therefore requires assessment. Furthermore, groundwater is an integral component of the hydrologic cycle that can interact with and indirectly affect fresh water resources, fresh water ecosystems and estuarine ecosystems at points of discharge.

Groundwater originates from percolation of rain, snowmelt, or surface water into the ground. This infiltrating water fills voids between individual grains in unconsolidated materials and fills fractures developed in consolidated materials. The upper surface of the saturated zone is called the water table. The water table intersects the surface at springs, lakes and streams where interaction between the groundwater and the surface water environment can occur.

There is a dynamic interaction between groundwater resources and surface water resources in Nova Scotia. Groundwater flows through soil and bedrock from areas of high elevation (recharge areas) to areas of low elevation (discharge areas) where it exits the sub-surface as springs, streams, and lakes. Groundwater generally sustains the base flow of springs, streams and wetlands during dry periods of the year. More rarely, surface water bodies can contribute to groundwater storage under specific hydrogeological conditions.

Yield to dug or drilled wells can vary greatly, depending on the hydraulic properties of overburden or bedrock aquifers. An aquifer is a formation or group of formations that can store or yield useable volumes of groundwater to wells or springs. Natural groundwater quality is directly influenced by the geochemical composition of the aquifer materials through which it passes, and the time the water resides within that material.

5.2.2 Environmental Assessment Boundaries

5.2.2.1 Spatial

Spatial boundaries for the assessment of groundwater resources are based on a combination of topography, aquifer hydraulic properties, expected groundwater flow directions, and the distance to residential supply wells that may be affected by the highway twinning activities.

Potential effects to water quality, including road salt effects, temporary siltation, and water table lowering are considered for all wells located hydraulically down-gradient of the Project construction activities. While the shallow groundwater can exhibit natural acidity (very low alkalinity and pH), acidic rock drainage (ARD) caused by presence of disseminated sulfide mineralization is not considered to be an issue in the granite terrain. The extent of the area potentially affected is dependent on surface drainage and surficial geology, and can generally extend 200 m in sand and gravel, and up to 50 m in glacial till.

Vibration damage to a drilled or dug well is generally a function of distance between the energy source and the well, and seismic properties of the aquifer materials. With respect to rock type, risk is greater for fractured crystalline bedrock than for overburden wells or sandstone wells. Based on experience, the risk from blasting or major excavation is considered to be greatest within 50 m, moderate from 50 to 200 m, and expected to be minimal beyond about 200 m. The magnitude and extent of the blasting activities required for this Project is currently unknown.

A 600 m groundwater assessment boundary (*i.e.*, 300 m on each side of the highway centerline) is considered to be conservative.

5.2.2.2 Temporal

With respect to temporal boundaries, most physical and chemical effects on groundwater resources are likely to be temporary and to occur during the construction phase. However, if a deep road cut is necessary, a permanent drop in elevation of the local groundwater table in the vicinity of the road cut could occur. Residual effects from road de-icing materials could occur throughout the operation phase of the Project.

5.2.2.3 Administrative and Technical

Administrative boundaries for groundwater resources include relevant water quality guidelines such as the Guidelines for Canadian Drinking Water Quality (Health Canada 2008).

A technical limitation for this assessment is that a well water inventory was not undertaken for this study. This preliminary assessment identifies areas of potential concern (*i.e.*, areas likely containing potable wells); a residential well water survey will be conducted within 300 m of the centerline of the new lanes prior to construction.

5.2.3 Residual Environmental Effects Rating Criteria

A **significant adverse residual environmental effect** on groundwater resources is defined as one in which the Project causes one or more of the following:

- Yield from an otherwise adequate well supply decreases to the point where it is inadequate for intended use;
- The quality of groundwater from an otherwise adequate well supply that meet guidelines deteriorates to the point where it becomes non-potable or cannot meet the guidelines for Canadian drinking water quality (Health Canada 2006); and/or
- The aquifer is physically or chemically altered to the extent that interaction with local surface water results in stream flow or chemistry changes that adversely affect aquatic life or surface water supply.

5.2.4 Baseline Conditions

An assessment of the hydrogeological features of the Project alignment was performed using previously published mapping, hydrogeologic reports, aerial photos, and the NSE pumping test inventory. No field reconnaissance was completed as part of this analysis.

Topography and Drainage

The Project alignment generally follows the current Highway 103 alignment at elevations ranging from near sea level at The Puddle / Stillwater Brook (near chainage14+250 m) to approximately 100 m above sea level (asl) near the eastern end of the alignment, at Tantallon. The elevation is approximately 50 m asl near the western end of the alignment, around Simms Settlement.

The study area is located entirely within the Chester Ecodistrict of the Southwest Nova Scotia Uplands Ecoregion, which is characterized by rugged and rolling topography surrounding St. Margaret‟s Bay and the Aspotogan Peninsula. The Chester Ecodistrict slopes along the Atlantic Peneplain (Roland 1982) in a south to southeasterly direction towards the Atlantic Ocean (slopes typically range from 9 to 15%) and has a mean elevation of 92 m asl, with ridges and low rounded hills rising less than 20 m above the average level, and an approximate maximum elevation of less than 200 m asl (Webb and Marshall 1999). Many of the local hills are classified as glacial till drumlins, comprised of thick deposits of sand and silt overlying the granite bedrock. Drainage is slow, with flow intercepted by many rivers, streams, bogs, and swamps (Webb and Marshall 1999). The tidal influence on St. Margaret‟s Bay at Boutilier‟s Point has a range of 5.7 m with a mean high tide of 2.8 m (RV Anderson 2010a).

Surficial Geology

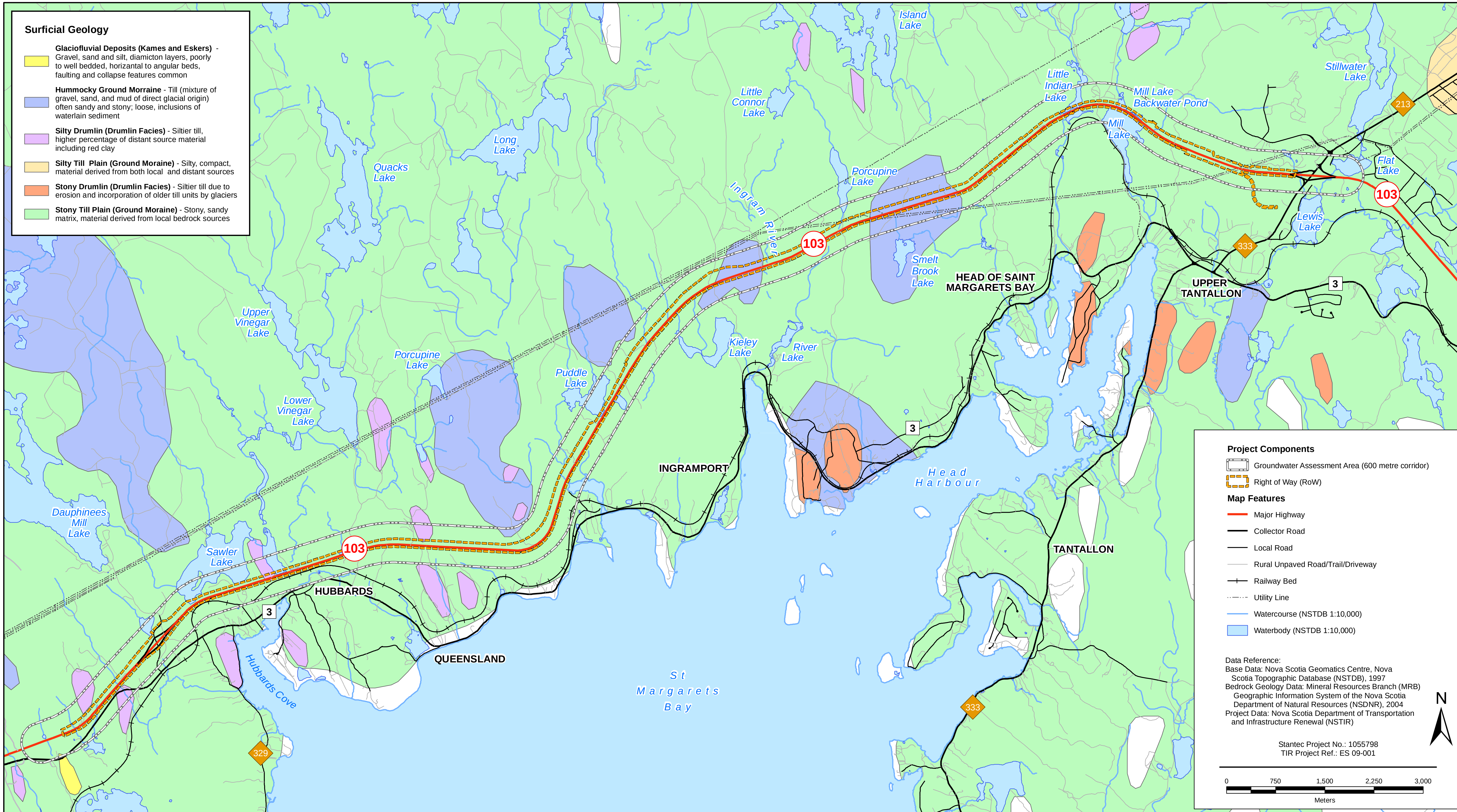
A review of the Nova Scotia Soil Survey (MacDougall *et al.* 1963) indicates that the soils along the Study Area and surrounding lands are primarily comprised of well-drained brown sandy loams of the Gibraltar Series, derived from granite. Bogs (Fibrisols), fens (Mesisols), and forested swamps (Mesisols and Humisols) are associated with poorly drained soils and slowly flowing streams in the area (Webb and Marshall 1999).

Figure 5.2.1 illustrates the surficial geology along the RoW (after Stea 1980 and Stea, Conley and Brown 1992). With the exception of a few isolated sections of hummocky ground moraine and silty drumlin hills, the entire RoW is underlain by stony glacial till ground moraine, locally described as moderately permeable silty sand to sand with a stony, sandy matrix, that is derived from the underlying granite bedrock (*e.g.*, granite till). Based on the local well drilling logs (Table 5.12), this material varies in thickness from essentially nil in areas of thin overburden or exposed bedrock to 56 m on drumlin hills, with a median depth of 4 m along the RoW. Exceptionally thick deposits are noted along the Head of St. Margaret‟s Bay and Station Road areas that may be associated with drumlins, kame deposits along the south flank of the uplands, or buried bedrock erosion channels. A few glacial drumlins comprised of siltier materials derived from softer rock types located farther afield are present in the vicinity of the southwest end of the RoW. It is suspected, but not confirmed, that many of the local hills are drumlins. Some road cuts would be expected when drumlins are encountered.

Bedrock Geology

A review of the Geological Map of the Province of Nova Scotia (Map ME 2000-1, NSDNR 2000) indicates that the bedrock in the Project Area is granitic rock of the Liscomb Complex, with which acid rock drainage or Karst topography are not generally associated.

Figure 5.2.2 illustrates the bedrock geology underlying the RoW. The entire RoW is underlain by Devonian-aged granite of the Liscomb complex, locally subdivided based on the relative proportions of mafic minerals into: light to medium gray biotite monzo-granite (medium to coarse grained, megacrystic granite), buff to pink fine-grained variable porphyritic and equigranular leucogranite with minor pegmatite and light colored, fine grained leucogranite. The biotite monzogranite dominates the bedrock lithology (MacDonald 1994).



DATE: September 2010

PREPARED BY: M. Huskins-Shupe

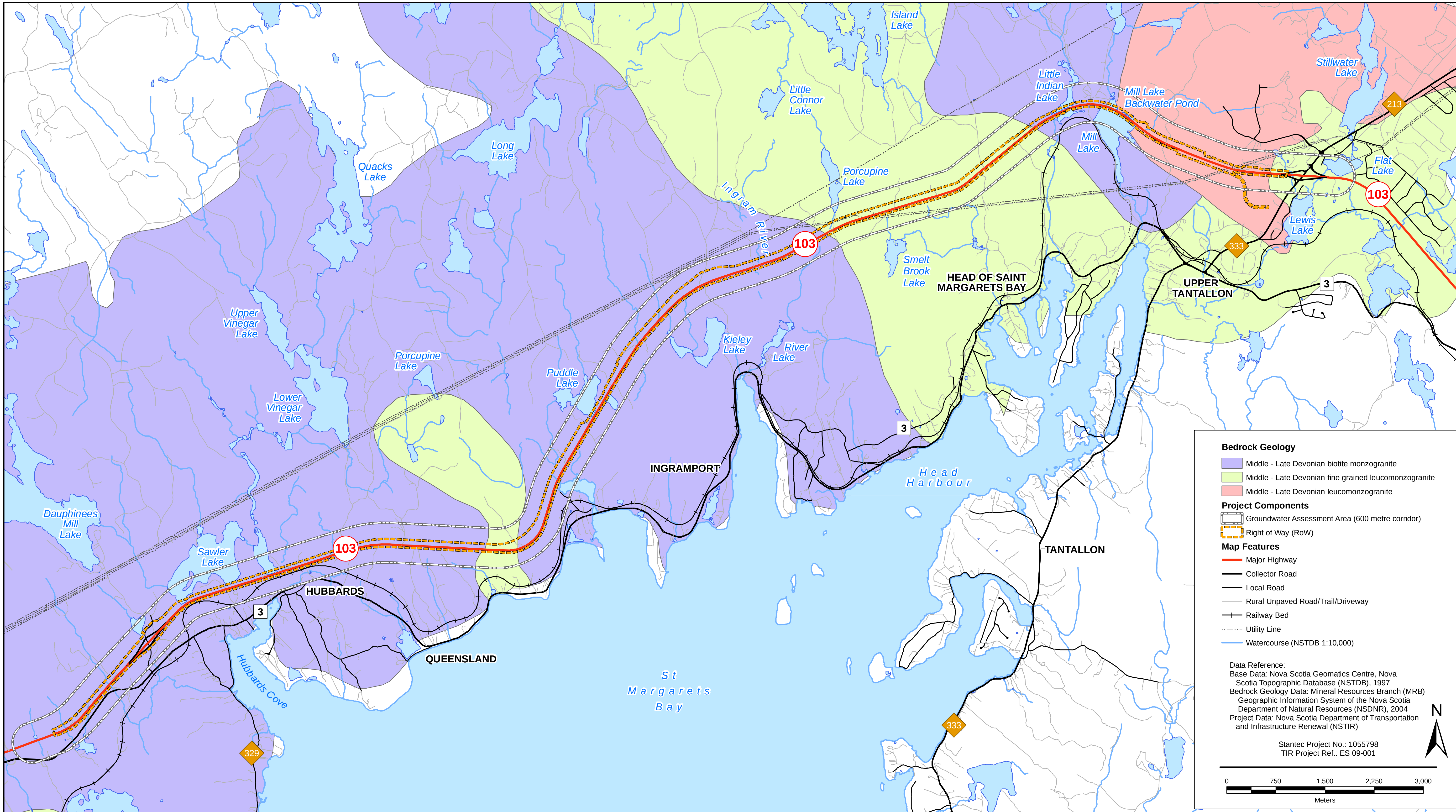
NOVA SCOTIA Transportation and Infrastructure Renewal

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Surficial Geology

FIGURE NO.: 5.2.1

Stantec



DATE: September 2010	Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening	FIGURE NO.: 5.2.2
PREPARED BY: M. Huskins-Shupe	**Bedrock Geology**	
NOVA SCOTIA Transportation and Infrastructure Renewal		Stantec

Hydrogeology

To provide a general description of aquifer properties in the vicinity of the proposed Highway 103 Twinning Project area, a summary of pumping tests performed on drilled wells completed in granite bedrock within Halifax County is included in Table 5.11. A summary of the nearest well drillers logs to the RoW is provided in Table 5.12. Although it cannot be confirmed whether any of these domestic wells are located within the 600 m groundwater Assessment Area for the Project, the aquifer and well construction conditions described herein should be reasonably indicative of the likely overburden and bedrock conditions within the Assessment Area.

Table 5.11 Summary of Hydraulic Testing Data – Granite Aquifer, Halifax County NS

	Well Depth (m)	Casing Length (m)	Water Depth (m)	Transmissivity (m^2/d)	Specific Capacity ($m^3/d/m$)	Safe Yield (igpm)
Minimum	22.3	3.1	0.5	0.1	0.2	0.2
Maximum	131.1	38.3	37.3	24.1	57.6	148.0
Mean	68.5	10.9	8.0	2.4	5.1	10.0
Geomean	63.1	8.7	4.9	1.1	2.2	4.1
Median	64.4	6.7	5.8	1.2	1.7	4.3
STD	26.9	9.1	8.4	4.1	9.8	23.5
N	40	26	40	40	39	40

Source: NSE Pumping Test Inventory, 1965-present

The hydrogeology and hydraulic properties of the various hydrostratigraphic units underlying and within the Assessment Area are presented below. The capacity of each unit to store and transmit groundwater to wells and the relative potential for impact from construction of a highway alignment is discussed.

Organic Deposits

Organic deposits of sphagnum moss, peat, gyttja (sedimentary peat consisting primarily of plankton and other plant and animal residues) and clay are identified by surficial geology mapping approximately 2.5 km west of the most western extent of the RoW. These deposits have a very high hydraulic conductivity; however, water supply wells are generally not constructed in organic deposits due to the very poor quality of the groundwater. The organic deposits are not considered to be groundwater resources, although they may have value as surface water or ecological resources.

Glaciofluvial Deposits

No glaciofluvial deposits are identified along the RoW; however, a minor area occurs on the extreme southwest end near Simms Settlement (Figure 5.2.1). Where sufficiently thick (*i.e.*, more than 3 m of saturated thickness), the stratified sand, silt and gravel of glaciofluvial deposits can yield sufficient water to meet the needs of an individual family. Several examples of deep open casing wells in 20 to 30 m of sand and gravel are noted in the Hubbards area. A typical open-cased borehole can yield up to 30 igpm. Properly located and developed screened wells may provide 50 to 100 igpm. No deep screened wells are known to be present close to the RoW. However, conventional dug wells may be commonplace.

Hummocky Ground Moraine

Hummocky ground moraine occurs in the central portions of the RoW, near Sawler and Station Roads and north of Head of St. Margaret"s Bay (Figure 5.2.1), and may be related to topographic depressions in the bedrock. The ground moraine is characterized by moderate to thin deposits of moderately permeable sand, gravel and silt glacial till overlying granite bedrock. This rough terrain is generally not suitable for major water supplies. Single dwelling dug wells may be feasible where sufficient saturated thickness exists.

Silty and Stony Drumlins (Drumlin Facies)

Drumlins are located in the southwest portion of the RoW, near Simms Settlement, Mill Lake, and Sawler and Station Roads (Figure 5.2.1). Where sufficient saturated thickness occurs, these materials may supply water for single family uses from dug wells. It should be noted that the depth to water table increases with elevation in a typical drumlin; therefore, dug wells on top of a drumlin hill are more susceptible to seasonal water level change than wells located at lower elevations along the flanks. Significant excavation into a drumlin can lead to water table lowering and affect dug wells within close proximity. An increased potential for erosion can also occur in saturated silty soils.

Silty and Stony Till Plains (Ground Moraines)

The majority of the RoW is underlain by silty glacial till ground moraine locally called granite till. This material is characterized by thin (*i.e.*, usually less than 10 meters) deposits of highly permeable mixtures of sand, gravel and boulders derived from the underlying granite. While moderate to high yields of groundwater are possible from this material, the lack of saturated thickness usually limits groundwater supply potential. Due to their high permeability, the granite till is highly susceptible to groundwater impact from urban or road salt activities.

Domestic Water Supply

As confirmed through the Highway Environmental Database Screening conducted by both the Halifax Regional Municipality and the Municipality of Chester, no municipal water supplies are located within the Project area. In addition, the Project area is not supplied with municipal water service. Residential, commercial, and industrial land uses within the Project area are therefore assumed to receive water from individual or shared on-site dug or drilled wells.

A “windshield” field survey of residential well locations was not conducted as a part of this Environmental Assessment. However, a review of available mapping information was conducted to determine the probable locations of water wells within a 600 m corridor of the proposed highway (*i.e.*, 300 m on either side of the highway centerline). A search of the Service Nova Scotia and Municipal Relations‟ Property Online database was also conducted to determine address and property ownership information for these areas. For the purpose of the groundwater resource evaluation, it has been assumed that each of the PIDs with property values exceeding $50,000 has a private well (drilled well or dug well) associated with the dwelling. Based on this approach, it is estimated that 121 wells are potentially located within 300 m of the highway centerline. A summary of domestic well occurrences is provided in Table 5.12 below (in Section 5.2.7.1 of this report).

A review of the NSE well drillers database was performed for the areas of interest shown on Figures 5.2.3a-b. Table 5.12 summarizes 57 NSE domestic well logs identified within areas A through F near the RoW centerline. While additional wells, especially dug wells, are likely present, and numerous additional logs are available for the nearby communities, this table characterizes the type of potable supply wells likely present along the RoW.

Table 5.12 Summary of Well Construction Details

Location		Well Depth (m)	Casing Length (m)	Diam (mm)	Yield (L/min)	Water Level (m)	Till Thickness (m)
Simms Settlement	Minimum	38.1	6.1	152	9.1	1.8	2.7
	Maximum	79.2	8.5	152	68.2	6.1	6.1
	mean	55.4	7.1	152	33.3	4.1	4.5
	Median	48.8	6.7	152	22.7	4.3	4.6
	N	3	3	3	3.0	3.0	3.0
Mill Lake Road	Minimum	5.3	5.3	152	11.4	1.8	0.9
	Maximum	91.4	35.4	2438	454.6	24.4	31.4
	mean	47.6	11.5	152	51.1	7.4	8.0
	Median	40.4	6.1	152	36.4	6.1	3.0
	N	12	12	12	12	11	11
Station Rd	Minimum	57.9	6.1	152	4.5	-	3.4
	Maximum	97.5	51.8	152	11.4	-	48.8
	mean	78.2	33.2	152	7.6	-	30.9
	Median	79.2	41.8	152	6.8	-	40.5
	N	3	3	3	3	0	3
Head of St. Margaret‟s Bay	Minimum	48.8	9.4	152	6.4	0.3	4.0
	Maximum	93.0	56.1	152	272.8	15.2	56.1
	mean	68.7	27.1	152	67.4	7.6	23.3

Table 5.12 Summary of Well Construction Details

Location		Well Depth (m)	Casing Length (m)	Diam (mm)	Yield (L/min)	Water Level (m)	Till Thickness (m)
	Median	67.1	18.3	152	31.8	7.6	13.7
	N	9	9	9	9	6	9
Tantallon North	Minimum	33.5	6.1	152	2.3	0.6	1.8
	Maximum	106.7	19.5	152	90.9	22.9	19.2
	mean	74.1	8.4	152	20.3	5.6	5.5
	Median	73.1	6.1	152	6.8	3.0	3.0
	N	10	9	9	10	5	9
Tantallon South	Minimum	25.3	6.1	152	6.8	1.5	2.1
	Maximum	121.9	12.5	152	113.7	6.1	8.5
	mean	66.4	8.2	152	23.6	5.7	4.1
	Median	74.7	7.3	152	15.9	6.1	3.4
	N	19	14	14	19	11	14
All	Minimum	5.3	5.3	152	2.3	0.3	0.9
	Maximum	121.9	56.1	2438	181.2	24.4	56.1
	mean	62.5	13.8	212	20.0	6.3	10.5
	Median	61.9	7.9	152	4.0	6.1	4.0
	N	57	51	51	55	37	50

Dug or screened drilled wells completed into the sandy till overburden can be expected to yield suitable volumes of water for individual residential use where sufficient saturated thickness (3 to 4 m) is available. These shallow (typically < 6 m deep) wells are subject to seasonal water level declines, and are more at risk to surface sources of pollution than deeper drilled bedrock wells. The water quality can be expected to be good, with a tendency to exceed drinking water guidelines for iron, manganese, low pH and seasonal coliform bacteria.

Properly constructed drilled wells can be expected to provide adequate yields (mean 20 L/min) for domestic uses. The water quality is generally considered to be good. Local naturally-occurring issues can include concentrations of iron, manganese, arsenic, uranium and fluoride above respective drinking water guidelines. Naturally corrosive conditions can occur in shallow wells completed in areas of thin sandy overburden. Based on Table 5.12, domestic wells located along the RoW can be expected to average 62 m in depth, with an average of 13.8 m of well casing. The static water table ranges from near grade to 24.4 m below grade (on drumlin hills), averaging 6.3 m below ground. Well yields exhibit a wide variation from 2.3 to 181 L/min, averaging 20 L/min (0.5 to 40 igpm, mean 7.7 igpm).

The groundwater along the entire RoW is considered to be suitable for potable uses. Naturally occurring water quality issues can locally include concentrations of arsenic, uranium, fluoride, iron and manganese in excess of drinking water guidelines. The most common risks to domestic supply wells in the granite terrain aquifer include salt runoff, septic effluents, and naturally corrosive groundwater in the shallow aquifer zones.

5.2.5 Potential Interactions, Issues and Concerns

This section evaluates the potential for Project-related activities to affect groundwater resources. Table 5.13 provides a summary of the potential environmental effects resulting from the Project-VEC interactions, which are discussed below.

Table 5.13 Project Activity – Environmental Effects Interaction Matrix for Groundwater Resources

Potential Interactions Between Project Activities - Other Projects and Environmental Effects Valued Environmental Component: GROUNDWATER RESOURCES		
Project Activities and Physical Works†	**Potential Environmental Effects**	
	Change in Groundwater Quality	**Change in Groundwater Quantity**
Construction		
Site Preparation	✓	✓
Roadbed Preparation	✓	✓
Watercourse Crossing Structure Construction	✓	✓
Surfacing and Finishing	✓	
Operation and Maintenance		
Project Presence	✓	✓
Infrastructure Maintenance	✓	
Winter Maintenance	✓	
Vegetation Management	✓	✓
Other Projects and Activities		
Existing and Planned Linear Features	✓	✓
Residential and Commercial Land Use	✓	
Recreational Land Use		
Resource Land Use	✓	✓

† See Table 4.1 and Section 2.3 for list and details of specific activities and works.

5.2.5.1 Construction

Construction activities that have the potential to affect groundwater quality and/or groundwater quantity include:

- Clearing, and grubbing of vegetation during site preparation;
- Blasting and major excavations associated with roadbed preparation and site preparation for watercourse crossing structures;

- Excavations associated with roadbed preparation and site preparation for watercourse crossing structures;
- Surfacing and finishing of paved surfaces which involve the application and mixing of asphalt; and
- Ancillary elements, including temporary access roads and borrow areas.

The clearing, grubbing, and stripping of vegetation may lead to increased surface runoff, since there is no vegetation to intercept precipitation or impede the flow of water. Surface runoff from cleared and grubbed areas typically contains sediments. Shallow springs and wells are most susceptible to direct surface water influence and could experience an increase in turbidity if exposed to this runoff. In addition, increasing the amount of surface runoff reduces the amount of infiltration into the ground, thereby decreasing the amount of groundwater recharge.

Blasting activities are commonly the cause of complaint from well owners. Major complaints associated with changes in well water quality include increased turbidity, discoloured water, and nitrate and/or coliform contamination due to damage of casing seals. The occurrence of acid rock drainage effects at down-gradient wells is a potential issue if there is blasting into bedrock and a significant degree of sulfide mineralization is encountered. Major complaints related to changes in well water production capacity include loss of quantity production, air in water and/or water lines, damage to pumps, and damage to well screens or boreholes.

Major excavations associated with cuts have the potential to affect groundwater quantity and/or quality in nearby or down-gradient shallow water wells and may cause localized changes in groundwater flow directions. Typical complaints are temporary increases in turbidity and decreased yield or “dry” wells due to a lowering in the water table.

Potential impacts to domestic water wells are a function of distance between a well, the drainage direction in relation to the highway construction activities (*i.e.*, domestic wells located hydraulically down-gradient of construction activities are of greater risk for potential water quality issues than wells located hydraulically up-gradient), and individual well construction methods.

Runoff during paving operations may contain dissolved hydrocarbons. At least part of this runoff will infiltrate the ground, introducing dissolved contaminants into the groundwater flow system. Vibrations from equipment have also been reported to environmentally affect water wells in close proximity, generally resulting in temporary increases in turbidity. In addition, accidental releases of hazardous materials (*e.g.*, hydrocarbons) during construction can degrade the chemical quality of down-gradient water supplies.

5.2.5.2 Operation and Maintenance

Operation of the highway has the potential to affect groundwater by:

- Reducing groundwater recharge due to the increase in impervious surface area;

- Affecting local groundwater quality due to dissolved contaminants in runoff from the highway or from accidental spills;
- Lowering of the water table due to ditching, cutting, and grading; and
- Altering shallow groundwater flow patterns due to changes in surface drainage patterns.

Impervious materials, such as asphalt, prevent the infiltration of precipitation into the ground, thereby reducing the amount of groundwater recharge. Similarly, ditching and cutting modify local drainage patterns, thereby reducing groundwater recharge and potentially resulting in a local lowering of the water table, as well as altering shallow groundwater flow patterns.

Runoff from roads and highways, as well as from paving operations during infrastructure maintenance may contain contaminants such as lubricants, coolants, vehicle deposits, and road salt. Some runoff may infiltrate into the ground, introducing dissolved contaminants into the groundwater system.

During winter, salt is used by NSTIR on road surfaces to aid in melting snow, and to provide clear road conditions. Road salt can enter into the environment (surface water, groundwater, and soil) through application of these salts. As road salt is applied directly to the road surface, its potential to affect the groundwater system is considered to be substantially higher than other potential contaminants whose origins are vehicle-related.

Vibrations from equipment during operation and maintenance have also been reported to affect water wells in close proximity, generally resulting in temporary increases in turbidity.

Since NSTIR primarily uses mechanical means to maintain vegetation control, ongoing maintenance of vegetation is not expected to affect groundwater quality. However, the removal of vegetation will reduce the amount of precipitation that is intercepted, thereby increasing runoff. This could result in a local reduction in groundwater recharge and a lowering of the water table.

5.2.6 Other Projects and Activities

Existing and Planned Linear Features

Existing linear features are limited to the existing Highway 103 and other streets and roads within the Assessment Area. The Project will interact with the existing Highway 103 and at the interchanges along the RoW. In locations where the Project parallels or crosses existing roads, these features and the Project will have the potential to interact cumulatively with the local groundwater quality and quantity. It is assumed that construction of the Ingramport interchange, which is scheduled for 2013, will follow mitigation measures similar to those recommended for this Project, including a pre-construction residential well survey.

Residential and Commercial Land Use

Adjacent land uses within the Assessment Area may affect groundwater quality and quantity. Residential and commercial land uses likely rely on groundwater for their potable water supplies. Petroleum storage (*e.g.*, diesel or home heating fuel) may be associated with these land types. Many of these rural residences and businesses would have on-site septic fields that can locally affect groundwater quality. Residential and subdivision roadways are a further source of salt recharge. Pesticides and herbicides are also associated with multiple land uses.

Resource Land Use

Nova Scotia Power Incorporated (NSPI) operates a generating station at Mill Lake, located to the northeast of the Assessment Area, immediately adjacent to the Project twinning centerline (adjacent to chainage 3+700 m). The associated Mill Lake hydroelectric dam is located approximately 1.1 km south of the twinning centerline. The Mill Lake powerhouse also includes the Sandy Lake generating station, which is located approximately 1.6 km north of the existing Highway 103.

Bowater Mersey Paper Co Ltd. (Bowater Mersey) operates over 20,234 ha of woodlands to the north of the Project corridor. Forestry operations are dependent upon sustainable groundwater resources to support future productivity. These operations also have an effect on the quantity and quality of local groundwater supplies.

According to available land classification mapping (Figures 5.4.1a-e), a total of five quarries/gravel pits are located within 500 m of the Project corridor. During field surveys, only one gravel pit was observed to be active, and the rest are believed to be inactive. The active pit is located north of the proposed RoW east of Porcupine Lake (in the vicinity of chainage 7+500 m). Quarrying activities could potentially affect groundwater quality and quantity in the Assessment Area.

5.2.7 Environmental Effects Assessment

This section provides an evaluation of key potential Project-VEC interactions as summarized in the environmental effects assessment matrix (Table 5.14).

Table 5.14 Environmental Effects Assessment Matrix for Groundwater Resources

Environmental Effects Assessment Matrix Valued Environmental Component: GROUNDWATER RESOURCES							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** **(A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Construction							
Site Preparation	Change in groundwater quality (A) Change in groundwater quantity (A)	• Pre-construction well survey • Erosion and sediment control measures will be taken to reduce surface runoff • Remedial action as necessary to restore damaged wells and provide temporary potable water as needed • Follow Generic EPP	2	2	1/1	R	2
Roadbed Preparation and Watercourse Crossing Structure Construction	Change in groundwater quality (A) Change in groundwater quantity (A)	• Pre-blast surveys • Ripping instead of blasting where possible near residential areas • Erosion and sediment control measures will be taken to reduce surface runoff • Remedial action as necessary to restore damaged wells and provide temporary potable water as needed • Follow Generic EPP	2	2	1/1	R	2
Surfacing and Finishing	Change in groundwater quality (A)	• Erosion and sediment control measures will be taken to reduce surface runoff • Remedial action as necessary to restore damaged wells and provide temporary potable water as needed • Follow Generic EPP	1	2	1/1	R	2
Operation and Maintenance							
Project Presence	Change in groundwater quality (A) Change in groundwater quantity (A)	• Minimize extent of clearing • Remedial action as necessary to restore damaged wells and provide temporary potable water as needed • Follow Generic EPP	1	2	1/6	R	2
Infrastructure Maintenance	Change in groundwater quality (A)	• Drainage and vibration controls • Remedial action as necessary to restore damaged wells and provide temporary potable water as needed • Follow Generic EPP	1	2	1/1	R	2

Table 5.14 Environmental Effects Assessment Matrix for Groundwater Resources

Environmental Effects Assessment Matrix Valued Environmental Component: GROUNDWATER RESOURCES							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Winter Maintenance	Change in groundwater quality (A)	• Follow NSTIR salt management plan • Remedial action as necessary to restore damaged wells and provide temporary potable water as needed • Follow Generic EPP	1	2	1/3	R	2
Vegetation Management	Change in groundwater quality (A) Change in groundwater quantity (A)	• Minimize extent of clearing • Remedial action as necessary to restore damaged wells and provide temporary potable water as needed • Follow Generic EPP	1	2	1/1	R	2

<u>Key</u>

Magnitude:

1 = Low: *e.g.,* affecting the available quantity or quality of groundwater resources in the shallow or deep aquifer, at levels that are indiscernible from natural variation

2 = Medium: *e.g.,* limiting the available quantity or quality of groundwater resources, such that these resources are occasionally rendered unusable to current users for periods up to two weeks at a time

3 = High: *e.g.,* limiting the available quantity and quality of groundwater resources, such that these resources are rendered unusable or unavailable for current users during the life of the Project or for future generations beyond the life of the Project

Geographic Extent:
1 = <1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101 - 1,000 km^2
5 = 1,001 - 10,000 km^2
6 = >10,000 km^2

Duration:
1 = <1 month
2 = 1 - 12 months
3 = 13 - 36 months
4 = 37 - 72 months
5 = >72 months

Frequency:
1 = <11 events/year
2 = 11 - 50 events/year
3 = 51 - 100 events/year
4 = 101 – 200 events/year
5 = >200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not Applicable
(A) = adverse
(P) = positive

5.2.7.1 Construction

During Project Construction, several activities could result in a change in groundwater quality and quantity. These include grubbing and stripping of vegetation during site preparation; erosion from denuded areas; major excavations associated with roadbed preparation; site preparation for watercourse crossing structures; surfacing and finishing of paved surfaces which involve the application and mixing of asphalt; and ancillary elements.

Stantec conducted a review of the available mapping to identify areas along the Highway 103 Twinning Project area where highway construction activities could potentially affect groundwater resources. In general, the majority of the well users in close proximity to the Project are located in the community of Hubbards at the western end of the Project area, along Highway No. 3 or along side roads connecting to Highway No. 3 in the central portions of the Project area, and in the vicinity of the Tantallon interchange at the east end of the Project area. For the purpose of the groundwater VEC evaluation, several areas of interest respecting potential effects to groundwater resources have been identified with an alphabetical designation (A to J), as shown on Figures 5.2.3a-b.

Table 5.15, provides a description of each of the potential groundwater supply risk areas, summarizes the estimated number of wells within 300 m of each side of the centerline, identifies the expected drainage direction (*i.e.*, whether the area is hydraulically down-gradient or up-gradient of the Highway 103 twinning activities), and identifies potential issues for each of the areas identified. Based on a cursory overview of the PID and topographic mapping, most supply wells are located more than 250 m from the RoW. It should be noted that this has not been field-truthed, and that new constructions (*e.g.*, Hurshman Drive at French Village) may be present. In addition to the identified wells within 300 m of either side of the RoW centerline, concentrations of domestic drilled wells are located within the Westwood subdivision (located >300 m to the north and up-gradient of the RoW and Area J) and Tantallon Woods/French Village subdivisions (located > 300 m south of Area J, Figure 5.2.3a).

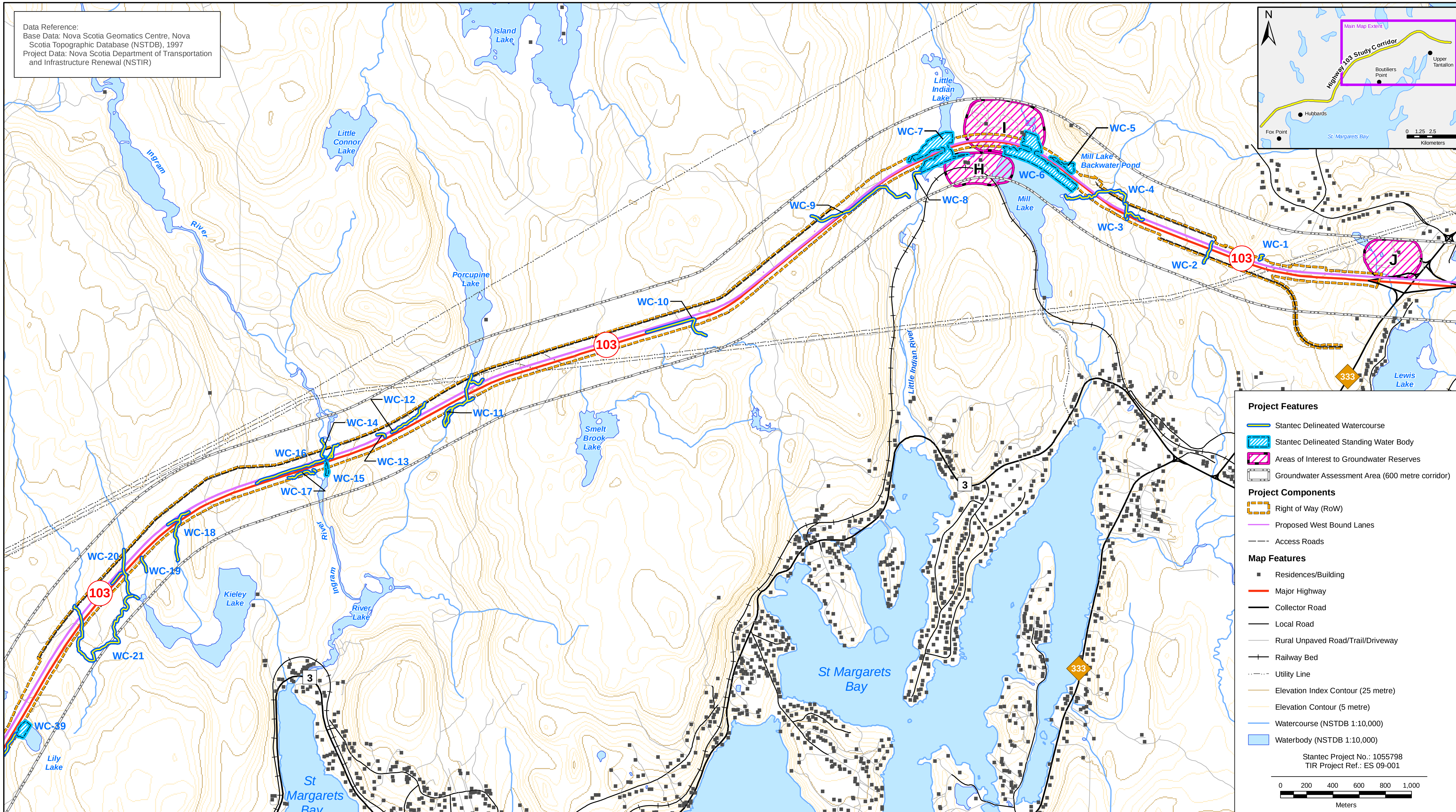
Table 5.15 Summary of Domestic Well Occurrences – Highway 103 Twinning Project Area

Figure Reference Label	Description of Location	Approximate Number of Wells within 300 m from Centerline	Drainage Direction	Potential Issues
A	No. 3. Highway and Scott Lane, Simms Settlement	34	Down-gradient	1,2,4,5
B	Miller Lake Road, No.2 Road	8	Down-gradient	1,2,4,5
C	Mill Lake Road, No.1 Road	10	Up-gradient	
D	Sawler Lake Road	8	Down-gradient	1,2,4,5
E	Station Road	9	Down-gradient	1,2,4,5
F	St. Margaret's Bay Road	24	Down-gradient	1,2,4,5
G	Puddle Road	11	Down-gradient	1,2,4,5
H	Bowater Mersey Road, Head of St. Margaret's Bay	5		
I	Little Indian Lake and Mill Lake	2	Both	1,2,4,5
J	Upper Tantallon Interchange: Wisteria Ln., Witbury Ct., Hurshman Rd, Sagebrook Lane	10	Down-gradient	1,2,4,5
Total		**121**		

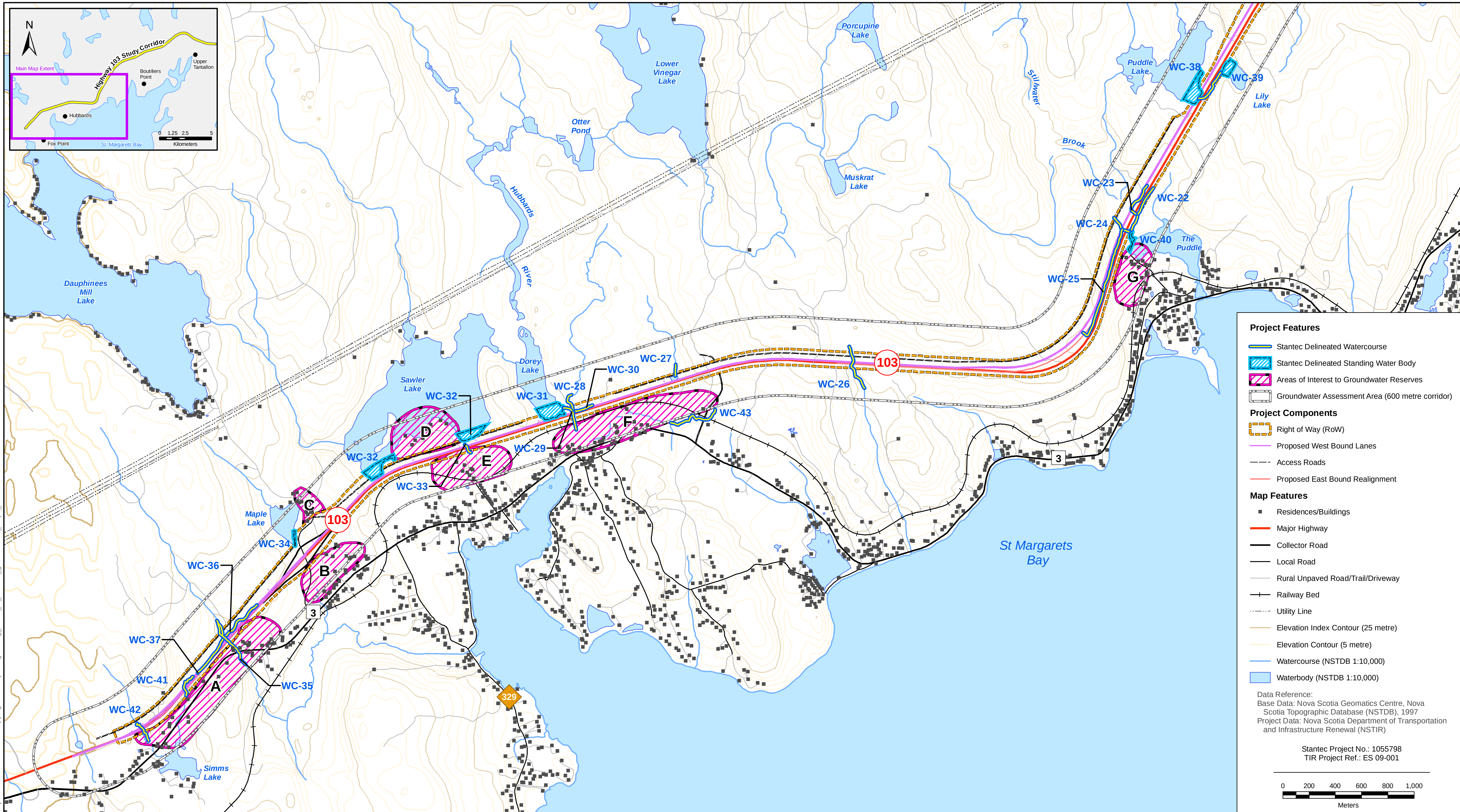
Table 5.15 Summary of Domestic Well Occurrences – Highway 103 Twinning Project Area

Figure Reference Label	Description of Location	Approximate Number of Wells within 300 m from Centerline	Drainage Direction	Potential Issues
Notes:	Potential Issues include : 1) Blasting Activities, 2) Dewatering of drilled or dug wells 3) Acid Drainage 4) Temporary Siltation 5) Road Salt Effects and 6) Other Effects			

Highway construction has potential to cause a decrease in well yield due to groundwater level lowering or interception of recharging bedrock fractures. Lowering of water table would be expected in the immediate vicinity of major (> 10 m) road cuts though saturated glacial till. Experience has shown that shallow screened or dug wells located immediately up-gradient of such cuts could experience permanent water level lowering, possibly leading to loss of supply. In consideration of the locations of potential water supply wells relative to the RoW, loss of supply due to water table decline is not anticipated. Clearing, grubbing, and stripping activities associated with site preparations will decrease interception of precipitation by vegetation and increase runoff in these areas, which would result in a reduction of groundwater recharge (*e.g.,* a decrease in groundwater quantity) and an increase in water turbidity within shallow wells and springs.



DATE: September 2010	Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening	FIGURE NO.: 5.2.3a
PREPARED BY: M. Huskins-Shupe	**Groundwater and Surface Water Resources - Map 1**	Stantec
NOVA SCOTIA Transportation and Infrastructure Renewal		



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DATE: January 27, 2011	Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening	FIGURE NO.: 5.2.3b
PREPARED BY: M. Huskins-Shupe		
NOVA SCOTIA Transportation and Infrastructure Renewal	**Groundwater and Surface Water Resources - Map 2**	Stantec

Erosion from grubbed and stripped areas is generally only a concern to shallow dug wells and springs in very close proximity to the RoW (*e.g.,* a few tens of metres) and where direct overland flow of silt occurs. Environmental effects to surface watercourses and aquatic environments (Section 5.3) by uncontrolled erosion are a more important concern.

Section 3.2 of the Generic EPP contains erosion and sediment control measures for Project Construction. Erosion control systems will be in place to manage runoff from the construction areas, minimizing the amount of runoff that occurs. Several generic measures that can be taken to minimize sedimentation and erosion potential include: construction sequencing to minimize soil exposure; retaining existing vegetation as long as possible; vegetation and mulching of denuded areas; diverting runoff away from denuded areas; minimizing length and steepness of slopes; keeping runoff velocities low; properly sizing and protecting drainage ways and outlets; intercepting sediments on site; and inspecting and maintaining control measures. Examples of potential erosion control measures to be used during the Project include erosion control fencing, check dams, use of mulch (possibly from shrubs and trees removed during clearing) and, if necessary, sedimentation control ponds. As these erosion control measures slow the transport of surface runoff, they will also increase the potential for localized infiltration to groundwater.

Runoff from paving areas may contain dissolved hydrocarbons, and intermittent blasting or heavy equipment operation (*i.e.*, vibration from equipment) may cause temporary siltation of adjacent wells. The concentration of dissolved hydrocarbons in any runoff from these areas is expected to be at trace levels. Domestic wells located hydraulically down-gradient of construction activities are of greater risk potential water quality issues than wells located hydraulically up-gradient. Proper staging of the paving (*e.g.,* dry weather application, drainage controls as required, paving of the roadway in sections) and vibration controls will minimize any potential environmental effects. Temporary siltation may be experienced during major blasting operations; however, this would be expected to be minimal in drilled wells completed in granite, or dug wells given the distance between the centerline and the nearest wells (> 200 m).

Potentially hazardous materials could be present during proposed Project activities, including fuels and lubricants for Project equipment. All will be handled in a manner consistent with currently accepted best practices. Mitigation and contingency measures related to hazardous material storage and spills are addressed in Sections 2.5 and 8.1 of this EA. The Generic EPP contains best management procedures to minimize the likelihood of spills, as well as instructions for crew training and orientation in spill prevention and management (refer to Appendix F of the EPP which contains a Spill Contingency Plan).

Based on the location of this RoW, and the inferred distances between the centerline and the nearest wells (> 200 m), no long term water quality effects are anticipated. Proper attention to the storage and handling of fuels, lubricants and blasting agents should further reduce the risks of local groundwater quality impact.

The potential for acid drainage production in the vicinity of the proposed highway twinning is considered to be low based on the type of bedrock underlying the RoW. Nonetheless, should a mineralized zone be encountered during the excavation work, the rock will be tested for acid generating potential. If determined to be acid generating bedrock, the excavated material will be handled in a manner as prescribed in the Nova Scotia Sulfide Bearing Material Regulations. Exposures of sulfide mineralized bedrock would be isolated from the environment with suitable fill or shot-crete options.

Major blasting operations can cause environmental effects in adjacent wells ranging from minor temporary turbidity to rare complete collapse of the well. Other potential effects include water quality deterioration from blasting agents (nitrate), and rare loss of yield. Groundwater vibrations caused by large scale blasting through competent bedrock can affect adjacent wells both short term and long term. Short-term turbidity impacts caused by blasting vibration are not anticipated, due to distance (> 200 m) and since it is anticipated that the surrounding groundwater well users have wells completed in highly competent granite bedrock which is less conducive to vibration-induced siltation than softer sandstone, shale or overburden.

Vibration damage to a drilled or dug well is generally a function of the distance between the energy source and the receptor well, the seismic properties of the intervening aquifer materials, age and construction method of the well, well yield, and blast magnitude. With respect to rock type, risk of water well damage is greater for acoustically transmissive fractured crystalline bedrock than for overburden wells or soft bedrock (*e.g.,* sandstone or shale) wells. Based on experience, the risk or water supply well damage from blasting or major excavation is considered to be greatest within 50 m, moderate from 50 to 200 m, and is expected to be minimal beyond about 200 m; however, the noise and vibration effects of blasting could be felt by persons at greater distances.

In the long term, there is a very small probability that blasting could reduce the yield of a water supply well. Again, the potential for this would be dependent on the distance, type of bedrock (granite), competency of the borehole (granite expected to be very competent), depth and yield of a well (*e.g.*, very small changes in fracture aperture induced by blasting more likely to affect a very shallow (< 30 m with resultant limited in-well storage) low yield (< 0.5 igpm) well than "normal" wells (> 50 m depth, > 1 igpm yield).

Several properties with potential onsite wells have been identified within the 600 m groundwater Assessment Area (*i.e.*, within 300 m of either side of the RoW centerline). Pre-blast well surveys will be conducted on wells within 300 m of planned blast locations. Major excavations through tills could lead to a drop in groundwater table elevations in proximity to the cut. The degree of water level lowering will be proportional to the depth of the cut below the natural water level table, the distance between the well and the cut, and the hydraulic properties of the overburden materials (*i.e.*, larger and faster decline in higher permeability media). Dug wells near the edge of a cut could suffer sufficient water level decline to become dry, while drilled wells are not likely to be adversely affected. Ripping will be used preferentially over blasting, when possible, near residential areas.

Significant water quality impacts on bedrock groundwater supply wells are not anticipated due to a combination of distance, anticipated low bedrock hydraulic conductivity and natural attenuation processes, primarily by dilution and dispersion, along the groundwater pathways.

Short-term turbidity impacts caused by blasting vibration are not anticipated, due to distance (> 200 m). In the very unlikely event of short-term turbidity impacts, mitigation would typically involve provision of bottled water to affected residents.

A contingency plan will be implemented to provide an interim water supply to consumers in areas that experience adverse effects in water quality or quantity during the various stages of construction, and operation and maintenance phases of the Project. Well repair and/or replacement, including deepening of existing wells and drilling new wells, which are permanently damaged or adversely affected by the Project may be undertaken in both the construction, and operation and maintenance phases of the Project. All wells drilled in relation to the Project will be drilled by a licensed water well contractor. The specifics of the contingency plan will be decided on a case-by-case basis, pending the nature of the adverse environmental effect and its relation to the Project.

5.2.7.2 Operation and Maintenance

Once the highway has been constructed, there will be a permanent decrease in the amount of infiltration to groundwater; however, as the surface extent of the highway within any one watershed is substantially less than the total watershed area, the magnitude of this effect will be imperceptible to groundwater users.

Environment Canada completed an assessment of road salt under *CEPA*. Recognizing that a total ban of road salt could potentially compromise human safety, the focus of road salt risk management is on implementation measures that optimize winter road maintenance practices so as to not jeopardize road safety while minimizing the potential environmental effects (Environment Canada 2001a). Therefore, Environment Canada has categorized road salt as a Track 2 substance, requiring Life-Cycle Management.

NSTIR has a Salt Management Plan which specifies application rates and designates vulnerable areas to be used to maximize the efficiency of salting and sanding. The drainage of salt laden runoff away from residences and their wells along ditching will likely mitigate this potential environmental effect on any nearby residential wells. A change in groundwater quality may occur with the presence of the Project. However, adherence to the Salt Management Plan will ensure the changes in groundwater quality would likely be at levels that are indiscernible from natural variation.

Dissolved contaminants such as lubricants, coolants, and vehicle deposits may also be present in runoff from the highways, and subsequently may infiltrate into the ground and reach the groundwater. However, the concentrations of these contaminants are expected to be very low relative to road salt. The effect of these other dissolved contaminants on the groundwater quality will be imperceptible to groundwater users.

Routine infrastructure maintenance may potentially interact with groundwater. Runoff from paving areas may contain dissolved hydrocarbons, and vibration from equipment may cause temporary increases in turbidity in adjacent wells. However, the concentration of dissolved hydrocarbons in any runoff from these areas is expected to be at trace levels. Proper staging of the paving (*e.g.,* dry weather application, drainage controls as required, paving of the roadway in sections) and vibration controls will minimize any potential environmental effects. The likelihood of an environmental effect on groundwater resources from runoff and vibration environmental effects during resurfacing activities is considered to be very low.

NSTIR uses mechanical means to maintain vegetation control. Since the use of herbicides is not anticipated, the ongoing maintenance of vegetation is not expected to affect groundwater quality.

A contingency plan will be implemented to provide temporary water to consumers in the area that experience adverse affects in water quality or quantity during the operation and maintenance of the Project. Repairs and replacement of any wells that are permanently damaged by the Project will be decided on a case-by-case basis, pending the nature of the adverse environmental effect and its relation to the Project.

5.2.7.3 Assessment of Cumulative Environmental Effects

The potential cumulative environmental effects of the Project on groundwater are primarily related to changes in groundwater quality and quantity resulting from construction activities in combination with landscape changes from past Projects and current and future uses of salt for winter driving safety. The Project will require removal of mature trees and shrubs. This removed vegetation can contribute to cumulative environmental effects in watersheds where there will be clearing in other areas of the same watershed. The result of these environmental effects acting cumulatively may be localized changes in groundwater recharge rates.

Current groundwater quality and quantity within the Assessment Area reflect the sum of the environmental effects on groundwater of all past and presently existing Projects and activities. This includes the cumulative environmental effects of existing highways and roads, all past and current adjacent land uses (*e.g.*, forestry practices), as well as other planned Projects. As such, current conditions provide a basis for considering cumulative environmental effects of past, present, and future projects.

Existing and Planned Linear Features

The Project parallels the existing Highway 103 and other roads, as well as intersects various streets and roads. These features will interact with the local groundwater quality and quantity. The presence of paved roads will reduce the amount of infiltration that occurs (*i.e.*, lead to a decrease in groundwater quantity). However, the most substantial potential environmental effect is on the potential groundwater quality changes from the application of and runoff from road salt, particularly on the down-gradient side of the Project footprint. The NSTIR Salt Management Plan, which specifies application rates and designates vulnerable areas, will be used to maximize the efficiency of salting and sanding. The drainage of salt laden runoff away from residences and their wells along ditching will likely mitigate this potential environmental effect on any nearby residential wells.

Residential and Commercial Land Uses

Adjacent land uses within the groundwater Assessment Area may affect groundwater quality and quantity. Urbanization may reduce groundwater availability by decreasing the amount of precipitation that is intercepted by vegetative cover and increasing the amount of runoff. Although residential land uses in the Assessment Area likely rely on groundwater for their potable water supplies, the Project will have a negligible effect on quantity; therefore, cumulative effects are unlikely.

Groundwater resources are unlikely to be cumulatively affected by interactions between Project-related hazardous material storage and residential and commercial petroleum storage (*e.g.*, diesel or home heating fuel), particularly given the extremely low potential for accidental events and malfunctions to simultaneously affect Project-related and non-Project-related petroleum storage.

The follow-up and monitoring program described in Section 5.2.9 includes well water sampling and analysis for parameters including chemistry, metals, and fecal and total coliform counts, as per NSE guidelines for sampling domestic wells. These pre-construction samples should serve to identify those proximity wells with existing problems. Therefore, although any on-site septic fields that may be present at rural residences and businesses can have localized effects on groundwater quality, measures are in place to protect landowners from cumulative effects on the quality of their well water. In addition, it is not expected that any Project activities will take place in close proximity to septic fields, thereby further reducing the potential for cumulative adverse effects.

Although residential and subdivision roadways are a source of salt recharge, potential effects from road salting operations associated with the Project are not expected to be any greater than those posed by the presence of the existing Highway 103 alignment, particularly given the application of appropriate mitigation measures and adherence to the NSTIR Salt Management Plan. Pesticides and herbicides are also associated with multiple land uses in the area. However, vegetation control for the Project will be by mechanical means and therefore will not add to this cumulative effect.

Resource Land Use

Forestry activities (*e.g.*, timber harvesting, road construction, and silvicultural practices) associated with the Bowater Mersey woodlands to the north of the Project corridor have potential to affect various aspects of groundwater hydrology, including water table position, groundwater recharge, and groundwater flow and storage on a regional or watershed scale. Conversely, since groundwater is an important aspect of several factors affecting forestry, including streamflows, slope stability, water quality, wetland sustainability, and operational activities, alterations to the groundwater regime can have an effect on future forest productivity (Smerdon *et al.* 2009). However, the clear-cut areas are a long distance (> 2 km) from the nearest residential wells along Highway No. 3 to the south. Measureable interactions between residential wells and forestry activities in this area are therefore considered to be unlikely. Furthermore, as stated above, vegetation control for the Project will be by mechanical means and will not interact cumulatively with any pesticide or herbicide use potentially associated with Bowater Mersey forestry operations.

One active borrow pit is located north of the proposed RoW east of Porcupine Lake (in the vicinity of chainage 7+500 m). The potential environmental effects on surrounding groundwater resources from a quarry operation include: groundwater table lowering close to the quarry high wall, depressurization of down-gradient springs, temporary siltation of nearby wells due to intermittent blasting or heavy equipment operation, decrease in well yield due to groundwater level lowering or interception of recharging bedrock fractures, and possible water quality deterioration at down-gradient wells from accidental releases of deleterious substances such as petroleum hydrocarbons and nitrate from blasting agents or equipment, or acidic drainage production if in the unlikely event that a mineralized zone is encountered within the quarry area. Potential impacts to domestic water wells are a function of distance, relative location of a well and the quarry with respect to groundwater flow directions, depth of excavation below the water table, intensity and frequency of blasting, aquifer hydraulic and acoustic properties, and individual well construction methods.

The active quarry located north of chainage 7+500 m is not expected to pose any risk to existing residential well water supplies. This appears to be a shallow surficial quarry situated in a zone of hummocky ground moraine, and it is located more than 2 km from any identified residential well locations along Head of St. Margaret"s Bay. Significant water table lowering at the nearest wells is highly unlikely, Even if bedrock excavation is carried out, the quarry is located outside the 800 m excavation assessment zone specified in the Nova Scotia *Pit and Quarry Guidelines* (NSE 1999).

Cumulative Environmental Effects Summary

Generally, the groundwater quality and quantity of wells within the Assessment Area is expected to be fair to good. This takes into account baseline environmental quality that is reflective of the cumulative environmental effects of past and present Projects and activities but is more influenced by the natural hydrogeologic properties of the area. The contribution of the Project to cumulative environmental effects will be mitigated such that the environmental effects of the Project on groundwater, in combination with the limited environmental effects of future projects and activities, will not likely further degrade groundwater in near-by water wells. Therefore, cumulative environmental effects of the Project, for all Project phases, acting in combination with all past, present, and future projects and activities in the groundwater Assessment Area, are rated as not significant.

5.2.8 Determination of Significance

Table 5.16 evaluates the significance of potential residual environmental effects on groundwater resources resulting from any interactions between Project activities and the VEC, after taking into account any proposed mitigation. The table also considers the level of confidence of the study team in this determination.

Table 5.16 Residual Environmental Effects Summary Matrix for Groundwater Resources

Residual Environmental Effects Summary Matrix Valued Environmental Component: GROUNDWATER RESOURCES				
Phase	Residual Environmental Effects Rating, Including Cumulative Environmental Effects*	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Construction	NS	2	N/A	N/A
Operation and Maintenance	NS	3	N/A	N/A
Project Overall	NS	3	N/A	N/A

Key

Residual Environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Level of Confidence
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence
N/A= Not Applicable

Scientific Certainty: based on scientific information and statistical analysis or professional judgment
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence
N/A= Not Applicable

*As determined in consideration of established residual environmental effects rating criteria.

In summary, provided the recommended mitigative measures are implemented, adverse residual environmental effects on groundwater resources during Project construction and operation are predicted to be not significant. Possible increases in sodium and chloride concentration in wells in close proximity and down-gradient of the proposed highway is the most likely potential effect, although this effect is not considered to be significant since modern highway drainage measures will be applied. Potential effects from road salting operations associated with the Project are not expected to be any greater than those posed by the presence of the existing alignment.

5.2.9 Follow-up and Monitoring

Several domestic water supply wells are likely located within the 600 m groundwater assessment boundary. As per Section 4.2.3 of the Generic EPP, NSTIR will complete a detailed standardized survey of wells within 300 m of the centerline of the new alignment prior to construction. This would include the type of water supply and its age, conditions, and known history based on property and survey information obtained during sample collections. Water samples will be collected by an independent contractor and analyzed for pH, general chemistry and metals (RCAp plus metals), as well as fecal and total coliform counts as per NSE guidelines for sampling domestic wells. The number of wells to be inventoried and the monitoring boundary will be determined through consultation with NSE and the well-log database. Should samples indicate the presence of fecal coliform or concentrations of other parameters in excess of Canadian Drinking Water Standards, NSTIR"s Project Engineer will immediately notify the landowner(s).

In the event that any residential wells are found within 300 m of any significant blasting excavation areas (*e.g.*, road cut or quarry), or if dug wells are located within 50 m of a major (> 5 m) overburden cut, pre-blast well surveys will be conducted and these wells will be inspected (measuring depth, yield and water level in dug wells) and sampled for baseline water quality (RCAp-MS and bacteria) by the contractor. In the event that several drilled wells are present within the proposed 300 m blast monitoring radius, selected representative proximal wells will be inspected, baseline sampled, and closely monitored during the construction phase. In addition, wells located down-gradient of the proposed RoW will be at potential risk from the residual effects of uncontrolled salt runoff in the operation stages.

Because water levels may change slowly over time in tight glacial till aquifers, follow-up water level monitoring is recommended for shallow dug wells located close to major overburden cuts along the alignment. Natural seasonal variation in water levels will be considered in the evaluation of effects. The suggested duration of any post-construction monitoring would be the lesser of two years of quarterly monitoring, or stabilization of water level and chemical indicators in wells of concern.

The extent and frequency of well monitoring post construction and during the operations phase will be determined once the pre-construction data has been assessed or following receipt of landowner complaints.

5.3 Aquatic Environment

5.3.1 Rationale for Selection as Valued Environmental Component

The Aquatic Environment was selected as a VEC because of the potential for Project activities to interact with the freshwater and estuarine environments. The Aquatic Environment VEC will address surface water quality, fish and fish habitat and sediment dynamics as indicators of the overall VEC.

In the context of the Aquatic Environment VEC, the following definitions apply:

Fish is defined by the *Fisheries Act* as fish, shellfish and crustaceans and any parts of fish, shellfish, crustaceans and marine animals; and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.

Fish habitat is defined by the *Fisheries Act* as spawning grounds, and nursery rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

Surface water quality is described as the chemical, physical, and biological attributes of surface water including, but not limited to, suspended sediments, flow regime, and water quality.

5.3.2 Environmental Assessment Boundaries

5.3.2.1 Spatial

The spatial boundaries (Assessment Area) for the assessment of the potential environmental effects (including cumulative environmental effects) of the Project on the Aquatic Environment include all watercourses falling within the Project RoW on Highway 103 between Tantallon (Exit 5 on the existing highway) and 2 kms past Hubbards (Exit 6 on the existing highway). Many of these watercourses eventually feed St. Margaret‟s Bay. Aquatic field surveys were conducted at the proposed watercourse crossing locations and from 100 m north to 250 m south of the existing highway, where habitat was accessible.

5.3.2.2 Temporal

The temporal boundaries for the assessment of the Project‟s potential environmental effects on the Aquatic Environment are the periods of Construction and Operation and Maintenance of the Project in perpetuity.

5.3.2.3 Administrative and Technical

There are a number of administrative and technical boundaries that were considered during the assessment of the environmental effects of the Project on the Aquatic Environment. Most of these boundaries are regulatory in nature as described in the following sub-sections.

The primary technical boundary encountered in the field was inaccessible habitat where the stretch of stream to be assessed was inaccessible due to private land boundaries. Additionally, the timing of the Project resulted in the majority of watercourses being assessed in September prior to the end of the DFO-approved electrofishing season as well during October 2009, with special Project-specific permission from DFO. The discovery of a few additional watercourses following the close of the electrofishing season resulted in follow-up assessments being required in July and August 2010 for a few watercourses.

Fish and Fish Habitat

Fish and fish habitat are protected through federal and provincial legislation. Fish habitat is protected under the *Fisheries Act* and by DFO"s *Policy for the Management of Fish Habitat* (DFO 1986). The *Policy for the Management of Fish Habitat* is regulated by Sections 20, 21, 22, 30, 32, 35, 37, 40 and 43 of the *Fisheries Act* which is administered by DFO. This policy applies to all projects and activities in or near water which could result in the Harmful Alteration, Disruption, or Destruction (HADD) of fish habitat by chemical, physical, or biological means. The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats.

Provincial regulations applicable to fish habitat protection include the Nova Scotia *Environment Act* and the *Activities Designation Regulations* which require completion of an application for a Division I Water Approval for Watercourse Alterations. The approval is issued by NSE.

Species at Risk

There are two freshwater fish species and one mussel species in Nova Scotia with special conservation status as designated by *SARA*:

- Atlantic whitefish (*Coregonus huntsmani*) – Endangered;
- Atlantic salmon [inner Bay of Fundy (iBoF) population] (*Salmo salar*) – Endangered; and
- Yellow lampmussel (*Lampsilis cariosa*) – Special Concern.

None of these three species is found in the primary watershed (Nova Scotia Geomatics Centre - NSGC) encompassing the Project area.

There is one species of freshwater fish listed under the Nova Scotia *Endangered Species Act*. That species is the Atlantic whitefish, which is also listed under *SARA*. Given that Atlantic whitefish are not known to inhabit the NSGC primary watershed associated with this Project, their listing under the *Act* did not affect the assessment.

Additional species found within the Project area have been given various at-risk designations provincially. These include Atlantic salmon, brook trout (*Salvelinus fontinalis*), and American eel (*Anguilla rostrata*). Atlantic salmon is listed by the Nova Scotia Department of Natural Resources (NSDNR) as red, indicating that it is known to be or thought to be at risk. ACCDC considers Atlantic salmon to be globally widespread and abundant but locally rare with the potential to be vulnerable to extirpation due to rarity or other factors (*i.e.,* G5 S2). Salmonids are generally considered a sensitive family of fish, indicative of good water quality in relation to pH, dissolved oxygen, and metals (or other contaminant) levels. Brook trout are also considered a salmonid and as such are similarly sensitive to several environmental conditions. NSDNR lists brook trout as yellow, or sensitive to human activities or natural events. Neither COSEWIC nor *SARA* list brook trout, although ACCDC does consider it to be globally widespread and abundant and locally widespread, fairly common, and apparently secure with many occurrences, but of long term concern. The NSDNR and ACCDC rankings of Atlantic salmon and brook trout did not impede fishing efforts within the Project area.

The American eel is a member of the Anguillidae family and was found throughout the Project area. The species is catadromous (live in fresh water, spawn in salt water) and as such can be found in lakes, streams, rivers and estuaries, depending on the lifecycle stage of the individuals. NSDNR considers the species to be green, or not believed to be sensitive or at risk. Similarly, ACCDC has designated the species as globally and locally widespread and abundant (G5 S5). However, the American eel has been assessed as a species of special concern by COSEWIC (*i.e.*, wildlife species that are particularly sensitive to human activities or natural events but are not endangered or threatened). This designation is due to recruitment issues because the species is panmictic, meaning that all spawners originate from a single breeding unit. Therefore, the Canadian recruitment can be affected by a decline in global population. While the American eel has not been listed under *SARA* at this time, it is likely that the species will be listed (and therefore protected) in the future. There are currently no restrictions on carrying out electrofishing surveys in Nova Scotia waters that are known to or suspected to supported American eel populations.

Surface Water Quality

Surface water quality is regulated through federal and provincial legislation. The CCME established guidelines for the Protection of Aquatic Life for many water quality parameters (CCME 2007). While these are guidelines and not standards, it is generally accepted as best practice in EA to undertake technical and economically feasible approaches to mitigate project activities to meet the objectives of the CCME Guidelines and all relevant updates.

5.3.3 Residual Environmental Effects Rating Criteria

Potential significant residual adverse environmental effects on the aquatic environment may affect multiple aspects of the VEC, including fish and fish habitat, and surface water quality. The significant effects criteria for each of these are defined below.

A **significant residual adverse environmental effect** on fish and fish habitat is one that alters fish habitat physically, chemically, or biologically, in quality or extent, in such a way as to cause an adverse change in the ecological function of that habitat, such that natural recruitment would not re-establish the community to its original composition, density and extent in one generation. It is also considered an effect if the alteration of the habitat results in an unmitigated or non-compensated net loss of fish habitat as defined in the *Fisheries Act*. Additionally, if fish habitat is altered in such a way as to affect an adverse change (caused by avoidance and/or mortality) in the distribution or abundance of a fish species or community that is dependent upon that habitat, it is considered a significant adverse environmental effect on fish and fish habitat.

There are both federal (*SARA*) and provincial (Nova Scotia *Endangered Species Act*) acts for the protection of species at risk, and there are different levels of protection afforded a species within these Acts depending on the species rarity ranking. For example, only those species currently listed in Schedule 1 of *SARA* are protected under the *Act*. Given that the Assessment Area does not support any fish species listed under *SARA*, the potential significance criteria are simplified.

A **significant residual adverse environmental effect** on surface water quality is one that causes a long-term Project-related exceedance of the CCME guidelines for the protection of aquatic life or recreation (CCME 2007).

5.3.4 Baseline Conditions

The baseline results obtained for water quality and water chemistry suggest that two of the 43 watercourses sampled are estuarine in nature or estuarine in part of their reach. Estuarine environments fill and empty with seawater with changes in sea level but may maintain a freshwater baseline depth even at low tide. They are typically considered rich environments in which nutrients can be supplied from freshwater and marine sources as well as recycled from the sea bed; this in turn can lend to the support of a range of estuarine-tolerant organisms, including benthic invertebrates, fishes, plants and birds. Within this Project, The Puddle (WC-40) is a fully estuarine environment and one of its tributaries (WC-23) is influenced by this estuarine environment at the confluence with The Puddle. Of the remaining 40 freshwater watercourses, eight are lentic (*e.g.*, lakes or ponds) and 32 are lotic (*e.g.*, drainage channels, streams or rivers). RV Anderson was commissioned to conduct a hydrological study for the Project. Refer to Appendix B for information on the hydrology of watercourses in the Assessment Area.

A review of existing 1:10,000 maps, aerial photographs of the Project area, and the RFP was completed. DFO had also identified a number of potential watercourses following their own previous site visit. Following field assessments along the length of the RoW, an additional 23 watercourses were confirmed (see Figures 5.2.3a-b). All 43 watercourses were assessed in the field.

To provide baseline data of existing conditions for the EA, field investigations were conducted primarily during the fall of 2009. Additional surveys were carried out in July 2010 as needed to supplement the data collected in the fall of 2009. Detailed habitat assessments were completed within a 100 m assessment zone north and a 100 m assessment zone south of the existing Highway 103. An assessment of connectivity to other watercourses and a survey for the presence or absence of potential fish passage barriers were completed within an additional 150 m zone south of Highway 103, resulting in a 250 m assessment zone on the south side of the highway.

The detailed habitat assessments used internal Stantec sampling protocol. The sampling protocol used is based on multiple existing protocols including the Environment Canada CABIN protocol (Canadian Aquatic Biomonitoring Network; Reynoldson *et al*. 2007), the Ontario Benthos Biomonitoring Network (OBBN) protocol (Jones *et al.* 2005), and the modified New

Brunswick Department of Natural Resources (NBDNR) and Fisheries and Oceans Stream Assessment Protocol (Hooper *et al*. 1995). The stream assessment included the identification of physical units (*i.e.*, run, riffle, or pool), designation of substrate type, and description of the riparian zone. The presence or absence of macrophytes, algae, over-head cover, and woody debris was also recorded since all of these habitat features affect the ability of the watercourse to support fish communities. The depth and width (wetted and bankfull) of streams and rivers were recorded as well.

One *in-situ* water quality sample was taken within each identified watercourse. The water quality measurement was taken within 10 m of the upstream end of the existing culvert crossing Highway 103 when possible. If the watercourse did not cross the existing highway, a water quality measurement was taken at an appropriate location as close to the existing highway as possible. The flow state at the time of the water quality sampling was also recorded. Measurements were collected using a handheld water quality meter (Yellow Springs International (YSI) 556 MPS unit) and included dissolved oxygen, pH, water temperature and specific conductivity. These water quality measurements were collected in all watercourses bearing water during the fall 2009 assessment period with the exception of watercourses WC-23, WC-37, WC-41 and WC-42. Water quality measurements were collected at these remaining four watercourses during the July 2010 assessment.

A presence-absence electrofishing survey was carried out within all lotic watercourses meeting the following requirements: anticipated to connect to known or suspected fish-bearing watercourses; containing sufficient water levels at the time of the survey to effectively electrofish; and meeting the water temperature requirements of the electrofishing permit (*i.e.*, <22 degrees Celsius). Electrofishing was completed using a Smith-Root Model LR-24 backpack electrofishing unit, operated by two qualified aquatic specialists.

The electrofishing survey was completed starting at the downstream end of watercourses falling on the north side of the existing highway as a result of the twinning being proposed for the north side. The electrofishers worked their way upstream as far as access and water depth allowed within the 100 m assessment zone on the north side of the highway ensuring that all habitat types present were fished. If fish were caught within this assessment area, the distance fished was dependent upon the frequency of fish catch, the diversity of the species, and the stream conditions. A fishing survey was only completed on the south side of the highway when fish were caught on the north side if a different habitat or flow type was observed than had been fished on the north side. The lotic watercourses were considered open systems from upstream to downstream of the existing highway. If no fish were caught on the north side, the survey was repeated on the south side of the highway in the event that a barrier to fish passage existed somewhere between the south and north assessment zones. On the south side of the highway, the electrofishing survey started as far downstream within the 100 m assessment zone as water conditions and access allowed. For watercourses only occurring on one of the two sides of the existing highway, the electrofishing survey was limited to that respective assessment zone.

In the eight lentic watercourses, baited minnow traps were set overnight to target littoral zone species since it is the littoral zone of the lakes that have the highest potential for effects from Project activities. When access permitted, a presence-absence electrofishing survey was also completed within the littoral zone of each lentic water body.

A desktop hydrological study was conducted for the Project by RV Anderson Associates Limited (RV Anderson) in February 2010 to evaluate the potential effects of the Highway 103 Twinning on hydrology. The study included a review of available mapping to identify significant watercourses crossing the Project area and assess general site drainage patterns. The desktop nature of the study resulted in a focus on the hydrological conditions of the larger, provincially mapped watercourses within the Project area. The smaller, field-identified watercourses were not included in RV Anderson‟s assessment. The RV Anderson study yielded a description of the existing surface water drainage and hydrology of key watercourses.

Key stakeholders were contacted throughout the EA Report preparation process to gain further insight into the local conditions and concerns along the Project Corridor. Stakeholders contacted during the EA include DFO, the current chairperson of the St. Margaret‟s Bay Stewardship Association (SMBSA; Ella McQuinn) and the former chairperson of SMBSA (Geoff LeBoutillier). Stocking program details were obtained from the Nova Scotia Department of Inland Fisheries and Aquaculture 2010 on-line resources. First Nations representatives were engaged through the MEKS.

5.3.4.1 Fish and Fish Habitat

The results of the field study confirmed the presence of several small bodied and multiple salmonid fish species within the Project area. Diverse fish habitat was observed within many watercourses and across the Project site, resulting in multi-species fish assemblages within many of the streams, rivers and lakes assessed. A summary of the physical habitat features and status of fish presence or absence within each of the 43 watercourses assessed is provided below. Table 1 in Appendix F summarizes key characteristics for each watercourse. Table 2 in Appendix F summarizes the results of the fishing surveys carried out on the watercourses identified as having the potential to support fish communities. Unless otherwise noted, the watercourse descriptions provided below are focused on the watercourse conditions observed on the north side of the existing highway within the RoW during the Fall 2009 assessment period. Drawings have been prepared for lotic watercourses (Appendix F). These drawings illustrate the flow types observed during the field surveys and include photos of the RoW for the majority of streams and rivers assessed. A photo log illustrating all lakes falling within the RoW assessment area has also been included in Appendix F.

WC-1

WC-1 is a small spring fed perennial stream that runs north to south, originating from a spring located approximately 50 m north of the existing highway. The shallow stream was approximately 2 m in width with an average depth of 15 cm and bounded by wetland WL-10.

This adjacent wetland heavily influences the composition of the substrate which was dominated by fines and organic deposition from leaves and sphagnum species. Filamentous algae and algal slimes were abundant and attached to the coarser material of the substrate. Stream banks were deemed stable and showed no signs of erosion or undercutting. Stream bank vegetation consisted of an even mix of trees, small woody stemmed plants and grasses. Beyond the stream banks the riparian vegetation community consisted of coniferous forest along the west bank while the east bank presented an open grassy wetland that extended 30 m from the east bank; beyond the wetland the coniferous forest resumed. Flows during the assessment period were low and averaged 0.02 m^3/s in the thalweg. These low velocities are not anticipated to vary drastically during the year based on the amount of fines in the substrate and the spring fed nature of the stream. This watercourse did not traverse under the highway; the water pooled along the north side of the highway ditch and percolated into the wetland.

A fishing survey was not carried out in WC-1. The isolated watercourse has no connection to fish-bearing waters.

WC-2

WC-2 is a perennial stream that runs north to south, originating from a ground seep (likely drainage from WL-18) located approximately 30 m north of the existing highway. This watercourse entered a culvert on the north side of the highway and continued south of the existing highway where it became intermittent between 15 and 25 m downstream of the highway. The narrow, shallow stream was approximately 0.75 m in width with an average depth of 6 cm. The substrate was composed of sand and fines. Submergent aquatic macrophytes were present, but algae were not observed. Stream banks were deemed stable and showed no signs of erosion or undercutting. Stream bank vegetation consisted of mostly grasses and deciduous trees. Beyond the stream banks the riparian vegetation community consisted of coniferous forest extending 100 m from each bank. Flows during the assessment period were very low and averaged 0.001 m^3/s in the thalweg. These low velocities are not anticipated to vary drastically during the year based on the amount of fines in the substrate and the subterranean nature of the stream.

No fish presence-absence survey was completed in WC-2 since the watercourse has no connection to fish-bearing waters.

WC-3

WC-3 drains from WC-4 through a 60 cm culvert passing under the existing highway. The average wet width of the watercourse was 0.75 m. It drained quickly over a steep gradient, dissipating after approximately 25 m. There was no defined channel beyond the 25 m downstream (on the south side) of the existing highway. The substrate within the short, defined area of the stream was comprised fully of fines. The average depth of water at the time of the survey was 17 cm, no undercutting was observed and both banks were vegetated and stable. The riparian vegetation consisted of grasses and shrubs, with grasses dominating.

The steep gradient of the short watercourse draining from WC-4 is prohibitive to fish passage. Therefore, no fish presence-absence survey was completed within WC-3 and the watercourse is not considered to be fish-bearing.

WC-4

WC-4 is a spring-fed perennial stream which runs south to the highway, bends west and flows alongside the highway for 125 m until flowing north and eventually curving south again, crossing the existing highway and feeding Mill Lake. In the east reach of the stream (on the north side of the existing highway), the stream varied from an intermittent 60 cm wide channel to a perennial 1.5 m wide channel. The substrate remained similar throughout the upper assessment area, dominated by a predominately sandy substrate with pockets of cobble and gravel. There was a limited amount of fines within the substrate and the larger substrate was only slightly embedded (<20%) in fines. Stream banks were stable with no signs of erosion or undercutting. Stream bank vegetation was equally composed of trees, shrubs and grasses with the grasses and shrubs providing little shade to the stream via overhanging vegetation. Riparian vegetation consisted of coniferous forest along the left bank and mixed forest along the right. Stream flow during the assessment period was low and averaged 0.01 m^3/s in the thalweg. Based on stream morphology and spring input the velocities are not anticipated to vary drastically during the year.

In the west reach of the stream (immediately upstream of the existing highway, extending downstream to Mill Lake) the small, shallow stream was approximately 2 m in width with an average depth of 17 cm and surrounded by coniferous forest. Multiple pools were observed within the assessment area and all the pools were observed to be less than 1.5 m deep with limited instream cover. This watercourse entered a concrete culvert which passed under the existing highway; on the downstream side of the highway the culvert emptied into a small plunge pool. Small areas of gravel were observed in the downstream section of the stream which were not present in the upstream section. The substrate within the riffle and run habitat along the remainder of the stream was composed of large substrate with boulders, cobble and gravel; sand embedded the larger substrate slightly (<20%). A large portion of the boulders was exposed above the waterline and covered in moss. Stream banks were deemed mostly stable/bare stable and showed minimal signs of erosion and undercutting. Stream bank vegetation consisted of an even mix of trees, shrubs and grasses with patches of bare soil. Beyond the stream banks the riparian vegetation community consisted of coniferous forest on both sides of the steam. Flows during the assessment period were moderate and averaged 0.18 m^3/s in the thalweg.

Electrofishing was performed on September 22, 2009 and yielded the results in Table 5.17.

Table 5.17 Electrofishing Results for WC-4

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	4	6.4 - 16.3

WC-5 Mill Lake Backwater Pond

Mill Lake Backwater Pond is a shallow pond with standing dead wood emerging from the water. With a surface area of 5740 m^2 and a maximum length of 208 m (northwest to southeast) the pond is protected from the wind and the associated fetch. Mill Lake Backwater Pond is adjacent to Mill Lake and while a continuous connection between the two water bodies is not present, it is possible that during periods of heavy precipitation or snow melt there may be a temporary connection. The substrate of Mill Lake Backwater Pond was composed of fine organic sediments. Algal slimes and filamentous algae were present in addition to lily pads and emergent flora. Riparian vegetation consisted predominantly of shrubs and trees on stable banks with no signs of undercutting or erosion. Very little of this vegetation overhung the water and the percent shade attributed to overhanging and canopy vegetation was less than 5%. Based on observations of substrate topography and flora, the backwater pond appears to be a flooded wetland and is identified on the wetland mapping as WL-99.

The heavy organic sediments comprising the Mill Lake Backwater Pond substrate do not provide desirable fish habitat within the Pond. The Pond also lacks a surface water connection to Mill Lake. To confirm the presence or absence of potentially stranded resident fish within the Backwater Pond, four minnow traps were set overnight July 7th, 2010. Two of the four traps were removed from the Pond overnight by raccoons but were not opened. No evidence of fish was found within the removed minnow traps. No fish were caught by the two minnows traps that remained set in the Pond overnight. Therefore, WC-5, Mill Lake Backwater Pond is not considered to be a fish-bearing watercourse.

WC-6 Mill Lake

Mill Lake is a moderately large lake intersected by the Hwy 103 causeway and bordered by a NSP access road along the western lake edge; in addition, NSP owns and operates a generation station on the Lake. With a surface area of 298,490 m^2 and a maximum length of 1.37 km (north to south) the lake is semi-protected from the wind and the associated fetch. NSTIR has determined that the lake is navigable. The Project will have the potential for direct effects on navigability within the lake.

The substrate, where observed, appeared to be composed of a mix of substrate classes from boulders to fine organic sediments with a greater proportion of boulder than any other class. Riparian vegetation consisted of mostly shrubs and grasses on stable banks. The westerly lake edge was void of vegetation as a result of armour rock which has been used to stabilize the NSP access road. Large woody debris in the lake was abundant and indicated that the lake may have been impounded and lake levels elevated. Algal slimes, submergent macrophytes and other emergent flora were present. Very little of this vegetation overhung the water and the percent shade attributed to overhanging and canopy vegetation was less than 5%.

Electrofishing was performed in multiple areas of the shallow littoral zone on September 29, 2009 and yielded the results in Table 5.18.

Table 5.18 Electrofishing Results for WC-6 Mill Lake

Scientific Name	Common Name	Number Caught	Size Range (cm)
Pungitius pungitius	Ninespine stickleback	3	5.2 - 5.7
Fundulus diaphanus	Banded killifish	4	2.8 - 9.9

Baited minnow traps were set on September 29, 2009, left overnight and yielded the results in Table 5.19.

Table 5.19 Minnow Trap Results for WC-6 Mill Lake

Scientific Name	Common Name	Number Caught	Size Range (cm)
Pungitius pungitius	Ninespine stickleback	3	6.0 - 6.2
Perca flavescens	Yellow perch	8	6.4 - 9.5

WC-7 Little Indian Lake

Little Indian Lake is a small, shallow lake intersected by the Hwy 103 causeway and bordered by wetlands, including the large wetland (WL-49) along the west bank which encompasses the majority of the riparian zone. With a surface area of 106,237 m^2 and a maximum length of 855 m (north to south) the lake is protected from the wind and the associated fetch. NSTIR has determined that the lake is navigable. The navigability of the lake has the potential to be directly affected by the Project.

The substrate appeared to be composed of a mix of substrate classes from boulders to fine organic sediments in the areas observed from shore, with a greater proportion of organic fines than any other class. Riparian vegetation consisted predominantly of shrubs and grasses on stable banks. Large woody debris was present in the lake. Algal slimes, filamentous algae, submergent macrophytes and other emergent flora were present at the time of the survey. Very little of this vegetation overhung the water and the percent shade attributed to overhanging and canopy vegetation was less than 5%.

A lake-specific fish survey was not carried out for Little Indian Lake. Multiple fish species were confirmed using electrofishing in the Little Indian River (see WC-8 summary below). The Little Indian River connects directly to Little Indian Lake. A timber spill-way style structure crosses the Little Indian River at the outlet of Little Indian Lake. This structure may prevent fish passage during low flow conditions (*e.g.*, July and August) but allows fish passage during high flows. Therefore, it is safe to assume that Little Indian Lake has the potential to support the same fish assemblage as observed in the Little Indian River at a minimum.

WC-8 Little Indian River

The Little Indian River is a moderately-sized river draining south from Little Indian Lake. The river starts at the outlet of Little Indian Lake, located south of the proposed RoW at the edge of the Project Study Area. The river was approximately 2 m wide with an average depth of 15 cm in the assessment area during the July 2010 habitat survey. The substrate was dominated by boulder and small cobble, with some large cobble and large pebble as well. Macrophytes observed in the river included emergent, floating and rooted floating varieties. Large woody debris was located within the stream and both slimes and attached algae varieties were present. The river banks on both sides represented an even mix of vegetated stable and bare stable sections. No undercutting was observed. River bank vegetation consisted predominantly of grasses, with a mix of shrubs and trees in lesser amounts. Beyond the river banks, riparian vegetation was mainly deciduous extending 100 m from each river edge.

Electrofishing was performed on September 29, 2009 downstream of the assessment area in a wider, deeper area of the river and yielded the results summarized below. There are no known barriers to fish passage between the area fished and the habitat assessment area located further upstream.

Table 5.20 Electrofishing Results for WC-8 Little Indian River

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	7	7.9 - 17.6
Pungitius pungitius	Ninespine stickleback	5	4.4-4.7
Anguilla rostrata	American eel	5	20 - 32

WC-9

WC-9 a small, perennial, unnamed stream originates from a spring North of Highway 103. The stream runs south and crosses under the highway through a 61 cm diameter concrete culvert. Once on the south side of the highway the watercourse flows east within the ditch for approximately 500 m, where it veers into the mixed forest south of Highway 103 and flows southeast for 225 m until dissipating into a wetland (WL-52) before the Little Indian River. As a result of the stream dissipating into the wetland, WC-9 does not provide a direct connection to the Little Indian River and therefore fish passage is interrupted between the river and the unnamed stream. Within the assessment area the unnamed stream characteristics vary.

Initially the stream flows through mixed forest over rock and rubble covered in moss. The stream channel width measured less than one meter (0.75 m) with an average depth of 25 cm. The substrate was composed of a fairly even mix of rock, cobble, sand and fines with patches of gravel and the occasional exposed boulder. The stream banks were not entrenched and appeared stable during the survey. Canopy cover was approximately 60%, resulting predominantly from the trees along both banks and minimally from grasses and shrubs also present within the riparian zone.

Downstream of the culvert the watercourse characteristics changed. The canopy cover decreased due to the proximity to the highway and instream velocities increased due to increased slope (changing the flow patterns from that of a run to a riffle). The minimal stream shading observed was provided by the vegetation within the highway ditch; the ditch vegetation was dominated by alders and shrubs. The substrate changed to mostly gravel with sand and areas of exposed bedrock; the gravel appeared to be of similar size to that used along the shoulders and under the asphalt on the existing highway. The stream was entrenched within the ditch and showed signs of erosion along both banks. Stream velocity during the assessment period was low and averaged 0.02 m^3/s in the thalweg.

As a spring-fed watercourse with no connection to the Little Indian River or other fish-bearing watercourses, WC-9 is not considered to have the potential to bear fish. Therefore, no fishing survey was carried out in WC-9.

WC-10

WC-10 is an unnamed stream that originates from wetland 99 located in the north ditch of highway 103. The stream follows the ditch along the north side of the highway through a 61 cm corrugated culvert under an old logging road, continues through an additional wetland before passing under the highway through a 61 cm concrete culvert. Along the north side of the highway the 0.65 m wide stream had depths ranging between 0.12 and 0.16 meters. The substrate consisted of an equal mix of rubble, gravel and sand with areas of organic fines and exposed bedrock. The predominant flow pattern of the stream was run, with pools present of depths less than 0.50 m. Stream banks were stable and vegetated predominately with grasses; overhanging vegetation was minimal and covered approximately 5% of the stream length. The stream was mostly shaded with canopy cover at 70%. Submergent macrophytes and algal slimes were present.

South of highway 103 the watercourse runs south east and drains into a wetland approximately 130 m from the highway. The downstream section of WC-10 passed under stands of coniferous trees and the gradual slope observed in the initial 50 m of the downstream assessment area increased for the remaining 80 m. Substrate within the initial 50 m was composed of sand and organics with large woody debris present, as well as submergent and emergent macrophytes. Beyond the 50 m mark the slope increased and the watercourse cascaded over rocks, roots and boulders. This hard substrate was covered with organics such as leaf litter and sphagnum. At the end of the 80 m section of cascades the slope decreased and the watercourse dissipated into a wetland. Stream flow during the assessment period was low and averaged 0.04 m^3/s in the thalweg.

A presence/absence electrofishing survey was performed on October 2, 2009 with 179 s of effort in a 15 m section upstream until fish habitat diminished. The 80 m downstream reach was fished as well, but no fish were observed.

WC-11 Porcupine Brook

Porcupine Brook is a straight perennial stream draining from Porcupine Lake and eventually feeding St. Margarets Bay with fish habitat observed throughout the assessment area. The reach upstream of Highway 103 is relatively straight with a mix of riffle/run habitat and pools approximately 1 to 1.5 m deep. The sections of run measured 4 m in width with an average depth of 0.60 m. NSTIR identified one "unnamed brook" as navigable following their inquiry on navigability of all watercourses crossed by the Project. It is assumed that WC-11, known herein as Porcupine Brook, is the unnamed brook to which they were referring. The Project will have the potential for direct effects on the navigability of WC-11.

The substrate was predominantly boulder and rock with sand embedded in the interstitial spaces. Instream vegetation consisted of filamentous algae and submergent macrophytes. Stream banks appeared to be vegetated and stable in the majority of areas; small areas of stream bank were observed to be stable but void of vegetation with slight undercutting. Riparian vegetation consisted of shrubs and grasses in a predominantly coniferous forest. The ground vegetation overhung the banks providing 10 % shade for the stream with canopy cover at 20%. At the northern end of the assessment area the riparian zone is cleared of trees because a NSPI transmission line crosses the brook at this point. An ATV trail runs under the transmission line and a small bridge is present across the brook. This trail continues along the east bank of Porcupine Brook and passes under the existing highway through a dry 183 cm culvert to the left of the identically sized culvert which Porcupine Brook flows through.

The reach downstream of Highway 103 meandered through an upland coniferous forest and split into two channels (2 m and 2.5 m wide) 120 m downstream of the highway before merging back into one channel (3.5 m wide). A large pool was present 30 m downstream of the culvert with another located at the divergence of the main and side channels. Habitat differed within the main and side channels. The main channel provided mostly riffle habitat with two pools observed and a 5 m section where deadfalls had created a cascade. In the side channel velocity was lower and it was mostly run habitat. Substrate and instream vegetation within the main and side channels in the downstream section were similar to that of the upstream. The stream banks appeared stable and vegetated throughout the assessment area and slight undercutting was observed in both the main and side channel. Riparian vegetation in the downstream section consisted of mixed forest with mostly grasses and sphagnum species covering the forest floor.

An input to Porcupine Brook was observed in the upstream section, approximately 100 m in length and draining from wetland WL-127. This small, unnamed tributary drained from the wetland, crossed a dirt access road by flowing over the road (*i.e.*, no culvert installed) and then drained through a steep gradient to Porcupine Brook. The stream section located downstream of the dirt access road was well defined, entrenched and dominated by a rocky substrate.

Upstream of the access road, the watercourse gradient flattens out and flow is less than that observed downstream. Substrate in this upper region is dominated by sand. Another input to Porcupine Brook was located in the downstream section, approximately 75 m in length. This unnamed tributary flowed from wetland WL-128 and is anticipated to be dry for a portion of the year. Based on the width, depth, flow and slope this additional input is not anticipated to provide fish habitat.

Stream flow during the assessment period was low and averaged 0.25 m^3/s in the thalweg.

Electrofishing was performed on September 22, 2009 and yielded the results in Table 5.21.

Table 5.21 Electrofishing Results for WC-11 Porcupine Brook

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	4	4.8 - 19.8
Anguilla rostrata	American eel	9	10 - 30
-	Salmonidae spp. [1]	4	N/A

[1] Fish stunned but not caught; identified to family level only.

WC-12

WC-12 is an intermittent stream that runs east to west, originating from wetland WL-131. The watercourse remained on the north side of the highway and emptied into wetland WL-135 approximately 300m downstream. The narrow, shallow stream was approximately 0.80 m in width with an average depth of 25 cm and surrounded by coniferous forest. The substrate was composed of organic material within the initial 140 m reach and where the watercourse discharge increased downstream, the fine substrate was scoured away revealing cobble and gravel embedded in sand with a layer of organics. Stream banks were predominantly stable with sections of bare, stable banks showing minimal signs of undercutting. Stream bank vegetation was dominated by grasses. Beyond the stream banks the riparian vegetation community consisted of coniferous forest along both banks. Stream flow during the assessment period was low and averaged 0.03 m^3/s in the thalweg.

Based on the field survey and stream conditions described above (*i.e.,* drainage between two wetlands), WC-12 was not considered a fish-bearing stream. Therefore, no electrofishing survey was carried out in the watercourse.

WC-13

WC-13 is a perennial straight stream that runs east to west, originating from wetland WL-135. This watercourse remained on the north side of the highway and drained into wetland WL-138. The narrow, shallow stream was approximately 0.15 m in width with an average depth of 10 cm and surrounded by coniferous forest. The substrate was composed of rock and cobble embedded in a layer of organics. Stream banks were deemed mostly stable and showed no signs of undercutting or erosion. Stream bank vegetation consisted predominantly of grasses. Beyond the stream banks the riparian vegetation community consisted of coniferous forest along both banks. Stream flow during the assessment period was low and averaged 0.006 m^3/s in the thalweg.

As a watercourse connecting two wetlands with no connection to fish-bearing waters, WC-13 is not considered a fish-bearing watercourse. No electrofishing was carried out in WC-13 for this reason.

WC-14

WC-14 is a perennial, straight tributary to the Ingram River that runs east to west originating from wetland WL-141 and passing through wetland WL-142. The narrow, shallow stream was approximately 1.25 m in width with an average depth of 15 cm and surrounded by coniferous forest. This watercourse remained on the north side of the highway and emptied into the Ingram River. The substrate was a mix of boulders and rocks in the upper sections and changed to sand and silt with organic fines in the lower wetland area. Stream banks were stable and showed minor signs of undercutting. Stream bank vegetation was dominated by grasses. Beyond the stream banks the riparian vegetation community consisted of coniferous forest with areas of wetland along both banks. Stream flow during the assessment period was low and averaged 0.01 m^3/s in the thalweg.

A presence/absence electrofishing survey was performed on October 6, 2009. The 100 m section of the watercourse upstream of the existing highway to the headwaters of the stream was fished (164 seconds of effort). No fish were observed during this survey.

WC-15 Ingram River

The Ingram River is a straight, perennial stream draining into St. Margaret‟s Bay. Fish habitat was observed throughout the assessment area. The reach upstream of Highway 103 is a meandering section with alternating riffle and run flow types; pools greater than 1.5 m deep were also observed in this upstream reach. The riffle and run sections of the stream measured 10 m in width with an average depth of 0.75 m. NSTIR has identified the Ingram River as a navigable watercourse. The Project has the potential to have direct effects on the river.

The substrate was dominated by rock and cobble with gravel and sand embedded in the interstitial spaces. Instream vegetation consisted of submergent and emergent macrophytes with algal slime on the substrate. Stream banks appeared to be vegetated and stable with no visible undercutting. Riparian vegetation consisted of shrubs and grasses in a mostly deciduous forest. The ground vegetation overhung the banks, providing <5 % shade for the stream with canopy cover at 5%. The Ingram River crosses the existing highway under a single span bridge.

The river widens as it flows past the armor stone used in the construction of the existing highway bridge. The river is narrower under the bridge, where it was approximately 8 m wide. The river widened to 15 m downstream of the bridge at the time of the survey. The reach downstream of Highway 103 meandered through an upland coniferous forest. Habitat within the stream was a mixture of run and riffle flow types. The substrate was predominantly boulder with gravel and sand embedded in the interstitial space in the downstream reach. Instream vegetation consisted of submergent and emergent macrophytes with algal slime on the substrate. Stream banks appeared to be vegetated and stable with no visible undercutting. Riparian vegetation consisted of shrubs and grasses in a dominantly deciduous forest. The ground vegetation overhung the banks providing <5 % shade for the stream with canopy cover at 5 %. Stream flow during the assessment period was moderate and averaged 4.13 m^3/s in the thalweg.

Electrofishing was performed on September 22, 2009 and yielded the results in Table 5.22.

Table 5.22 Electrofishing Results for WC-15 Ingram River

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	1	18
Catostomus commersoni	White sucker	9	5.2 - 15.6
Anguilla rostrata	American eel	84	10 - 55
Rhinichthys atratulus	Blacknose dace	1	4.3
Salmo salar	Atlantic salmon	1	7.1
Fundulus diaphanus	Banded killifish	1	7.4

WC-16

WC-16 is a perennial, straight tributary to the Ingram River that runs west to east originating from under highway 103 and passing through wetlands WL-149 and WL-145. At the origin, an area of borrow rock is present under highway 103; this borrow is dominated by large boulders and the watercourse is audible but not visible in this area. Where the stream did become visible, emerging from under the borrow rock, the narrow, shallow stream was approximately 0.5 m in width with an average depth of 10 cm. The stream was surrounded by coniferous forest on the left bank and highway along the right. This watercourse remained on the north side of the highway and emptied into the Ingram River. The substrate was a mix of sand and gravel interspersed with boulders; organic sediments were present as the watercourse passed through the wetlands. Stream banks were stable and mostly stable, and showed minor signs of undercutting. Stream bank vegetation consisted of shrubs and grasses. Stream flow during the assessment period was low and averaged 0.02 m^3/s in the thalweg.

Electrofishing was performed on October 2, 2009 and yielded the results in Table 5.23.

Table 5.23 Electrofishing Results for WC-16

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	4	6.6 - 10.9

WC-17

WC-17 is a spring-fed perennial stream that runs west to east, originating from wetland WL-150 located approximately 5 m south of the existing highway. The narrow, shallow stream flows along the southern side of highway 103 and through a small section of deciduous forest before draining into wetland WL-146 adjacent to the Ingram River. WC-17 was approximately 0.5 m in width with an average depth of 10 cm at the time of the survey. The substrate was comprised primarily of fines and organic deposition from leaves and sphagnum species. Rocks and boulders were interspersed throughout the stream. Algal slimes and submergent macrophytes were present and attached to the substrate. Stream banks were stable and showed minimal signs of undercutting. Stream bank vegetation consisted of an even mix of shrubs and grasses. The riparian vegetation community consisted of coniferous forest beyond the south stream bank and an open grassy ditch and highway 103 beyond the north stream bank. Flows during the assessment period were low and averaged 0.01 m^3/s in the thalweg.

WC-17 is a spring-fed stream that does not connect to the Ingram River or any other fish-bearing waters. Therefore, the stream is not considered a fish-bearing watercourse and no electrofishing was carried out in the stream.

WC-18

WC-18 is a wetland-fed perennial stream that runs north to south. Two streams originating from wetlands WL-169 and WL-172 converge approximately 5 m north of the existing highway before flowing into the 91.5 cm concrete culvert. The East branch is the larger of the two streams; it originates from wetland 169 and flows east to west before entering the culvert under highway 103. The second stream originating from WL-172 is a narrow, shallow ephemeral stream that runs along the highway ditch. Characteristics for this tributary are similar to WC-18 with the exception of width and depth (narrower and shallow). Downstream of Highway 103, WC-18 flows through three wetlands (WL-171,WL-173,WL-175) before entering Kieley Lake. Throughout the upstream assessment area WC-18 was approximately 1.5 m in width with an average depth of 15 cm. Further downstream the watercourse widened to 2.2 m and deepened to 20 cm; velocity decreased as it entered wetland WL-171. The substrate was primarily sand and gravel upstream of the highway while downstream of the highway the substrate consisted of rock, cobble, and gravel with little organic material or sand prior to entering the wetland, where the substrate became dominated by organics. Algal slimes, crusts and submergent macrophytes were present and attached to the substrate throughout the assessment area.

Stream banks were stable upstream and showed slight signs of erosion and undercutting. Stream bank vegetation consisted primarily of grasses and sphagnum species. Beyond the stream banks the riparian vegetation community consisted of mixed forest upstream and mainly coniferous forest downstream. Flows during the assessment period were moderate and averaged 0.05 m^3/s in the thalweg.

A presence/absence electrofishing survey was performed on October 1, 2009 with 554 seconds of effort in a 70 m section downstream of the existing highway and a 50 m section upstream of the highway. No fish were observed.

WC-19

WC-19 is an ephemeral, drainage fed stream that originates downstream of the highway and runs south into Kieley Lake. The narrow, shallow stream was approximately 0.5 m in width with an average depth of 5 cm at the time of the survey. The substrate was primarily sand and organics with larger substrate embedded by more than 50%. Algal slimes, crusts and submergent macrophytes were present and attached to the substrate throughout the assessment area. Stream banks were deemed stable with no signs of undercutting. Stream bank vegetation consisted of grasses and sphagnum species with some areas void of vegetation. Beyond the stream banks the riparian vegetation community consisted of mainly coniferous forest. Flows during the assessment period were low and not detectable in the thalweg.

A fish presence/absence survey was not carried out in WC-19 as a result of the presence of a natural barrier to fish downstream of the assessment area. A steep gradient change was observed starting at approximately 145 m downstream of the existing Highway 103. The gradient was determined to be substantial enough to prevent the passage of fish upstream of this natural barrier. Therefore, despite the connection to Kieley Lake, WC-19 is not considered to be fish-bearing within the Project Study Area or immediately downstream.

WC-20 and 20A

WC-20 is a perennial stream that originates upgradient of the highway and runs south into Kieley Lake. The stream was approximately 1.0 m in width with an average depth of 15 cm. Within the upstream assessment area the substrate was primarily rock and rubble surrounded by sand and gravel, the larger substrate being embedded by less than 20%. Downstream, sand and gravel dominated with a layer of organics present in slow moving run areas. Algal slimes and submergent macrophytes were present and attached to the substrate throughout the upstream assessment area. Stream banks appeared stable with minimal undercutting. Stream bank vegetation consisted of grasses and sphagnum species. Beyond the stream banks the riparian vegetation community consisted of forested wetland vegetation upstream and coniferous forest downstream. Flows during the assessment period were low at 0.01 m^3/s in the thalweg.

WC-20A is an ephemeral, drainage-fed stream that joins WC-20 before entering the culvert under the existing highway. Substrate within WC-20A consisted of organics, vegetation and sphagnum over sand. It is anticipated that at the time of the survey, WC-20A was supporting drainage of the rain that had fallen during the previous 48 hours.

A presence/absence electrofishing survey was performed on September 29, 2009 with 515 seconds of effort in a 75 m section downstream of the existing highway and a 50 m section upstream of the highway. No fish were observed.

WC-21 Mud Lake Brook

WC-21 is a perennial stream that runs north to south originating from Mud Lake approximately 3 km north of Highway 103. WC-21 passes under the highway through a 91.5 cm concrete culvert before draining into wetland WL-188 and subsequently Kieley Lake. Upstream, WC-21 was approximately 3.0 m in width with an average depth of 20 cm; further downstream the watercourse narrowed to 1.25 m and deepened to 50 cm. The velocity of the stream decreased as it flowed through wetland WL-188. Upstream of the existing highway the substrate contained rock ranging in size from gravel to boulder, with very little organic material. Once the watercourse entered wetland WL-188 downstream of the highway, the substrate changed to primarily organic material. Algal slimes, crusts were present and attached to the substrate throughout the assessment area. Macrophytes were abundant downstream leading into the wetland; grasses as well as both submergent and emergent varieties of other macrophytes were observed. Stream banks were deemed stable upstream and were mostly stable downstream with sections of erosion and undercutting. Stream bank vegetation consisted of mostly grasses and sphagnum species. Beyond the stream banks the riparian vegetation community consisted of mainly coniferous forest. Flows during the assessment period averaged 0.15 m^3/s in the thalweg.

Electrofishing was performed on September 25, 2009 and yielded the results in Table 5.24.

Table 5.24 Electrofishing Results for WC-21 Mud Lake Brook

Scientific Name	Common Name	Number Caught	Size Range (cm)
Anguilla rostrata	American eel	2	10 - 15

WC-22

WC-22 is a perennial, wetland fed stream that runs south alongside Highway 103. Originating from wetland WL-209, WC-22 remains on the south side of the highway running through coniferous forest before draining into wetland WL-225. WC-22 was approximately 0.5 m in width with an average depth of 5 cm. The substrate within the assessment area was composed of sand overlaid with organic material. Algae were abundant within the watercourse and macrophytes were present within the entire watercourse; grasses were abundant throughout wetland WL-225. Stream banks were deemed stable with minimal undercutting visible on one bank. Stream bank vegetation consisted of mostly grasses, sphagnum species and shrubs. Flows during the assessment period averaged 0.001 m^3/s in the thalweg.

WC-22 is a wetland-fed, roadside drainage channel that is anticipated to be ephemeral and does not support adequate fish habitat. Therefore, the stream is not considered a fish-bearing watercourse and no electrofishing was carried out in the stream. The stream does not have a defined connection to WC-23 but has the potential to overflow into WC-23 during high flow conditions.

WC-23

WC-23 is a perennial, wetland-fed stream originating from wetland 215. WC-23 runs south alongside highway 103 before passing under the highway through a 91.5 cm concrete culvert which drains into wetland WL-225 and subsequently into The Puddle. WC-23 was approximately 0.75 m in width with an average depth of 15 cm. The substrate was composed of sand and gravel overlaid with organic material. Algae were abundant within the watercourse and macrophytes were present within the entire watercourse; grasses were abundant throughout the wetlands. Stream banks were determined to be stable with no undercutting observed. Stream bank vegetation consisted predominantly of grasses, and sphagnum species. Beyond the stream banks the riparian vegetation community was dominated by coniferous forest and the existing highway. Flows during the assessment period averaged 0.007 m^3/s in the thalweg.

Electrofishing was performed on September 25, 2009 and yielded the following results within the tidally influenced portion of the stream. Electrofishing was also carried out (July 7, 2010) in the freshwater area of the stream immediately downstream of the existing highway. No fish were caught within the freshwater portion of the stream. The lower, tidally influenced portions of the stream are anticipated to be the only areas of WC-23 to support fish as the remainder of the stream represents very poor fish habitat, with several areas of braiding and very low (or no) flowing water.

Table 5.25 Electrofishing Results for WC-23

Scientific Name	Common Name	Number Caught	Size Range (cm)
Unidentified (tidal influence; fish would not stun effectively)	N/A	2	-

WC-24 Stillwater Brook

WC-24, known as Stillwater Brook, is a perennial watercourse that originates from Big Loaf Hill Lake and runs south into The Puddle. The stream was approximately 4.0 m in width with an average depth of 60 cm in the assessment area. Upstream the substrate was primarily boulder surrounded by sand and gravel with the larger substrate being embedded by less than 20%. The lower sections of the upstream reach were tidally influenced at high tide. The water from The Puddle backs up through the culvert at high tide and meets the freshwater flowing down the cascade approximately 40 m upstream of the existing highway. The Puddle is located immediately downstream of the existing highway; therefore, WC-24 does not continue on the downstream side of the highway. Algal slimes and submergent macrophytes were present and attached to the substrate throughout the upstream assessment area. The stream banks were not entrenched and appeared predominantly stable with areas of erosion on the western banks. Stream bank vegetation consisted of grasses and trees. Beyond the stream banks the riparian vegetation community consisted of coniferous forest. Flows during the assessment period were 0.35 m^3/s in the thalweg.

Electrofishing was performed on September 25, 2009 and yielded the results in Table 5.26.

Table 5.26 Electrofishing Results for WC-24 Stillwater Brook

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	4	6.4 - 13.7
Fundulus diaphanus	Banded killifish	4	3.0 - 7.8
Anguilla rostrata	American eel	79	7.5 - 35
Apeltes quadracus	Fourspine stickleback	14	3.5 - 4.5
Gasterosteus aculeatus	Threespine stickleback	6	3.1 - 4.2
Gasterosteidae spp.	Stickleback spp.	7	N/A

WC-25

WC-25 is a wetland fed perennial stream that runs south to north. Originating from the wetland WL-233 area the narrow, shallow stream runs within the ditch alongside the existing highway for approximately 800 m before entering Stillwater Brook. WC-25 was approximately 0.3 m in width with an average depth of 10 cm at the time of the survey. Closer to Stillwater Brook the watercourse widened to 0.75 m, deepened to 15 cm and supported an increased velocity as slope and the associated drainage increased. The substrate was primarily gravel with sand; little organic material was observed. Algal slimes and submergent macrophytes were present and attached to the substrate throughout the assessment area. Stream banks were deemed stable and bare stable; the bare stable sections were observed in areas where the stream bank shared the highway shoulder. Stream bank vegetation was dominated by grasses and small woody stemmed plants. Beyond the stream banks the riparian vegetation community consisted of mainly coniferous forest and the existing highway to the south. Flows during the assessment period averaged 0.005 m^3/s in the thalweg.

WC-25 is not considered a fish-bearing watercourse and no electrofishing was carried out during the EA. The stream does connect directly to Stillwater Brook, but a steep cascade section is present at the downstream end of the stream preventing fish passage into the watercourse from Stillwater Brook.

WC-26

WC-26 is a wetland-fed perennial stream originating from wetland WL-253 north of the existing highway. WC-26 runs south where the narrow, shallow stream passes under the highway through a 61 cm concrete culvert. Downstream of the existing highway the watercourse drains into a plunge pool below a hung culvert and flows approximately 25 m before draining into wetland WL-252. Upstream WC-26 was approximately 1.0 m in width with an average depth of 20 cm. The watercourse widened to approximately 1.5 m and deepened to 25 cm in areas. The substrate was primarily gravel and sand with interspersed cobble. Gravel beds were also noted in the upstream and downstream assessment areas although they were not of sufficient size to be considered salmonid spawning habitat. Algal slimes with both submergent and emergent macrophytes were present and attached to the substrate throughout the assessment area. Stream banks were determined to be a mix of stable and bare stable with sections of eroding banks in the upstream assessment area. Stream bank vegetation consisted predominantly of grasses, sphagnum species and small woody stemmed plants which provided very little overhanging vegetation. Beyond the stream banks the riparian vegetation community consisted of mainly coniferous forest with a cleared area visible upstream. Flows during the assessment period averaged 0.03 m^3/s in the thalweg.

Electrofishing was performed on September 30, 2009 and yielded the results in Table 5.27.

Table 5.27 Electrofishing Results for WC-26

Scientific Name	Common Name	Number Caught	Size Range (cm)
Anguilla rostrata	American eel	1	10.0

WC-27

WC-27 is a narrow stream running through wetland WL-277. Land-owner permission was not granted for the majority of the watercourse falling within the Project Study Area. A small section was accessible for electrofishing but was of insufficient size to complete a full fish habitat assessment. It was noted that the water in the accessible portion of the defined stream north of the existing highway was darkly tea-stained, the substrate included a substantial amount of fines, and stream width was approximately 1 m. Stream banks appeared primarily stable and the riparian zone was dominated by wetland habitat. Approximately 30 m of the watercourse was electrofished on September 30, 2009; the results are summarized in the table below. Two baited minnow traps were set overnight on October 1, 2009 in the standing water area of the watercourse, immediately beside the existing Highway 103. No fish were caught in the minnow traps during the overnight set.

Table 5.28 Electrofishing Results for WC-27

Scientific Name	Common Name	Number Caught	Size Range (cm)
Anguilla rostrata	American eel	1	12.0

WC-28

WC-28 is a fast moving, perennial stream that runs southwest into the Hubbards River. Flowing from Otter Pond approximately 1.75 km north of Highway 103, WC-28 runs through wetland WL-294 before passing under a logging road through a 61 cm corrugated steel culvert and feeding Hubbards River. WC-28 was approximately 3.0 m in width with an average depth of 50 cm. Water was ponded upstream of the logging road at the outlet of Wetland WL-294. Due to the elevation of the impounded water and the steep slope of the culvert, high velocities were observed throughout WC-28. The substrate was primarily rock and rubble with smaller substrate removed by the hydraulic force. Algae and macrophytes were not observed within the assessment area. Stream banks were deemed unstable and eroding. Stream bank vegetation consisted primarily of grasses and small woody stemmed plants which provided very little overhanging vegetation. Beyond the stream banks the watercourse was bounded by coniferous forest, wetland and the existing highway. Flows during the assessment period averaged 0.21 m^3/s in the thalweg.

WC-28 is not considered a fish-bearing watercourse. The steep slope and high velocity of the stream serve as barriers to fish passage from Hubbards River. Therefore, WC-28 was not included in the electrofishing survey.

WC-29 Hubbards River

Hubbards River originates from the top of the watershed; the existing highway intersects with the River at a point south of Dorey Lake. At this location, below the outlet of the lake and upstream of the existing highway, the river exhibits a riffle type habitat. The shallow, wide watercourse passed over boulders surrounded by rock and cobble. As a result of the turbulence and high velocity, very little organic or fine sediment was observed at this location. Upstream of the existing highway Hubbards River was approximately 10 m wide with a depth of approximately 40 cm and a flow that averaged 3.76 m^3/s at the time of the survey. Stream banks were observed to be stable and vegetated with grasses, small woody stemmed plants, alders and mature trees. Beyond the stream banks the riparian community was observed to be dominated by coniferous forest.

Downstream of the highway the river widened, slowed and deepened. The majority of pools observed within the assessment area were found within the downstream survey area. Within the downstream section the substrate remained dominated by boulders with some rock and cobble. Stream banks remained stable and riparian vegetation changed slightly as more mature trees were observed. A large still-water area (Shenkles Pond) was located 125 m downstream of the existing highway, off the left side (looking downstream) of the river. On the right side of the river, a sheltered pool was observed upstream of Shenkles Pond.

Electrofishing was performed on September 30, 2009 and yielded the results in Table 5.29.

Table 5.29 Electrofishing Results for WC-29

Scientific Name	Common Name	Number Caught	Size Range (cm)
Anguilla rostrata	American eel	60	10 - 51
Catostomus commersoni	White sucker	3	12.9 - 14
Salvelinus fontinalus	Brook trout	1	14

WC-30

WC-30 is a wetland-fed, perennial stream that originates from wetland WL-288 and runs through the southern edge of wetland WL-294 to Hubbards River. WC-30 runs along the north side of the highway for approximately 120 m and was 0.40 m in width with an average depth of 8 cm at the time of the survey. The substrate was primarily gravel and sand with increased organic material where the stream runs through the southern section of wetland WL-294. Emergent macrophytes were present and attached to the substrate throughout the assessment area. Stream banks were determined to be stable with no visible signs of erosion or undercutting. Stream bank vegetation consisted of grasses, sphagnum species and small woody stemmed plants which provided substantial cover for this small stream. Beyond the stream banks the riparian vegetation community consisted of roadside vegetation and the existing highway with a predominantly coniferous forest and wetland on the north banks. Flows during the assessment period averaged 0.004 m^3/s in the thalweg.

WC-30 is not considered to be fish-bearing because of the presence of a steep drop over a short distance at the confluence of the watercourse with Hubbards River. The steep gradient at the confluence is a natural barrier to fish passage.

WC-31 Dorey Lake

Dorey Lake is a small, glaciated lake north of Highway 103 that receives water from Hubbards River as well as Sawler Lake to the west. With a surface area of 107,639 m^2 and a maximum length of 740 m (north to south) the lake is protected from wind and the associated fetch. The riparian zone surrounding Dorey Lake consisted of mature coniferous forest with no observed anthropogenic stresses at the time of the survey. A rudimentary boat access site was observed on the south-western edge of the lake, close to the existing highway. The lake has been identified as navigable by NSTIR. It is drained by Hubbards River (WC-29), which can also be considered part of the navigable system. The navigability of this watercourse system has the potential to be directly affected by the Project.

Substrate in the littoral zone was composed of boulders surrounded by a mix of sand and gravel. Lake banks were comprised of boulders extending above the waterline 0.5 – 1 m; beyond the boulders the banks appeared vegetated and stable and the riparian vegetation consisted of grasses and mature trees. Algae and submergent macrophytes were present in the shallow area of the lake along the southern banks. An old net was observed at the inlet from Sawler Lake, which contained numerous yellow or white perch in various stages of decomposition (positive species-level identification was not possible as a result of the decomposition).

Electrofishing was performed in the littoral zone on September 30, 2009 and yielded the results in Table 5.30.

Table 5.30 Electrofishing Results for WC-31 Dorey Lake

Scientific Name	Common Name	Number Caught	Size Range (cm)
Anguilla rostrata	American eel	15	10 - 25

Baited minnow traps were set in the littoral zone on September 30, 2009, left overnight and yielded the results in Table 5.31.

Table 5.31 Minnow Trap Results for WC-31 Dorey Lake

Scientific Name	Common Name	Number Caught	Size Range (cm)
Perca flavescens	Yellow perch	1	N/A
Notropis cornutus	Common shiner	1	N/A

WC-32 Sawler Lake

Sawler Lake is a medium-sized glaciated lake north of Highway 103 which receives water from Dauphinees Mill Lake and drains into Dorey Lake. With a surface area of 667,319 m^2 and a maximum length of 1.5 km (northwest to southwest) the lake is semi-exposed to wind and the associated fetch. The riparian zone surrounding Sawler Lake consists of mature coniferous forest with recreational docks and cottages dotted sparsely along the southern and northern shores. Two areas of Sawler Lake were assessed during the field survey, one in the south-east cove and the second in the south-west cove; both coves represented the only areas of the lake that fell within the Project Study area. NSTIR has identified Sawler Lake as being navigable. The Project has the potential to have direct effects on the navigability of the lake.

Within the south-east cove substrate in the littoral zone was composed of boulders surrounded by a mix of sand and fines. Lake banks were comprised of boulders extending above the waterline 0.5 – 1 m. Beyond the boulders the banks appeared vegetated and stable and the vegetation consisted of grasses, small woody stemmed plants and mature trees. Algae and submergent macrophytes were present in the littoral zone along the southern banks.

Within the south-west cove substrate in the littoral zone was composed of sand and fines. There was a beach in the south-west cove that measured approximately 150 m in length and 2 m in width. Lake banks extended above the waterline 0.5 – 1 m and were eroding into the lake. Beyond the banks the riparian zone appeared vegetated and stable with a steep slope; the vegetation consisted of grasses, small woody stemmed plants and mature trees. Algae and submergent macrophytes were present in the littoral zone along with a large amount of woody debris from an active beaver.

Electrofishing was performed in the littoral zone of the south-east and south-west coves on September 30, 2009. No fish were caught using electrofishing in the south-east cove; the results for the south-west cover are summarized in Table 5.32.

Table 5.32 Electrofishing Results for WC-32 Sawler Lake

Scientific Name	Common Name	Number Caught	Size Range (cm)
Anguilla rostrata	American eel	6	8 - 15
Perca flavescens	Yellow perch	2	3.7 - 4.3
Fundulus diaphanus	Banded killifish	23	3.0 - 9.0
Catostomus commersoni	White sucker	3	4.4 - 5.5

Baited minnow traps were set in the littoral zones of both the south-east and south-west coves on September 28, 2009, left overnight and yielded the results in Table 5.33.

Table 5.33 Minnow Trap Results for WC-32 Sawler Lake

Scientific Name	Common Name	Number Caught	Size Range (cm)
Perca flavescens	Yellow perch	1	8.0

WC-33

WC-33 originates from a spring on the south side of the existing highway and runs north under the existing highway towards Sawler Lake through wetland WL-304. A direct surface water connection to the lake is not achieved as the stream becomes subterranean before the lake boundary. With an average depth of 5 cm and width of 0.60 m at the time of the survey, the small stream is likely ephemeral. The substrate was primarily sand with increased organic material where the stream runs through wetland WL-304. Submergent macrophytes (*i.e.*, sphagnum species) were present and attached to the stream banks throughout the assessment area. Stream banks were deemed stable with no visible signs of erosion and minimal signs of undercutting. Vegetation along the stream banks consisted of grasses, sphagnum species and mature trees which provided substantial shade for this small stream. Beyond the stream banks the riparian vegetation community consisted of roadside vegetation within the upstream section and mainly coniferous forest and wetland downstream of the existing highway. Flows during the assessment were non-detectable (ND) in the thalweg.

WC-33 is spring-fed and does not connect via surface water to Sawler Lake or any other fish-bearing watercourse. Therefore, the stream does not have the potential to bear fish and is not considered to be fish-bearing. The stream was not included in the electrofishing survey for this reason.

WC-34 Maple Lake

Maple Lake is a small sized, glaciated lake north of Highway 103 which appears to have no surface water inputs. With a surface area of 44,576 m^2 and a maximum length of 345 m (north to south) the lake is protected from the wind and the associated fetch. The riparian zone surrounding Maple Lake consists of mature coniferous forest with a few recreational docks and homes located along the western and northern shores. The south-eastern shore of Maple Lake was assessed during the survey since this is the only section of the lake within proximity of the Project Study Area. The substrate in the littoral zone was composed of gravel surrounded by a mix of sand and fines. Lake banks were comprised of till and extend above the waterline 0.25 – 0.50 m at the time of the survey. The banks appeared vegetated and stable with areas of bare stable till. Riparian vegetation consisted of grasses, small woody stemmed plants and mature trees. Algae, submergent macrophytes and small woody debris were present in the littoral zone along the southern banks.

Baited minnow traps were set in the south-eastern section of the lake on October 5, 2009, left overnight and yielded the results in Table 5.34.

Table 5.34 Minnow Trap Results for WC-34 Maple Lake

Scientific Name	Common Name	Number Caught	Size Range (cm)
Notemigonus crysoleucas	Golden shiner	3	5.4 - 7.3

WC-35

WC-35 is a perennial stream that originates from north of the highway and runs south through wetland WL-324 to Hubbards Cove. WC-35 forks approximately 110 m north of the highway into an east and west channel; the two channels merge again before entering the 183 cm concrete culvert. Both channels measured approximately 1.0 m in width with an average depth of 15 and 8 cm. The east channel which was the deeper of the two channels was considered the main channel.

Within the main (east) channel the substrate was a mix of substrate sizes ranging from boulder to sand. Sphagnum was present and attached to the substrate throughout the assessment area along with algal slime layers. Stream banks were deemed stable with no visible signs of erosion and minimal undercutting. Stream bank vegetation consisted of grasses, sphagnum species and small woody stemmed plants which provided substantial cover for this small stream. Beyond the stream banks the riparian vegetation community was dominated by coniferous forest and wetland vegetation along the west bank. Flows during the assessment period averaged 0.04 m^3/s in the thalweg.

Within the side (west) channel the substrate was primarily boulders with sand and some fines where the west channel passed through the wetland. Sphagnum was present and attached to the substrate throughout the assessment area as were algal slime layers. Stream banks were deemed stable with small areas of erosion and minimal undercutting. Stream bank vegetation consisted of grasses, sphagnum species and small woody stemmed plants which provided substantial cover. Beyond the stream banks the riparian vegetation community consisted primarily of coniferous forest and wetland vegetation along both banks. Flows during the assessment period averaged 0.04 m^3/s in the thalweg.

Downstream the watercourse meanders over substrate dominated by boulder and large cobble that was entrenched within a stone lined channel between two residences. The stream runs under Highway 3 through a box culvert. Downstream of the highway the watercourse continues through a mainly coniferous forest along the west banks and a residence along the east bank. Several foot paths cross the stream below the Highway 103 crossing. A pool was noted shortly downstream of the highway crossing and gravel beds were present further downstream. Stream banks were deemed stable with 10% of the banks being designated as bare stable. Stream bank vegetation consisted of grasses, sphagnum species and small woody stemmed plants which provided substantial cover. Beyond the stream banks the riparian vegetation community consisted of mixed forest and residential land along both banks.

Electrofishing was performed on October 1, 2009 and yielded the results in Table 5.35.

Table 5.35 Electrofishing Results for WC-35

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	2	10 - 17.9
Anguilla rostrata	American eel	1	30

WC-36

WC-36 originates on the north side of the existing highway and runs west along the existing highway towards WC 35. WC-36 joins with WC-35 upstream of the WC-35 culvert draining under the existing highway, at wetland WL-324. With an average depth of 15 cm and width of 1.0 m at the time of the survey the small stream is likely ephemeral. The substrate was primarily sand and gravel with increased organic material where the stream ran through wetland WL-324. Submergent macrophytes (*i.e.*, sphagnum species), algal slimes and crusts were present and attached to the substrate. Stream banks were determined to be stable with no visible signs of erosion and/or undercutting. Vegetation along the stream banks consisted of grasses, sphagnum species and small woody stemmed plants. The riparian vegetation provided minimal shade for the stream. Beyond the stream banks the riparian vegetation community consisted of roadside vegetation and coniferous forest. Flows during the assessment were non-detectable (ND) in the thalweg.

A presence-absence electrofishing survey was carried out on July 8, 2010, 25 m upstream of the confluence with WC-35. The results are summarized below. It is anticipated that the brook trout were stranded in the one remaining pool at the time of the survey since low water levels in July 2010 prevented a surface water connection between WC-36 and WC-35 at that time.

Table 5.36 Electrofishing Results for WC-36

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	11	4.4 – 21.2

WC-37

WC-37 originates from a spring on the north side of the existing highway and runs east along the highway towards WC-35. WC-37 becomes intermittent and subterranean before joining WC-35 upstream of the existing highway 103 culvert. The small stream (1 m average width) is anticipated to be ephemeral; it supported an average depth of 10 cm following a rain event but was predominantly dry during a second visit. The substrate is primarily sand and gravel with increased organic material where the stream runs through wetland WL-324. Submergent macrophytes (sphagnum species) were present and attached to the substrate as were algal slimes and crusts. Stream banks were found to be stable. No signs of erosion or undercutting were observed. Vegetation along the stream banks consisted of grasses, sphagnum species and small woody stemmed plants which provided minimal shade for this small watercourse. Beyond the stream banks the riparian vegetation community consisted of roadside vegetation and coniferous forest. Flows during the assessment were non-detectable (ND) in the thalweg.

Watercourse WC-37 does not connect to any fish bearing waters via surface flow. The watercourse is ephemeral and is anticipated to be dry during the summer months at a minimum.

Therefore, WC-37 is not considered to be fish-bearing. No fishing – ephemeral and dry most of the year.

WC-38 Puddle Lake

Puddle Lake is a medium sized, shallow, glaciated lake north of Highway 103 which appears to have an output to Stillwater Brook. With a surface area of 213,375 m^2 and a maximum length of 680 m (west to east) the lake is protected from the wind and the associated fetch. The lake has been identified as navigable by NSTIR. Navigability within the lake has the potential to be directly affected by the Project.

The riparian zone surrounding Puddle Lake consisted of mature coniferous forest with no visible anthropogenic pressures. The southern area of Puddle Lake was assessed during the survey; this is the only section of the lake that falls within the Project Study Area. The substrate in the littoral zone of the southern assessment area was composed of sand and boulder. Lake banks were comprised of till and extend above the waterline 0.25 – 0.50 m; the banks appeared vegetated and predominantly stable with approximately 20% of the bank area being considered bare stable till. Riparian vegetation consisted of grasses, small woody stemmed plants and mature trees. Algae were present and macrophytes were abundant (including emergent, submergent and floating varieties) within the littoral zone.

Electrofishing was performed in the littoral zone of the southern assessment area on September 28, 2009 and yielded the results in Table 5.37.

Table 5.37 Electrofishing Results for WC-38 Puddle Lake

Scientific Name	Common Name	Number Caught	Size Range (cm)
Anguilla rostrata	American eel	6	12 - 31
Perca flavescens	Yellow perch	2	5.2 - 10.6

Baited minnow traps were set on September 28, 2009, left overnight and yielded the results in Table 5.38.

Table 5.38 Minnow Trap Results for WC-38 Puddle Lake

Scientific Name	Common Name	Number Caught	Size Range (cm)
Perca flavescens	Yellow perch	2	5.2 - 6.1

WC-39 Lily Lake

Lily Lake is a small sized, shallow, round, glaciated lake south of Highway 103 which appears to have no surface water inputs. With a surface area of 24,211 m^2 and a maximum length of 243 m (north to south) the lake is protected from the wind and the associated fetch. The riparian zone surrounding Lily Lake consisted of mature coniferous forest with no anthropogenic structures apparent from the shore-based survey. The northern shoreline of Lily Lake was assessed during the survey since this is the section of the lake falling within the Project Study area. The substrate in the littoral zone along the northern shoreline was composed of fine sediment and organics with interspersed boulders also being observed within the lake. Floating mats of vegetation were present along the shoreline and extended above the waterline 0.00 – 0.25 m. Beyond the vegetated mats the banks appeared vegetated and stable. Riparian vegetation consisted of small woody stemmed plants, sphagnum and mature trees. Algae, submergent, emergent and floating macrophytes were present within the littoral zone at the time of the survey.

A short outlet from Lily Lake connects it directly to Puddle Lake via a culvert under the existing Highway. The Lily Lake outlet is a well-defined, shallow, narrow stream channeling tea-stained, clear water. It is anticipated to be perennial and was 0.6 m wide in wetted width at the time of the July 2010 survey.

Electrofishing was performed in the littoral zone along the northern shoreline of Lily Lake as well as in the associated short outlet on September 25, 2009 and yielded the results in Table 5.39 below.

Table 5.39 Electrofishing Results for WC-39 Lily Lake

Scientific Name	Common Name	Number Caught	Szie Range (cm)
Fundulus diaphanus	Banded killifish	2	5.2
Anguilla rostrata	American eel	7	15 - 25

Baited minnow traps were set on September 25, 2009, left overnight and yielded the results in Table 5.40.

Table 5.40 Minnow Trap Results for WC-39 Lily Lake

Scientific Name	Common Name	Number Caught	Size Range (cm)
Fundulus diaphanus	Banded killifish	15	3.5 - 6.5

WC-40 The Puddle

The Puddle is a small sized estuary south of Highway 103 at the mouth of Stillwater Brook. The riparian zone surrounding The Puddle consisted of mature coniferous forest along the east banks and a roadway with residential land along the south-west banks. Docks are present within the waterbody and homes are present within the residential zone. The western area of The Puddle was assessed during the survey since it is only a small portion of the western end of the lake that falls within the Project Study area. The Puddle has been identified as navigable by NSTIR. Stillwater Brook (WC-24) feeds The Puddle and can be considered navigable within the vicinity of its confluence with the estuary. The Project has the potential to result in direct effects on the navigability of this watercourse system.

The substrate in the littoral zone of the western end of the estuary was composed of sandy silt. The estuary banks were comprised of till and boulders and extended above the waterline 0.50 – 0.75 m; the banks appeared vegetated and stable with areas of bare stable till. Riparian vegetation consisted of grasses, small woody stemmed plants and mature trees. Algae and submergent macrophytes were present in the littoral zone along the western banks.

Baited minnow traps were set on September 29, 2009 along the western shoreline, left overnight and yielded the results in Table 5.41.

Table 5.41 Minnow Trap Results for WC-40 The Puddle

Scientific Name	Common Name	Number Caught	Size Range (cm)
Fundulus heteroclitus	*Mummichog*	25	3.5 - 9.0
Apeltes quadracus	Fourspine stickleback	2	3.2 - 3.5
Gasterosteus aculeatus	Threespine stickleback	1	4.0

WC-41

WC-41 originates from wetland WL-325 on the north side of the existing highway and runs west, eventually draining south through a culvert under Highway 103 and feeding WL-329 and Simms Lake. WC-41 is a perennial, clear-water stream that exhibited an average depth of 7 cm and a wetted width of 0.5 m during the July 2010 survey. The substrate in the RoW was dominated by large cobbles and small cobble, with some coverage being provided by boulders, large cobble, small pebble and gravel. Submerged macrophytes were present in the stream but no algae were observed instream at the time of the survey. Stream banks were predominantly stable and vegetated, with small areas that were bare stable or eroding. Stream bank vegetation was comprised primarily of grasses with small amounts of shrubs and trees. The riparian vegetation beyond the stream banks and up to 100 m was mainly coniferous. On the left bank (looking downstream), the existing Highway 103 was located within the 30 – 100 m section of the riparian zone. Flow during the assessment period average 0.001 m^3/s.

A presence-absence electrofishing survey was carried out in WC-41 on July 7, 2010. The results of the electrofishing survey are summarized in Table 5.42.

Table 5.42 Electrofishing Results for WC-41

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	18	3.0 – 6.6

WC-42

WC-42 is a perennial stream draining from wetland WL-330, north of the existing highway. The watercourse continues to flow south under Highway 103 through an existing culvert and eventually feeds wetland WL-329, a wetland surrounding Simms Lake. The clear-water stream supported an average depth of 5 cm and wetted width of 0.95 m at the time of the July 2010 survey. The RoW substrate was dominated by boulders and large cobble, with a mix of other substrate types being observed throughout the assessment area as well. Submerged macrophytes were present in the stream but algae were absent at the time of the survey. The stream banks predominantly stable and vegetated, although areas of bare stable or eroding ground were observed as well. The stream bank vegetation was dominated by grasses and the riparian zone beyond the banks to approximately 100 m from the stream was mainly coniferous on the both the left and right sides of the stream. At the time of the July 2010 survey, average flow was estimated to be 0.517 m^3/s.

A presence-absence electrofishing survey was carried out in WC-41 on July 7, 2010. No fish were caught within the 50 m area fished downstream of the existing Hwy 103. The low water level in the watercourse at the time of the survey allowed only 25 m to be fished upstream of Highway 103. No fish were caught during the electrofishing survey in this upstream reach either. A natural barrier to fish exists starting at approximately 80 downstream of the existing highway. A large boulder field with steep gradient change at this point is anticipated to impede fish passage further upstream. Given that WC-42 is a wetland drainage stream, low flows are likely present throughout much of the year. The low flows coupled with the boulder field and gradient change result in a natural barrier to fish passage upstream of the boulder field.

WC-43

WC-43 is a perennial unnamed stream that crosses a proposed Highway 107 access road for the community of Hubbards. A habitat assessment and electrofishing survey were completed on August 27, 2010. The watercourse drains from east to west towards Hubbards River. The presence or absence of a direct surface water connection with Hubbards River was not assessed as part of the current Project since the confluence of the unnamed stream with Hubbards River was outside the Study Area. The small stream was lightly tea-stained and exhibited an average depth of 25 cm, while supporting an average wetted width of 0.5 – 1.5 m throughout much of the assessment area at the time of the survey. Downstream of the existing dirt road, the substrate was dominated by fines and organics with sand, gravel and boulder providing limited cover as well. Upstream of the existing road, the substrate was dominated by sand, organic and fines. Submerged and emergent macrophytes, as well as both algae slimes and attached algae were observed in the assessment area. The banks were predominantly stable and were dominated by grasses with some cover being provided by shrubs and trees. A few small areas of bare ground were also observed. Riparian vegetation was mixed and included deciduous and evergreen tree species, alders, grasses and floodplain habitat.

A presence-absence electrofishing survey was carried out in WC-43 on August 27, 2010. The survey was completed downstream of the existing road. No fish survey was completed upstream of the existing road because the culvert was perched at the downstream end, prohibiting fish passage further upstream. The results of the electrofishing survey are summarized in Table 5.43.

Table 5.43 Electrofishing Results for WC-43

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	5	6.7 – 7.3

Summary

Following the completion of fish surveys in 28 of the 43 watercourses located within the proposed RoW, it is apparent that American eel and brook trout are the two most commonly occurring species. A total of thirteen different species were confirmed to be present within the Assessment Area based on the field assessments. A range of spawning periods is supported by these various fish species (Table 5.44). American eel were confirmed in 12 of the 28 watercourses and brook trout were confirmed present in 11 of the 28 watercourses fished. A single Atlantic salmon was caught within the Assessment Area as well (*i.e.,* Ingram River, south of Highway 103). Historically, Ingram River, Little Indian River and Northeast River (feeding and draining Mill Lake) were known to support Atlantic salmon but the installation of dams for hydroelectric use appear to have resulted in the disappearance of the species from the Little Indian and Northeast Rivers (G. LeBoutillier, pers. comm. 2010). All three rivers (Ingram, Little Indian and Northeast) have suffered historical impacts through the straightening of the rivers to facilitate their use in the logging industry. The presence of these types of historical anthropogenic activities (*e.g.,* straightening of the river for logging use and damming for hydroelectric use) has affected the physical habitat of the rivers themselves and has contributed to sedimentation within St. Margaret‟s Bay.

Table 5.44 Summary of Spawning Times (Scott and Crossman 1998) for all Fish Caught within the Assessment Area

Scientific Name	Common Name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Anguilla rostrata	American eel					1			2	2			
Apeltes quadracus	Fourspine stickleback												
Catostomus commersoni	White sucker												
Fundulus diaphanus	Banded killifish												
Fundulus heteroclitus	Mummichog												
Gasterosteus aculeatus	Threespine stickleback												
Notemigonus crysoleucas	Golden shiner												
Notropis cornutus	Common shiner												
Perca flavescens	Yellow perch												
Pungitius pungitius	Ninespine stickleback												
Rhinichthys atratulus	Blacknose dace												
Salmo salar	Atlantic salmon												
Salvelinus fontinalus	Brook trout												

1 Upstream Migration of young fish

2 Downstream migration of mature fish

Spawning

Eggs/Sacfry in substrate

The continued prevalence of brook trout and the potential for Atlantic salmon within the Assessment Area are supported by the presence of several foot trails used by anglers during recreational fishing season. Recreational fishers were observed within the Assessment Area several times during the Fall 2009 survey period. Specifically, angler trails were observed in the vicinity of the following watercourses: Stillwater Brook, Ingram River, Porcupine Brook, Dorey Lake and Maple Lake. There are no “Special Trout Management Areas”, as designated by the Nova Scotia Department of Fisheries and Aquaculture (NSFA), within the Assessment Area nor are there any downstream of the Assessment Area (NSFA 2010a). The NSFA has initiated salmonid stocking programs in the Assessment Area. A spring 2010 stocking program released juvenile hatchery grown Brook trout into Mill Lake, Sawler Lake and Maple Lake (NSFA 2010b).

The diversity of watercourse types ranges from small drainage channels connecting wetlands to large river systems connecting lakes to St. Margaret"s Bay. The habitat supported by this range of watercourse types is equally diverse. The presence or absence of fish species within the larger watercourses appears to correspond to appropriate water quality and the absence of barriers to fish passage; within the smaller streams and channels, fish presence corresponds to appropriate water quality and connectivity to larger fish-bearing watercourses in the smaller streams and channels.

The MEKS recounts the traditional use of Mi"kmaq fish weir technology in various river systems throughout the province, particularly southwestern Nova Scotia, and indicates that mackerel, salmon and trout are fished in the study area (which is defined in the MEKS to include a 5 km radius around the Project). No specific fishing locations are identified.

5.3.4.2 Surface Water Quality

Water quality measurements were collected *in situ* in all watercourses with sufficient water volume during either the fall 2009 or summer 2010 surveys. Water quality was measured at one location, at one point in time within the upstream section of the assessment area for each watercourse. Natural variation in the water quality parameters measured *in situ* is expected seasonally and annually within both lentic and lotic systems. Within lotic systems, the water quality measurements were collected in run flow types whenever possible. Within lentic systems, the water quality measurements were taken within a representative area of the littoral zone closest to the existing highway.

Water quality data was compared to guidelines taken from the *Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life* (FWAL) from Canadian Council of Ministers of the Environment (CCME). This document provides guidelines specific to Canada in relation to the water quality parameters required for the growth and development of eggs and juvenile fish into mature spawning adults. FWAL guidelines for pH suggest that a pH of 6.5 units is the minimum level observed before stress is induced on fish and eggs. All but three streams in the assessment area are below this threshold value (WC- 33 –Tributary to Sawler Lake, WC-40 - The Puddle and WC-41 – Unnamed watercourse; see Table 5.45). Within Nova Scotia, pH levels below 6.5 are common and fish recruitment and development are continuing. Acidification can be caused by a variety of factors including influences from wetlands, naturally occurring organic acids and geological sources (CCME 2007), as well as anthropogenic effects. Natural soil composition conditions such as higher sulfur content affect pH because, once oxidized and in contact with water, sulfuric acid is created which leaches into the ground and surface water, lowering pH.

Another parameter measured during the field surveys was dissolved oxygen. The FWAL guidelines set a minimum of 9.5 mg/L for early life stages of cold water species. The dissolved oxygen in 18 out of the 43 streams assessed fell below the minimum guideline (see Table 5.45). In several of these streams, fish were still caught during the fish survey period. CCME guidelines pertaining to the dissolved oxygen concentration for the protection of warm-water aquatic species are 6.0 mg/L for early life stages and 5.5 mg/L for all other life stages. Dissolved oxygen concentrations were above guidelines pertaining to the warm water aquatic species in all watercourses with the exception of WC-36.

Table 5.45 *In Situ* Water Quality Measurements and CCME FWAL Exceedances

Stantec Field Reference Number	Watercourse Name	Water Temp (^{0}C)	pH	Specific Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Discharge (m^3/s)
WC-1	Unnamed Watercourse	9.26	**4.55**	55	**7.98**	68.9	0.02
WC-2	Unnamed Watercourse	10.21	**4.47**	45	**8.15**	72.6	0.001
WC-3	Unnamed Watercourse	9.42	**4.28**	67	9.85	86.5	0.01
WC-4	Unnamed Tributary to Mill Lake	8.99	**4.65**	105	10.59	91.7	0.18
WC-5	Mill Lake Backwater Pond	6.61	**5.83**	40	10.07	82.1	N/Ap[1]
WC-6	Mill Lake	8.42	**6.07**	58	11.71	100.1	N/Ap
WC-7	Little Indian Lake	8.68	**5.60**	48	12.01	103.2	N/Ap
WC-8	Little Indian River	13.16	**5.01**	168	**8.30**	79.0	N/Av[2]
WC-9	Unnamed Watercourse	8.52	**4.28**	44	9.79	83.8	0.02
WC-10	Unnamed Watercourse	8.26	**4.33**	48	9.67	82.1	0.04
WC-11	Porcupine Brook	10.54	**4.39**	43	**9.11**	81.7	0.25
WC-12	Unnamed Watercourse	8.07	**4.18**	117	9.64	81.6	0.03
WC-13	Unnamed Watercourse	9.58	**4.55**	384	**6.59**	57.7	0.006
WC-14	East Tributary to Ingram River	8.29	**4.39**	278	**8.31**	70.7	0.01
WC-15	Ingram River	10.43	**5.09**	28	9.76	87.4	4.13
WC-16	West Tributary to Ingram River	7.16	**5.29**	462	11.89	98.5	0.02
WC-17	Unnamed Tributary to Ingram River	7.22	**4.26**	383	9.60	79.7	0.01
WC-18	Unnamed Tributary to Kieley Lake	8.48	**4.44**	42	**9.07**	77.2	0.05
WC-19	Unnamed Tributary to Kieley Lake	7.16	**5.53**	1158	**9.12**	78.7	ND[3]
WC-20	Unnamed Tributary to Kieley Lake	8.33	**4.47**	38	9.76	83.1	0.01
WC-21	Mud Lake Brook	7.72	**4.09**	55	**8.92**	74.8	0.15
WC-22	Unnamed Tributary to The Puddle	7.52	**4.89**	1538	**6.03**	49.5	0.001

Table 5.45 *In Situ* Water Quality Measurements and CCME FWAL Exceedances

Stantec Field Reference Number	Watercourse Name	Water Temp (°C)	pH	Specific Conductivity (μs/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Discharge (m^3/s)
WC-23[4]	Unnamed Tributary to The Puddle	6.22	**4.26**	144	**7.15**	57.7	0.007
WC-24	Stillwater Brook	14.14	**5.15**	51	**9.34**	90.9	0.35
WC-25	Unnamed Tributary to Stillwater Brook	8.51	**4.30**	51	**9.43**	80.6	0.005
WC-26	Unnamed Watercourse	7.90	**4.21**	84	**6.30**	53.0	0.03
WC-27	Unnamed Watercourse	10.69	**4.57**	55.00	**8.93**	80.40	N/Av
WC-28	East Tributary to Hubbards River	6.75	**4.36**	42	11.10	82.7	0.21
WC-29	Hubbards River	9.14	**4.71**	32	9.83	85.0	3.76
WC-30	Unnamed Tributary to Hubbards River	6.65	**4.58**	72	**9.45**	77.1	0.004
WC-31	Dorey Lake	7.69	**6.08**	36	10.13	84.4	N/Ap
WC-32	Sawler Lake	8.59	**6.40**	45	9.95	85.6	N/Ap
WC-33	Unnamed Tributary to Sawler Lake	7.52	6.95	315	**8.23**	68.7	ND
WC-34	Maple Lake	8.53	**6.49**	54	12.36	106.0	N/Ap
WC-35	Unnamed Watercourse	6.50	**5.96**	40	11.31	92.0	0.08
WC-36[4]	Unnamed Watercourse	14.08	**6.03**	48	**5.30**	53.4	ND
WC-37[4]	Unnamed Watercourse	Dry at time of survey July 2010					N/Ap
WC-38	Puddle Lake	9.48	**5.48**	214	10.59	92.7	N/Ap
WC-39	Lily Lake and Outlet	6.83	**5.76**	234	10.85	89.1	N/Ap
WC-40	The Puddle	7.44	6.85	10106	10.22	88.1	N/Ap
WC-41[4]	Unnamed Watercourse	14.14	6.54	70	10.52	102.2	0.001
WC-42[4]	Unnamed Watercourse	12.65	**5.37**	28	10.15	95.7	0.517
WC-43[5]	Unnamed Watercourse	16.13	N/Av	317	12.12	123	0.004

All water quality measurements were collected September-October 2009 unless noted

Exceedances of the CCME FWAL Guidelines are highlighted in bold font

[1] Not Applicable

[2] Not Available

[3] Not Detected

[4] Sampled July 2010

[5] Sampled August 2010

CCME FWAL - DO warm spp. Early life stage	DO < 6.0	
CCME FWAL - DO warm spp. Other life stage	DO < 5.5	
CCME FWAL - DO cold spp. Early life stage	DO < 9.5	
CCME FWAL - DO cold spp. Other life stage	DO < 6.5	

Guidelines for conductivity and temperature are not available within the CCME FWAL guidelines. Specific conductivity in the 40 freshwater streams and lakes along the Assessment Area ranged from 28 – 1158 μS/cm, with a mean of 144 μS/cm. Within the estuarine environments of The Puddle and an associated tributary, specific conductivity was recorded as 10,106 and 1538 μS/cm, respectively.

Temperatures within the watercourse were cool and based on the amount of stream cover observed during the survey, are anticipated to remain cool during the summer months. Temperatures for the freshwater streams ranged between 6.62 and 14.14^{0}C with a mean of 8.50^{0}C. Lake temperatures were slightly lower with a range of 6.61 to 9.48^{0}C and a mean of 8.03^{0}C.

Summary

Water quality at watercourses along the proposed RoW reflects the acidification that is common throughout water bodies in Nova Scotia. Much of the province is underlain by bedrock types that weather poorly and soils with low acid-buffering capacities (Whitfield *et al.* 2006). The prevalence of wetlands within and surrounding the RoW is also a contributor to the acidic conditions observed in the majority of watercourses assessed. Additionally, sulphate and nitrogen deposition are considered to be drivers of surface water acidification in eastern Canada (Whitfield *et al*. 2006). Watershed acidification has the potential to be further influenced by road salting and deposition of sea salt. Road salting can result in changes in soil chemistry which can add further stress to systems already suffering from acidification. Cumulative anthropogenic stresses on water quality within watersheds can result in increased effects on fish and benthic invertebrate populations, which have been observed in the neighboring Woodens River Watershed.

Existing anthropogenic effects on water quality within the Project area are limited primarily to the presence of the current Highway 103 road system and the associated salting that has occurred during the winter months since the completion of the original highway in the 1950s. The consistently low pH conditions observed throughout the Project area have likely been influenced by the multiple factors discussed above, including the long history of road salting along the existing Highway 103 corridor.

Many of the watercourses identified within the Project RoW eventually feed St. Margaret‟s Bay. Using an ecosystem science approach to integrated resource management (DFO 2007a), consideration should be given to the existing water quality within the receiving water environment of St. Margaret‟s Bay. The current water quality within the St. Margaret‟s Bay is known to support a range of fish species including herring, flounder, mackerel, American eel and various shellfish species (Barrington *et al*. 2003). While the Bay itself is not part of the current Study area, it is the receiving environment for the water that crosses the proposed RoW in several areas, making it an important consideration in relation to water quality. St. Margaret‟s Bay has been the focus of oceanographic studies previously as a result of pollution, land-use changes and potential sedimentation concerns (Barrington *et al.* 2003). Bacteria issues have been reported in the Bay and are anticipated to result from septic system issues throughout the watershed (Barrington *et al.* 2003; HRM 2009). Increased sedimentation resulting from construction activities can further complicate bacteria issues within various types of water bodies. The historical anthropogenic effects from straightening and damming of several rivers crossing the proposed RoW contributed to sedimentation issues in the Bay as well. The existing cumulative stresses on the water quality within St. Margaret‟s Bay continue to increase as a result of ongoing development in the area. Mitigation of potential effects on water quality related to the construction and operation phases of the proposed Highway 103 twinning between Tantallon and Hubbards recognize St. Margaret‟s Bay as the receiving water environment for surface water leaving the Project area.

5.3.5 Potential Interactions, Issues and Concerns

This section evaluates the potential for Project-related activities to affect the aquatic environment. Table 5.46 provides a summary of the potential environmental effects resulting from the Project-VEC interactions, which are discussed below.

Table 5.46 Potential Interactions Between Project Activities, Including Other Projects and Environmental Effects

Valued Environmental Component: AQUATIC ENVIRONMENT			
Project Activities and Physical Works†	Potential Environmental Effects		
	Direct Mortality	Change in Habitat	Change in Surface Water Quality
Site Preparation		✓	✓
Roadbed Preparation	✓	✓	✓
Watercourse Crossing Structure Construction	✓	✓	✓
Surfacing and Finishing		✓	✓
Project Presence		✓	✓
Infrastructure Maintenance		✓	✓
Winter Maintenance		✓	✓
Vegetation Management		✓	✓
Other Projects and Activities			
Existing and Planned Linear Features	✓	✓	✓
Residential and Commercial Land Use		✓	✓
Resource Land Use		✓	✓
Recreational Land Use	✓	✓	✓
Industrial Land Use			

5.3.5.1 Construction

Physical Effects on Fish and Fish Habitat

Project-related construction activities could potentially affect fish and fish habitat including benthic invertebrates. The most substantive and likely interactions are the loss, or change, of habitat and a change in surface water quality from the installation of the watercourse crossings, including culvert installation, culvert extension and lake infilling.

Table 5.47 presents the estimated fish habitat loss associated with the project. These calculations are based on the worst case scenario as the total area of habitat loss for both lotic and lentic systems. Habitat loss for lotic systems was determined based on the length of watercourse channel located within the RoW and the associated wetted width. The total area habitat loss for lentic systems was determined based on the total area within the RoW; this area was determined through aerial photos. This is a conservative ballpark estimate assuming all fish habitat within the RoW is lost.

Table 5.47 Estimated Fish Habitat Loss within the RoW

Watercourse ID	Estimated Fish Habitat Loss within RoW (m^2)[1]
WC-1	0
WC-2	0
WC-3	0
WC-4	595
WC-5	0
WC-6	38076
WC-7	30471
WC-8	0
WC-9	0
WC-10	0
WC-11	947
WC-12	0
WC-13	0
WC-14	0
WC-15	95
WC-16	277
WC-17	0
WC-18	482
WC-19	0

Table 5.47 Estimated Fish Habitat Loss within the RoW

Watercourse ID	Estimated Fish Habitat Loss within RoW (m^2)[1]
WC-20	145
WC-20A	0
WC-21	389
WC-22	0
WC-23	278
WC-24	289
WC-25	0
WC-26	60
WC-27	
WC-28	0
WC-29	1558
WC-30	94
WC-31	16908
WC-32	21294
WC-33	0
WC-34	1029
WC-35	144
WC-36	411
WC-37	0
WC-38	11714
WC-39	
WC-40	2421
WC-41	239
WC-42	0
WC-43	55

[1] This assumes all fish habitat within the RoW is lost.

Within these areas of potential habitat loss, environmental effects resulting from project-VEC interactions could include: direct mortality, change in habitat and a change in surface water quality. More specific information on potential effects of construction is provided below.

The physical installation of a watercourse crossing can result in changes in habitat and fish population, particularly during culvert installation, culvert extension and lake infilling activities. Watercourse beds and banks may be disturbed during the installation of culverts. Fish movement could be impaired or fish may be displaced during culvert installation as well as following installation if the culvert is not properly placed or measured (*i.e.*, sufficient depth and flow). In-water work also contributes to sedimentation and the potential for damaging stream habitat. If altered, the stream must be remediated to natural conditions. Flow alterations must be kept short and be completely reversible.

Infilling along the edge of a lake to facilitate the installation of a causeway or bridge results in the permanent alteration of the littoral zone of the lake and a temporary increase in sedimentation within the watercourse. The littoral zone is an important component of the lake ecosystem, providing food as well as rearing and mating habitats for a variety of fish species. The littoral zone of lakes typically also supports thriving benthic invertebrate communities and diverse macrophytes. When altered, the newly infilled area of the lake becomes the new littoral zone. The physical environment of these new littoral zones should be remediated to conditions that encourage re-population of benthic invertebrates, macrophytes and fish communities.

Surface water supplies are sensitive to the environmental effects resulting from general development activities as well. The key environmental issues for surface water resources from a linear development such as twinning of Highway 103 may include:

- Interference with drainage;
- Interference with the local flood regime; and
- Degradation of the water quality of surface water resources.

Surface water quality and quantity can be directly affected by groundwater quality and quantity, and *vice versa*.

Riparian vegetation will be cleared for the Project. Removing vegetation near streambanks removes shaded habitat and may increase bank erosion. Shading from riparian vegetation helps to maintain cooler water temperatures during periods of warm, sunny weather and provides physical shelter for food.

Erosion and sedimentation can occur whenever soil is exposed. Sedimentation (increased sediment load in stream water and deposition in downstream sediments) is perhaps the most common environmental effect of construction activities on fish and fish habitat. The environmental effects of sedimentation are well studied and understood. Anderson *et al.* (1996) and Trow Consulting Engineers Ltd. (1996) summarized the potential environmental effects of sedimentation and siltation on fish and fish habitat as follows:

- Changes in stream morphology and stream bed porosity leading to degradation of spawning substrates, holding pools, instream cover and foraging habitat;
- Reduced diversity and abundance of bottom dwelling fish food organisms; and
- Destruction of aquatic vegetation that is buried by sediments.

The potential direct environmental effects of sedimentation on fish and benthic invertebrates include the following:

- First-level behavioural responses, usually temporary, and not resulting in a change in health;
- Minor physiological influences where the fish and invertebrates may avoid exposure but there may be environmental effects to health due to exposure or reduction in food supply;
- Physiological changes due to long-term exposure affecting life stages or feeding; and
- Environmental effects on eggs and larvae which cannot avoid areas of exposure.

Noise from construction activities may result in habitat avoidance by fish. The handling of asphalt, concrete, hydrocarbon and hazardous materials in the vicinity of watercourse crossings during the construction phase of the new highway lanes could potentially affect fish and fish habitat through exposure to contaminating substances.

Blasting can have physical and chemical environmental effects on the aquatic environment. Shock waves and vibrations from blasting can damage fish swim bladders and rupture internal organs, and may kill or damage fish eggs or alevins. Blasting can cause re-suspension of sediments, bank failure and resultant sedimentation and habitat avoidance. Nitrogen-based explosives can affect aquatic life through direct toxicity of the compounds, reducing dissolved oxygen during nitrification and providing nutrients for aquatic plants. Nitrite is highly toxic to fish and can reduce the oxygen carrying capacity of blood, and ammonia can cause gill damage and promote algal growth. Blasting may also result in the release of sediment to watercourses through the settling of dust and through landslips.

Benthic invertebrate populations can be sensitive to changes in substrate type and water quality, including pH, flow, turbidity and dissolved oxygen. Changes in the benthic invertebrate community can have cascading effects throughout the food chain, as invertebrates are a primary food source for many aquatic organisms higher within the chain (*e.g.*, fish).

Surface Water Quality

Project-related construction activities could potentially affect surface water quality. The most substantive and likely interaction is erosion and sedimentation resulting from lake infilling as well as culvert installation and extension work. Sedimentation and siltation of surface water can degrade surface water quality (*e.g.*, oxygen levels, light penetration, water temperature, water chemistry such as organics and metals) leading to changes in primary production and food availability (Anderson *et al.* 1996;Trow Consulting Engineers Ltd. 1996) as well as aesthetics. Bacteria levels can also be affected by changes in sediment loading within a system. There are no beaches within the Assessment Area, but the lakes are used recreationally by anglers as well as cottage and home owners.

As discussed in the previous section, riparian vegetation will be cleared for the Project, which decreases shaded habitat and may increase bank erosion. Changes in vegetation and land cover can also lead to increased water temperature, as it is the shaded areas that provide cooler water temperatures during periods of warm, sunny weather. With increased water temperature, there is a potential for decreased dissolved oxygen.

Other potential environmental effects on surface water quality that may occur during construction include increases in total suspended sediments (*i.e.*, increased turbidity), a change in hydrologic conditions, and changes in pH from runoff. These changes in surface water quality can lead to effects on the benthic invertebrate community, in addition to potential physical effects resulting from sedimentation and siltation. Changes in pH resulting from runoff can also have a direct effect on fish in watercourses already experiencing acidification. Salmonid species in particular (*e.g.*, brook trout and Atlantic salmon) are sensitive to pH changes throughout their life history, including during egg incubation and larval hatching. Over an evolutionary time scale, fish populations can adapt and survive within acidified systems, but abrupt changes (particularly decreases) in pH can be detrimental to their survival. Abrupt decreases in pH can be associated with spring runoff. Construction may occur during the spring runoff period.

5.3.5.2 Operation and Maintenance

Physical Effects on Fish and Fish Habitat

An increase in sediment entering the watercourses can affect fish and fish habitat, as discussed previously. Various operation and maintenance activities can result in increased sediment entry into watercourses, including ditching for improved runoff water flow, vegetation control and watercourse crossing repairs and maintenance. Accumulation of debris or erosion can lead to loss of fish passage within watercourse crossings. The sudden release of blockages can result in increased sediment levels and an associated decrease in water quality. Decreases in habitat quality can result from large depositions of sediments remaining upstream after water levels normalize.

Surface Water Quality

Surface runoff from operation and maintenance of the impermeable paved area of the highway can affect surface water quality. Rainfall on the pavement may be warmed during summer and the temperature of subsequent runoff may be elevated. If this runoff reaches the receiving waters, the surface water temperature of those waters may be affected, particularly in areas that are shallow with low flow. Repetitive clearing of vegetation, including overheard cover, along the RoW at watercourse crossings may also affect stream temperature control following construction. Increased water temperature results in decreased dissolved oxygen within aquatic environments, which in turn can negatively affect aquatic organisms within that system (*e.g.*, benthic invertebrates and fish). Increased water temperatures can also affect various fish behaviours (*e.g.*, mating activities), which can be detrimental to the traditional life history patterns of fish species. The first flush of runoff may also contain traces of various substances that can result in contamination of surface water, including automotive fluids, dust, metals or PAHs.

Similar to the potential effects described above for fish and fish habitat, various operation and maintenance activities can result in an increase in sediments entering the watercourse. These activities include ditching for improved runoff water flow, vegetation control, and watercourse crossing repairs. Increased sediment deposition as a result of these activities can affect surface water quality in the same manner as sedimentation effects during construction (described in Section 6.3.5.1).

Winter maintenance activities such as salting and/or sanding highways during winter months can lead to increased sedimentation in surface water in relation to sanding, and changes in salinity of surface water in relation to salting. As discussed previously, winter salting activities also have the potential to influence acidification within watercourses and the chemistry of surrounding soils, which can result in effects on surface water quality over time. The spring melt may present the greatest potential for environmental effects on surface water quality (refer to Section 2.3.2.2 and Appendix C for additional information concerning the NSTIR Salt Management Plan).

5.3.6 Other Projects and Activities

Existing and Planned Linear Features

Linear features, such as roads and rails, typically cross many watercourses. There are existing linear features in the Project area, including the current Highway 103 and the planned Highway 103 interchange. Winter maintenance activities and periodic repairs required during operation of existing highways, roads and rails may increase sedimentation and salinity in watercourses, or may increase potential for contaminant introduction downstream of the existing linear RoWs in the area. Salt and sand applications will be done in accordance with the NSTIR Salt Management Plan (SMP). Potential run-off effects associated with impermeable road surfaces (as described above) may also contribute to environmental effects from existing linear features.

Residential and Commercial Land Use

Residential, commercial and industrial land use can have environmental effects on fish habitat and water quality. The Puddle, Sawler Lake and Maple Lake support residential dwellings, many with direct access to the water. No commercial businesses are located in close vicinity to watercourses. Potential compounding environmental effects resulting from residential land uses include: garbage, nutrient enriched runoff (*i.e.,* fertilizer), sedimentation and salting (access roads), and heavier traffic (foot and automobile).

Resource Land Use

Resource land use within the Project corridor includes forestry activities carried out by Bowater Mersey, active and inactive gravel quarries, as well as water resource use by Nova Scotia Power Inc. (NSPI). One of the quarries is located close to Ingram River but is no longer active. NSPI property and operations are in the vicinity of Mill Lake and Little Indian Lake. Facilities associated with these operations include NSPI‟s hydroelectric plant on Mill Lake itself. Bowater Mersey maintains a logging camp in the Sawler Lake area. Potential compounding environmental effects resulting from these land uses include: garbage, sedimentation and salting (access roads), heavier traffic (foot and automobile), increased runoff (logging), and physical disturbance of the aquatic environment (storage dam and hydroelectric generating station on Mill Lake).

Recreational Land Use

Recreational land use is limited in the Assessment Area. No evidence of effects on the Aquatic Environment resulting from recreational land use was observed during the field surveys with the exception of the discarded fishing net in Dorey Lake that contained several dead fish. The primary recreational land use within the aquatic environment is the establishment and use of small access trails along watercourses that are popular with anglers. These walking trails may contribute minimal amounts of debris and increased sedimentation to the Aquatic Environment. A well-established ATV trail was also confirmed adjacent to WC-11 (Porcupine Brook). One of the two large culverts passing under the existing Highway 103 roadbed is being used as a crossing by ATV users. A soil berm has been built between the two existing culverts to direct flow into the most western culvert, keeping the eastern culvert predominantly dry. This eastern culvert is used by ATV drivers to cross underneath the existing highway. The Project activities may provide temporary disruption to access of traditional angling and ATV trails, but alternative access points are likely to be used by anglers and ATV drivers, as needed. Several lakes in the Assessment Area show evidence of recreational boat use but volumes of watercraft are anticipated to be low, resulting in correspondingly low effects on the Aquatic Environment. Effects of the Project on recreational aquatic resource uses are anticipated to be negligible.

5.3.7 Environmental Effects Assessment

This section provides an evaluation of key potential Project-VEC interactions as summarized in the environmental effects assessment matrix (Table 5.48).

Table 5.48 Environmental Effects Assessment Matrix for Aquatic Environment

Environmental Effects Assessment Matrix Valued Environmental Component: AQUATIC ENVIRONMENT							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** **(A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Construction							
Site Preparation	• Change in habitat (A) • Change in surface water quality (A)	• Follow Generic EPP and Standard Specifications and NSE Watercourse Alteration Specifications (1997) • Implement erosion and sediment control measures • Limit area of clearing within 30 m of watercourses to the extent possible • No storage of chemicals or POLs or equipment maintenance or refuelling will occur within 30 m of a watercourse or wetland • Heavy machinery use during clearing will be kept a minimum of 10 m from the watercourse banks • Follow conditions of Water Approval	1	3	2/1	R	2
Roadbed Preparation	• Direct mortality (A) • Change in habitat (A) • Change in surface water quality (A)	• Follow Generic EPP and Standard Specifications and NSE Watercourse Alteration Specifications (1997) • Implement erosion and sediment control measures • Minimize area of disturbance especially within 30m of watercourses • Follow conditions of Water Approval • Follow DFO"s blasting guidelines (Wright and Hopky 1998)	1	3	2/6	R	2

Table 5.48 Environmental Effects Assessment Matrix for Aquatic Environment

Environmental Effects Assessment Matrix Valued Environmental Component: AQUATIC ENVIRONMENT								
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** **(A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Watercourse Crossing Structure Construction	• Direct mortality (A) • Change in habitat (A) • Change in surface water quality (A)	• Maintain fish passage for all species that use the watercourses for life-cycle purposes • Follow Generic EPP and Standard Specifications, NSE Watercourse Alteration Specifications (1997), and DFO (1998) draft document Guidelines for the Protection of Fish and Fish Habitat: The Placement and Design of Large Culverts • Erosion and sediment control measures • Minimize area of disturbance • Minimize in-water work • Work in the dry (streams/rivers) or in isolation (lakes/ponds) • Clean rock below high water level for infilling (where required) • Installation to occur from June 1 to September 30 • HADD Authorization application to DFO and preparation of compensation plan if required • No storage of chemicals and POLs and no equipment maintenance and refuelling will occur within 30 m of a watercourse or wetland • Structure sizing should be equal to or greater than existing structures (and meet DFO guidelines for fish passage)	2	3	2/6	I/R	2
Surfacing and Finishing	• Change to habitat (A)	• Follow Generic EPP • No storage of chemicals and POLs and no equipment maintenance and refuelling will occur within 30 m of a watercourse or wetland	1	2	2/6	R	2

Table 5.48 Environmental Effects Assessment Matrix for Aquatic Environment

Environmental Effects Assessment Matrix Valued Environmental Component: AQUATIC ENVIRONMENT							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** **(A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Operation and Maintenance							
Project Presence	• Change in habitat (A) • Change in surface water quality (A)	• Proper design of ditching • Follow Generic EPP and Standard Specifications	1	3	5/6	R	2
Infrastructure Maintenance	• Change in habitat (A) • Change in surface water quality (A)	• Maintain normal water flows at crossing structures (*i.e.*, regular inspection, cleaning and repair) • Follow Generic EPP and Standard Specifications • Follow conditions of Water Approval permits • Follow necessary erosion control measures • Maintain buffer zone within 30 m of watercourse where possible	1	2	2/1	R	2
Winter Maintenance	• Change in habitat (A) • Change in surface water quality (A)	• Follow the NSTIR SMP and EPP • Consider the CCME-Chloride guideline (when finalized)	1	3	2/2	R	2
Vegetation Management	• Change in habitat (A) • Change in surface water quality (A)	• Follow Generic EPP • Follow conditions of Water Approval permits • Maintain buffer zone within 30 m of watercourse where possible	1	2	2/1	R	2

Key

Magnitude:
1 = Low: *e.g.,* specific group, habitat, or ecosystem localized one generation or less, within natural variation
2 = Medium: *e.g.,* portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability
3 = High: *e.g.,* affecting a whole stock, population, habitat or ecosystem, outside the range of natural variation

Geographic Extent:
1 = <1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101 - 1,000 km^2
5 = 1,001 - 10,000 km^2
6 = >10,000 km^2

Duration:
1 = <1 month
2 = 1 - 12 months
3 = 13 - 36 months
4 = 37 - 72 months
5 = >72 months

Frequency:
1 = <11 events/year
2 = 11 - 50 events/year
3 = 51 - 100 events/year
4 = 101 – 200 events/year
5 = >200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not Applicable
(A) = adverse
(P) = positive

5.3.7.1 Construction

Fish and Fish Habitat

Prior to initiating construction of watercourse crossings, an application for a (Division 1) Water Approval under the provincial *Activities Designation Regulations* or a Notification of Culvert Installation will be submitted to NSE describing the construction activities and proposed mitigation measures proposed for the crossings. Conditions associated with the permit will be met by NSTIR. All watercourse crossings will be properly sized and designed to ensure watercourse flow and, in fish-bearing streams, to allow fish passage as per the criteria detailed in the DFO Practitioner‟s Guide to Fish Passage (2007). Infilling of lake littoral zone areas for the purposes of construction of causeways, bridges, or roadway footprint will also involve discussion with DFO to minimize effects and footprint size while still meeting design requirements. Clean rock will be used below the high water level when infilling is required. It is not currently known whether dredging will be required in advance of the infilling. NSTIR will conduct soundings before construction to determine the construction method.

The construction of the existing Highway 103 required infilling in multiple lakes within the current Assessment Area. During the Fall 2009 and July 2010 surveying, it was confirmed that the littoral zones of all lakes included in the Assessment Area had productive littoral zones. Steep littoral zone gradients and uncharacteristically rocky substrate were observed in multiple lakes that had been previously infilled in areas to create causeways (*e.g.*, Mill Lake). However, these sections of littoral zone have become naturalized, as evidenced by the presence of macrophytes, woody debris and fish at the time of the 2009 and 2010 aquatic surveys. Therefore, it is anticipated that any infilling required by the currently proposed twinning will result in lake littoral zone areas that become naturalized over time if measures are taken to encourage re-population of biological organisms.

The final designs of the watercourse crossing structures will be forwarded for review to DFO under Section 20 of the *Fisheries Act* and can be used to support an application for authorization under the *NWPA* as well. DFO officials will determine if an authorization under Section 35(2) of the *Fisheries Act* is required. If a HADD is determined, habitat compensation under DFO‟s *No Net Loss Policy* will be required and it would be unnecessary to exercise the Section 20 provisions as well (DFO 2007b).

All watercourse crossing structures will be installed in compliance with the conditions set in the site-specific Water Approval and following mitigation outlined in the Project EPP. NSTIR will ensure that the installations are conducted according to the planning process, meet the Conditions of Approval as described in the Watercourse and Wetland Alteration Permit and do not introduce suspended sediments or contaminants to surface waters. Specifically, NSTIR will work with NSE and DFO to ensure that new culverts installed in fish-bearing streams or rivers will not obstruct fish passage, can handle peak flows, and will maintain natural stream conditions (*e.g.*, width, habitat), as well as ensure that culvert extensions will also adhere to these same criteria. Culvert extensions or upgrades may be required where the alignment meets existing routes.

In-water work will be conducted to avoid sensitive biological periods such as brook trout spawning and egg incubation times. In general, in-water work will be conducted between June 1 and September 30, where possible. During the summer, low water flow makes instream work easier and erosion more manageable. Where possible, the installation of watercourse crossings will be done in the dry, using dam and pump procedures or channel diversion and following the guidelines of the Generic EPP and the NSE Watercourse Alteration Specifications (NSTIR 1997 and revisions). In either case, fish will be removed from the area of planned construction activities prior to construction. This will be accomplished by enclosing the construction area with fine-mesh nets and removing the fish using DFO approved methods (*e.g.*, seine nets or electrofishing). Direct mortality of some fish can be expected at low rates consistent with those typical for the use of seine nets. Water pump intakes, used during dam and pump procedure, will be screened in compliance with the DFO *Freshwater Intake End-of-Pipe Fish Screen Guideline* (DFO 1995).

Subject to regulatory approval, in-water work may be conducted outside of the June 1 - September 30 period when seasonal weather conditions permit (where there is no anticipated environmental effect on sensitive life stages), when work must be completed prior to the onset of winter conditions, or where the advantages of completing the work (*e.g.*, sediment control structures) prior to winter conditions justifies late season work. In the event of in-water work outside of the June 1 to September 30 season, a Division I approval will be required and DFO will be consulted and appropriate authorizations (*e.g.,* HADD Authorization) will be obtained. Any in-water work completed after September 30 will require monitoring during the work period, and inspection of sediment control mitigation during periods of the visible overland flow of water (*e.g.,* heavy rain or thaw events). Alternative sediment control mitigation may be required during the winter period. Alternative sediment control techniques will be discussed with DFO prior to authorization of late season in-stream work.

In the event of late season work (*e.g.*, after September 30 and with regulatory approval) stabilization of exposed soils within the Work Area will be completed as follows:

- Within 5 days of disturbance within 30 m of a watercourse (using mulch or another approved late season stabilization material), or prior to any forecasted storm event and/or the onset of frozen ground conditions; or
- Within 30 days of disturbance beyond 30 m of a watercourse, or prior to any forecasted storm event and/or the onset of frozen ground conditions, when possible.

Specific preventative measures to mitigate the potential environmental effects from erosion and sedimentation are detailed below, under surface water quality.

Should blasting be required during construction in or near a watercourse, authorization will be required from DFO for the use of explosives. Blasting will be conducted in accordance with the

Generic EPP and *Guidelines for the use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998), and in full compliance with the requirements of DFO‟s authorization.

Habitat avoidance as a result of Project-related noise (from all construction activities) would be temporary. It is assumed that fish would begin re-populating the affected area immediately upon cessation of noise generating activities.

Habitat compensation is typically undertaken at a 3:1 ratio for all watercourse crossings where substantial in-stream work is required (*e.g.*, culvert installation and/or stream diversion). Refer to Section 10.4.2 for information on the proposed fish habitat compensation program developed by NSTIR in consultation with DFO.

Watercourse crossings will be installed according to the conditions of the Water Approval to minimize potential for introduction to surface waters of contaminants or suspended sediments at levels that exceed the CCME Guidelines (25 mg/L) as described below. The potential for environmental effects to fish and fish habitat through direct disturbance at a site will be minimized by limiting the area accessed, situating temporary ancillary elements at least 30 m from the watercourse, and remediating altered littoral zone areas to encourage re-population of biological organisms.

Throughout the period of highway construction, erosion and sediment control measures should be installed and maintained. Based on experience with erosion and sediment control measures in eastern Canada, it is recommended that these measures are designed to function to the applicable water quality limits during a 1 in 2 year return period storm event and designed to withstand a 1 in 10 year return period event without incurring significant damage.

Construction of the roadway footprint and potential causeway expansion (*e.g.*, Mill Lake) will result in the permanent destruction or alteration of fish habitat, as discussed in Section 6.3.5.1. In addition to effects on lake littoral zone habitat, the primary potential effects to fish and fish habitat will be a result of erosion and sedimentation along the construction site. To minimize environmental effects on fish and fish habitat, work will be limited to within the RoW, and erosion and sediment control measures will be employed, as detailed below.

Based on available data, as well as assumptions and consideration of the potential environmental effects of the Project-related activities during the construction phase, the proposed mitigation, and the residual environmental effects significance ratings criteria, it is anticipated that the environmental effects of Project construction on fish and fish habitat will be not significant.

Surface Water Quality

CCME guidelines stipulate that total suspended sediments (TSS) must not increase by a level exceeding 25 mg/L over background levels during any short-term exposure period (*e.g.,* 24 hours), and must not exceed a maximum average increase of 5 mg/L from background levels for longer term exposure (*e.g.*, 24 hrs to 30 days) (CCME 2007). Background sampling for total suspended solids will be undertaken for all water course crossings at appropriate times (*e.g.*, during clear flows and not after major rainfall events) prior to construction. During construction, monitoring will occur directly following major rain events.

To minimize erosion and sedimentation, clearing will be limited within 30 m of the watercourse, to the extent possible. Sufficient vegetation must be allowed to grow along the bank of the watercourse to maintain bank stability. Heavy machinery used during clearing will be kept a minimum of 10 m from the watercourse banks.

Erosion and sedimentation controls employed during construction and operation will be designed and maintained in accordance with the Generic EPP and Standard Specifications, and in the Watercourse Alteration Specifications (NSE 1997). Mitigation includes diversion berms to divert flow, erosion protection measures at the berm outlets, and flow-checks in ditches, swales and chutes to reduce runoff velocity. Geomembranes and geotextiles will be used to minimize erosion where necessary. Re-vegetation of cleared slopes and embankments will lead to long term slope stabilization. NSTIR will consider the use of native, shade-providing vegetation at regular intervals along the banks of watercourses that were confirmed to support salmonid species. Regular monitoring of runoff diversion and sediment control structures is required to ensure these structures operate properly and reduce the potential for sedimentation of watercourses within the Assessment Area. Monitoring and controlling of sedimentation will help minimize effects on surface water quality.

Soil loss from slopes may occur even with erosion and runoff control measures. To prevent this soil from entering watercourses, further mitigative measures, including vegetated buffer strips, silt fences, filter berms and sediment traps will be implemented to intercept sediments. During construction, steep highway embankments could lead to sediment entering the watercourses, but the use of standard erosion and sediment control measures should adequately mitigate the effects of sediment laden runoff on nearby surface water sources of watercourses. Any watercourses having steep banks should have an augmented level of erosion and sediment control measures.

There are no planned Project activities that will release substantial amounts of sediment to water or suspend settled sediment or cause erosion with the potential exception of infilling some areas of multiple lakes to facilitate causeway and/or bridge construction. Small increases of sediment in watercourses near construction sites are often unavoidable. To minimize effects, on the remainder of the lake water quality during construction activities, various containment measures may be employed (*e.g.*, silt curtains) to isolate the work area.

Increases in watercourse nutrient levels from hydroseeding would be temporary as the applications are infrequent and these nutrient forms are readily flushed away (nitrates), absorbed by sediments (phosphates) or taken up by plants.

The potential for environmental effects on surface water through direct disturbance will be minimized by limiting areas of disturbance and situating temporary ancillary elements at least 30 m from watercourses. Storage of hazardous materials will not occur within 30 m of watercourses. Permanent storage areas for containers or drums will be clearly marked, have appropriate secondary containment, and be located on an impermeable floor that slopes to a safe collection area. Fuel storage and designated fuelling areas will be located at least 30 m from watercourses and wetlands. Refuelling and equipment maintenance required in the field will not be undertaken within 30 m of a watercourse or wetland. Wastewater from washing equipment will not be released into the watercourse. Storage of all hazardous materials will comply with WHMIS requirements, and appropriate material safety data sheets will be located at the storage site.

Based on available data, as well as assumptions and consideration of the potential environmental effects of the Project related activities during the Construction phase, the proposed mitigation, and the residual environmental effects significance ratings criteria, it is anticipated that the environmental effects of Project construction on surface water quality will be not significant.

5.3.7.2 Operations and Maintenance

Fish and Fish Habitat

The watercourse crossing structures will be inspected, cleaned and repaired on a regular basis, as required, to maintain normal water flows. Water Approval permits will be applied where required and the associated maintenance or construction will be conducted according to the requirements specified in the permits. Erosion control measures will be installed and properly maintained. Any materials removed from watercourses will be disposed of in a manner that prevents them from re-entering the watercourse.

Mitigation measures to reduce the potential environmental effects from increased sedimentation resulting from Maintenance activities are described below, under surface water quality. Based on available data and assumptions and consideration of the potential environmental effects of the Project-related activities during the operation and maintenance phase, the proposed mitigation, and the residual environmental effects significance ratings criteria, it is anticipated that the environmental effects of Project operation and maintenance on fish and fish habitat will be not significant.

Surface Water Quality

Adherence to the NSTIR SMP and winter maintenance guidelines will reduce the environmental effects to surface water quality, as the guidelines specify application rates and designate vulnerable areas. Detailed protection measures outlined in the Generic EPP and Standard Specifications will help to minimize the potential environmental effects to fish and fish habitat and surface water quality resulting from maintenance activities. Ditching will end a minimum of

30 m from watercourses where possible, and will be directed into the surrounding vegetation to allow filtering of sediment prior to water entering the watercourse.

Environment Canada‟s Code of Practice for the Environmental Management of Road Salts (Environment Canada 2004) presents thresholds associated with concentrations for chloride in surface water and impacts on aquatic biota. Concentrations of chloride of approximately 140 mg/L should be protective of freshwater organisms for short-term exposure. This value is based on a 4-day LC_{50} for *Ceriodaphnia dubia* (water flea). Environment Canada‟s Code of Practice also references the United States Environmental Protection Agency (EPA), which has developed a similar guideline. The EPA guideline indicates that biota, on average, should not be adversely affected if the one-hour average concentration of chloride does not exceed more than 860 mg/L more than once every three years and/or the four-day average concentration of chloride does not exceed 230 mg/L more than once every three years (Environment Canada 2004). The CCME is in the process of developing a Canadian Water Quality Guideline for chloride to protect aquatic biota from harmful exposure to chloride in water. This guideline was still under review at the time of publication of the current report (CCME 2010). NSTIR will take this new CCME chloride guideline under consideration once it has become finalized.

Changes in hydrology during operations can result in effects on surface water quality through changes in runoff volumes resulting from the creation of impervious (paved) surfaces. Changing runoff volumes can affect the impacts of potential contaminants in runoff. The volume of runoff from the driving surfaces of the proposed new highway lanes ranges between 0.02 % and 4.83 % of the mean annual flow in the watercourses assessed (RV Anderson 2010a). Crossings with a runoff volume of mean annual runoff less than 10 % are unlikely to have a significant potential impact on the water quality of a watercourse (RV Anderson 2010a). The hydrological assessment (Appendix B) of the crossings assessed indicated that all fell below 10 %. Based on preliminary hydrologic estimates, the volume of contaminants in surface runoff from the proposed new highway lanes (considering usual contaminants in highway runoff and excluding accidental spills and similar unforeseen events) are considered not great enough to have a major effect on downstream water quality, and thereby aquatic life (RV Anderson 2010a).

Mechanical clearing will primarily be used for vegetation control during highway operation on the RoW (*e.g.*, road shoulders and interchanges). NSTIR does not use any pesticides other than herbicides. Herbicides are used only under the guidance of the department‟s Integrated Roadside Vegetation Maintenance (IRVM) program.

For tall-growing vegetation on roadsides, NSTIR has traditionally utilized manual and mechanical means to control the growth. This non-selective control method (brush cutting) has resulted in the destruction of road-side terrestrial habitats and a decrease in plant diversity, while enhancing the presence of undesirable tall growing deciduous woody species. Limited herbicide use on selected species has been investigated to provide a means of achieving goals of habitat enhancement and maintenance of species diversity along our roadsides.

It is not anticipated that NSTIR will ever be engaged in widespread herbicide use. Herbicides will be considered as an option for undesirable species in selected locations and in compliance with all appropriate legislation. Specifically, there will be no herbicide applications under any of the following legislated conditions:

- Within a 30 m buffer zone of any watercourse;
- Within any distance of any watercourse prescribed on a product label; and
- Within 60 m of a protected water supply.

Based on available data, as well as assumptions and consideration of the potential environmental effects of the Project-related activities during the operation and maintenance phase, the proposed mitigation, and the residual environmental effects significance ratings criteria, it is anticipated that the environmental effects of Project operation and maintenance on surface water quality and benthic invertebrates will be negligible.

5.3.7.3 Assessment of Cumulative Environmental Effects

The potential cumulative environmental effects on the Aquatic Environment VEC in the Assessment Area are primarily related to changes in habitat resulting from Project construction activities in combination with existing land uses (*e.g.,* resource, residential, and linear road features), and future projects (*e.g.*, planned Highway 103 interchange). Taking an ecosystem science approach (DFO 2007a) during the assessment of environmental effects improves the integrated management of the Aquatic Environment within the St. Margaret‟s Bay watershed area.

The construction phase will require removal of mature trees and shrubs. This removed vegetation can contribute to cumulative environmental effects in watersheds where there will be or has been clearing in other areas of the same watershed. The result of these environmental effects acting cumulatively may be localized and include increases in stream temperatures (direct sun and pavement exposure), increased sedimentation, and the reduction of fish cover (*e.g.,* shade from canopy cover). Longer-range cumulative effects from changes in water quality have the potential to reach St. Margaret‟s Bay in the absence of appropriate mitigation. The existing acidified condition of the watercourses located within the Project area may result in them having a lower threshold for disturbance and changes in water quality than non-acidified water bodies. Potential long-term effects of road-salting on acidified water bodies and their surrounding soil environments are continuing to be assessed in the province. For the time being, adherence to the SMP is particularly important to minimize cumulative environmental effects resulting from the operations and maintenance phase of the proposed Project.

Many of the watercourses within the Assessment Area have likely experienced sedimentation from the existing Highway 103 over the past few decades. Straightening of the Northeast, Little Indian and Ingram Rivers in the past and the historical installation of dams in the Northeast and Little Indian Rivers are anticipated to have contributed to sedimentation in St. Margaret‟s Bay.

The Project may contribute some additional sediment to the watercourses that it crosses. There may be some temporary reduction in the quality of fish habitat in the vicinity of the construction activities within those watercourses where sedimentation was not substantial prior to potential sediment-generating activities for the current Project. Cumulative effects further downstream on the receiving waters of St. Margaret"s Bay are anticipated to be not significant given the proposed mitigation to control sediment and erosion from the site and through the adoption of the integrated management approach of managing the Aquatic Environment.

As noted in Section 6.1.7.1 above, DFO officials will be contacted to determine if an authorization under Section 35(2) of the *Fisheries Act* is required. If this authorization is found to be a requirement, habitat compensation will be designed in consultation with DFO and will be undertaken for all watercourse crossings where substantial in-water work is required (*e.g.*, culvert installation, stream diversion and/or lake infilling). This compensation will ensure that a net gain of productive fish habitat is achieved.

Watercourses within the Assessment Area that are not crossed by the Project will not be directly affected by Project activities. The Project crosses a total of forty-three watercourses. In general, most of these watercourses are also crossed by the existing Highway 103 or an adjacent road system or fall in close vicinity of the existing Highway 103 roadbed. The presence of brook trout was confirmed in multiple watercourses throughout the Project corridor. A single Atlantic salmon (juvenile) was also observed in one watercourse. It is considered unlikely that the Project will cause a residual exacerbation of the existing conditions in the watercourse crossings or affect current trends in salmonid stocks.

The environmental effects of the Project (in combination with past and present projects and activities) on fish habitat within the Assessment Area will not act cumulatively to cause an exceedance of the residual environmental effects rating criteria. The Project is not likely to interact with any future operation of the existing highways and roads (including winter salting/sanding), or adjacent land uses, in such a way that the residual environmental effects rating criteria (as defined in Section 6.3.3) will be exceeded for the Aquatic Environment.

In consideration of the potential environmental effects of the Project, the proposed mitigation, and in consideration of the residual environmental effects rating criteria, it is anticipated that the cumulative environmental effects of the Project (in combination with other Projects and activities) on the Aquatic Environment VEC will not be significant.

5.3.8 Determination of Significance

Table 5.49 evaluates the significance of potential residual environmental effects on the Aquatic Environment resulting from any interactions between Project activities and the VEC, after taking into account any proposed mitigation. The table also considers the level of confidence of the study team in this determination.

Table 5.49 Residual Environmental Effects Summary Matrix for Aquatic Environment

Residual Environmental Effects Summary Matrix Valued Environmental Component: AQUATIC ENVIRONMENT				
Phase	Residual Environmental Effects Rating, Including Cumulative Environmental Effects*	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Construction	NS	2	N/A	N/A
Operation and Maintenance	NS	3	N/A	N/A
Project Overall	NS	2	N/A	N/A

Key

Residual Environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Level of Confidence
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence
N/A = Not Applicable

Scientific Certainty: based on scientific information and statistical analysis or professional judgment
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence
N/A= Not Applicable

*As determined in consideration of established residual environmental effects rating criteria.

In summary, construction and operation and maintenance of the Project are not anticipated to have any significant adverse residual environmental effects (including cumulative effects) on the Aquatic Environment.

5.3.9 Follow-up and Monitoring

The loss of fish habitat from the construction activities will be mitigated by ensuring no net loss of fish habitat through habitat compensation, if necessary. It is anticipated that HADD authorization will be required, as the extension of culvert lengths and infilling of multiple lake sections to accommodate the twinned highway will likely result in some habitat loss. NSTIR is currently in discussion with DFO concerning the potential for HADD authorization, which will need to be determined prior to construction when final designs are made available.Opportunities for HADD compensation within the St. Margaret‟s Bay watershed are being identified as part of an independent study being carried out in 2010 (G. LeBoutiller, pers. comm. 2010). A watershed study has been commissioned by HRM within the St. Margaret‟s Bay area, as well. Additional HADD compensation opportunities within the Project area may be able to be identified through a review of the results of this watershed study.

The primary residual environmental effect of the Project on fish, fish habitat and water quality is the potential for the sedimentation of watercourses in the vicinity of Project activities. In particular, TSS concentrations in watercourses may increase as a result of the mobilization of sediment from Project-related activities. An increase in TSS concentrations may elevate surface water temperature and increase the rate of sedimentation that may adversely alter fish habitat (including water quality and benthic invertebrates).

Monitoring during construction will promote and confirm application of applicable environmental protection and permitting requirements for work in and adjacent to watercourses and successful implementation of remedial actions where necessary. Monitoring for the Aquatic Environment will consist of the following core elements at the watercourse, as applicable:

- Collection of baseline water quality measurements (*e.g.,* general chemistry, including chloride and sodium, and a metals scan) at all watercourse crossings prior to the start of construction activities, for comparison against the CCME guidelines for the protection of freshwater aquatic life;
- Monitoring of TSS when precipitation events result in the visible overland flow of water;
- Regular inspection of all sediment and erosion control measures; and
- Inspection of hazardous materials storage areas (including possible sediment generating materials).

The location and frequency of observations, required sample sizes, and reporting frequency will be determined in consultation with NSE and DFO through their respective permitting and authorization processes where required.

The secondary potential residual environmental effect of the Project on fish, fish habitat and water quality is the potential for road-salting activities during the operation and maintenance phase to influence the pH of watercourses already experiencing acidification. The existing acidic condition of the watercourses may make them more vulnerable to disturbance and/or land-use changes. Therefore, NSTIR will consider developing and implementing a benthic macroinvertebrate repeat-monitoring program within a selection of the watercourses crossed by the proposed highway twinning. NSTIR may be able to work with local interest groups such as the St. Margaret‟s Bay Stewardship Association to carry out on-going benthic macroinvertebrate sampling after the initial establishment of the program.

A recent study by the United States Geological Survey (USGS) has focused on assessing the various indicators of urbanization in stream environments across the United States. Increased road development is a part of the urbanization trend within watersheds. During their assessment, the USGS concluded that benthic macroinvertebrates had important advantages over other biological indicators for assessing the effects of urbanization on stream ecosystems, including a predictable response of macroinvertebrate assemblages to an urbanization gradient they developed (Brown *et al*. 2009). Benthic macroinvertebrate surveying can be carried out reliably with appropriate training; sampling methods are repeatable, allowing direct comparisons seasonally and annually; and indices have been developed and have proven successful for assessment of changes in the aquatic environment over time. For these reasons, a repeat benthic macroinvertebrate monitoring program may be considered to monitor for potential longer-term effects from sedimentation and road-salting along the Project corridor. The inclusion of chloride and sodium in the collection of baseline water quality measurements will also allow changes in the parameters in response to road salting to be evaluated within the Project area over time.

5.4 Vegetation

5.4.1 Rationale for Selection as Valued Environmental Component

Vegetation was selected as a VEC because of the potential for interactions between Project activities and vegetation, in particular, terrestrial vascular plants that are considered as Species at Risk or Species of Conservation Concern. Further discussion of the effects of the Project on wetland vegetation is provided in Section 5.6.

5.4.2 Environmental Assessment Boundaries

5.4.2.1 Spatial

The spatial boundary for the assessment of vegetation via field surveys was approximately 85 m to the south and 120 m to the north of the existing highway centerline (*i.e.*, the “Study Corridor”). However, the area within 500 m from the centerline of the existing highway (*i.e.*, the “Assessment Area”) was used for certain descriptive purposes relating to the distribution of land-use types and wetlands.

5.4.2.2 Temporal

The temporal boundaries for the assessment of the potential environmental effects of the Project on Vegetation include the duration of Project construction, and operation and maintenance of the Project in perpetuity.

5.4.2.3 Administrative and Technical

Endangered and threatened plant species that are protected federally under the *Species at Risk Act* (*SARA*) are listed in Schedule 1 of the Act. As defined in *SARA*, "wildlife species" means a species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and (a) is native to Canada; or (b) has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. The purpose of this Act is to protect wildlife Species at Risk and their critical habitat. *SARA* is administered by Environment Canada, Parks Canada Agency, and DFO. Those species listed as “Endangered” or “Threatened” in Schedule 2 or 3 of *SARA* may also be considered as Species at Risk, pending regulatory consultation.

Certain plant species are also protected under the Nova Scotia *Endangered Species Act*. Species identified as seriously at risk of extinction in the province are identified by a provincial status assessment process through the Nova Scotia Endangered Species Working Group. Once identified, they are protected under the *Endangered Species Act*. The conservation and recovery of species assessed and legally listed under the *Endangered Species Act* is coordinated by the Wildlife Division of the Nova Scotia Department of Natural Resources (NSDNR). There is also a provincial General Status assessment process that serves as a first alert tool for identifying species in the province that are potentially at risk. Under this process, the populations of species which are native to the province are classified to be either “At Risk”, “May be at Risk”, “Sensitive” to human activities or natural events, “Secure”, or “Undetermined” should there be insufficient data, information, or knowledge available to assess their status. Although species listed under this process are not granted legislative protection, the presence of species whose populations are considered to be At Risk, May be at Risk, or Sensitive is an issue of concern for provincial regulators.

Information used in support of the assessment of vegetation, including the potential of the area for harboring rare and endangered species, was obtained from aerial photography, provincial forest inventory mapping, the Atlantic Canada Conservation Data Center (ACCDC), the Nova Scotia Department of natural resources (NSDNR), and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Field data was gathered in the fall of 2009 and the spring and early summer of 2010.

5.4.3 Residual Environmental Effects Rating Criteria

There is both federal (*SARA*) and provincial (NS *Endangered Species Act*) legislation for the protection of Species at Risk and Species of Conservation Concern, and there are different levels of protection afforded a species within these acts pending the species rarity ranking. For example, only those species currently listed in Schedule 1 of *SARA* are protected by that Act. *SARA* listed species designated as “Special Concern” are not protected by the prohibitions of Sections 32-36 of *SARA*, but do require that provincial or regional management plans are developed to protect the species. Also, there are multiple agencies that provide lists of “Species of Conservation Concern” that are not protected by legislation, but that do require special consideration for the purpose of environmental assessments. As a result, multiple significance criteria are required to accommodate the different levels of protection afforded by these various acts, agencies and listings. Definitions of rarity ranks referred to in the significance criteria are summarized in Appendix G.

Species at Risk

A **significant residual adverse environmental effect** on all plants listed in Schedule 1 of *SARA* as “Extirpated”, Endangered” or “Threatened” or listed by NSDNR as “At Risk” is:

- One that results in a non-permitted contravention of any of the prohibitions stated in Sections 32-36 of *SARA*, or in contravention of any of the prohibitions stated in Section 3 of the NS *Endangered Species Act*.

Species of Conservation Concern

A **significant residual adverse environmental effect** on listed species not under the protection of *SARA* or the *Endangered Species Act* (*i.e.,* listed as "Special Concern" in Schedule 1 of *SARA*; listed in Schedule 2 or 3 of *SARA*); or ranked as S1, S2, or S3 by ACCDC; and/or ranked "May Be At Risk" or "Sensitive" by NSDNR (2007c) is:

- One that alters the habitat within the assessment boundaries physically, chemically, or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable population that is dependent upon that habitat such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Atlantic Interior Theme Region is substantially reduced as a result; or
- One that results in the direct mortality of individuals or communities such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Atlantic Interior Theme Region in the case of species of "Special Concern" listed in Schedule 1 of *SARA*, where the Project activities are not in compliance with the objectives of management plans (developed as a result of Section 65 of *SARA*) that are in place at the time of relevant Project activities.

Secure Species

A **significant residual adverse environmental effect** on all secure species (including those designated S4 or S5 by ACCDC, and/or designated as "Green" by NSDNR) species is:

- One that effects plants (*e.g.,* direct mortality, change in migratory patterns, habitat avoidance) or their habitat (loss or change) in such a way as to cause a decline in abundance or change in distribution of these common and secure population(s) of indicator/representative vascular plant species such that the likelihood of the long-term survival of these species may be reduced within the assessment boundaries, defined as the Atlantic Interior Theme Region, and natural recruitment may not re-establish the population(s) to its original level.

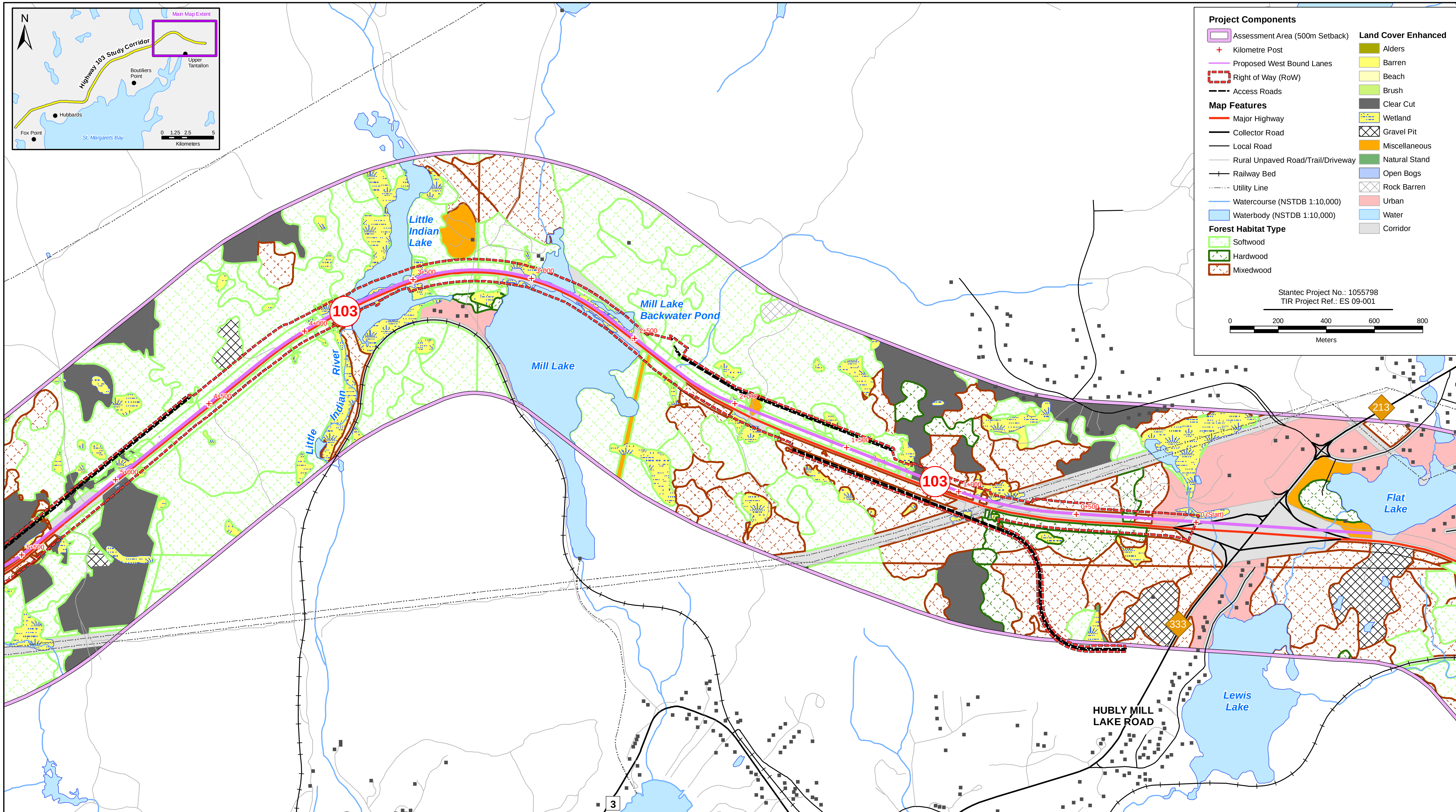
5.4.4 Baseline Conditions

General information regarding the biogeography of the Assessment Area was derived from a review of Davis and Browne (1997) whereas data on the specific habitat types present in the Assessment Area was obtained from a number of sources. The distribution of habitats within 500 m of either side of the proposed highway center line (Assessment Area) was determined using NSDNR‟s forest (NSDNR 2008a) and wetland inventory (NSDNR 2007a) mapping, and adjusted based on air photo interpretation and results of the field surveys. Analysis of 2002 aerial photography within the Assessment Area was used to determine the distribution of clear-cuts made after the NSDNR habitat mapping was prepared and to identify and classify wetlands that were not identified. Field surveys were conducted 120 m north and 85 m south of the existing highway centerline (*i.e.*, the Study Corridor). Data collected during these surveys were used to refine the shapes and classification of wetlands found within this area. Data collected during the various field surveys were also used to help describe the types of habitats present in the Study Corridor, and by extrapolation within the Assessment Area. Wetland shapes and types beyond the 200 m Study Corridor were derived from the 2002 aerial photography.

The Study Corridor is located in the Atlantic Interior Theme Region (Davis and Browne 1997). This large region exhibits considerable climatic variation but is characterized by an inland-lowland climate which is sheltered from direct marine influences and has cold winters and warm summers. Being in close proximity to the coast, mean total annual precipitation within the Study Corridor would approach 1600 mm whereas the frost-free period is between 100-140 days. The mean annual temperature of the Atlantic Interior Theme Region varies from 1°C to over 5°C. Average January temperatures are below -5°C within most of the Region, but areas closer to the coast are generally warmer. By the end of March, mean temperatures are typically above freezing and by July most of the Region has warmed to greater than 17.5°C (Davis and Browne 1997).

The main influences on vegetation within the Atlantic Interior Theme Region are its inland climate with warm summers, its sandy and acidic soils, varied drainage, and extensive disturbance by fire and logging (Davis and Browne 1997). Forested areas are dominated by softwoods but shade-intolerant hardwoods are also frequent and pockets of shade-tolerant hardwoods are associated with some of the higher, better-drained sites. Red spruce (*Picea rubens*) and eastern hemlock (*Tsuga canadensis*) were once abundant throughout much of the Region, but both have been depleted by forest harvesting activities (Davis and Browne 1997).

Figures 5.4.1a-e show the distribution of various habitat types present within 500 m of the existing Highway 103 centerline. Table 5.50 presents the areas of each of these habitats within the Study Corridor, as well as the amount of each which is likely to be directly impacted by the proposed twinning.



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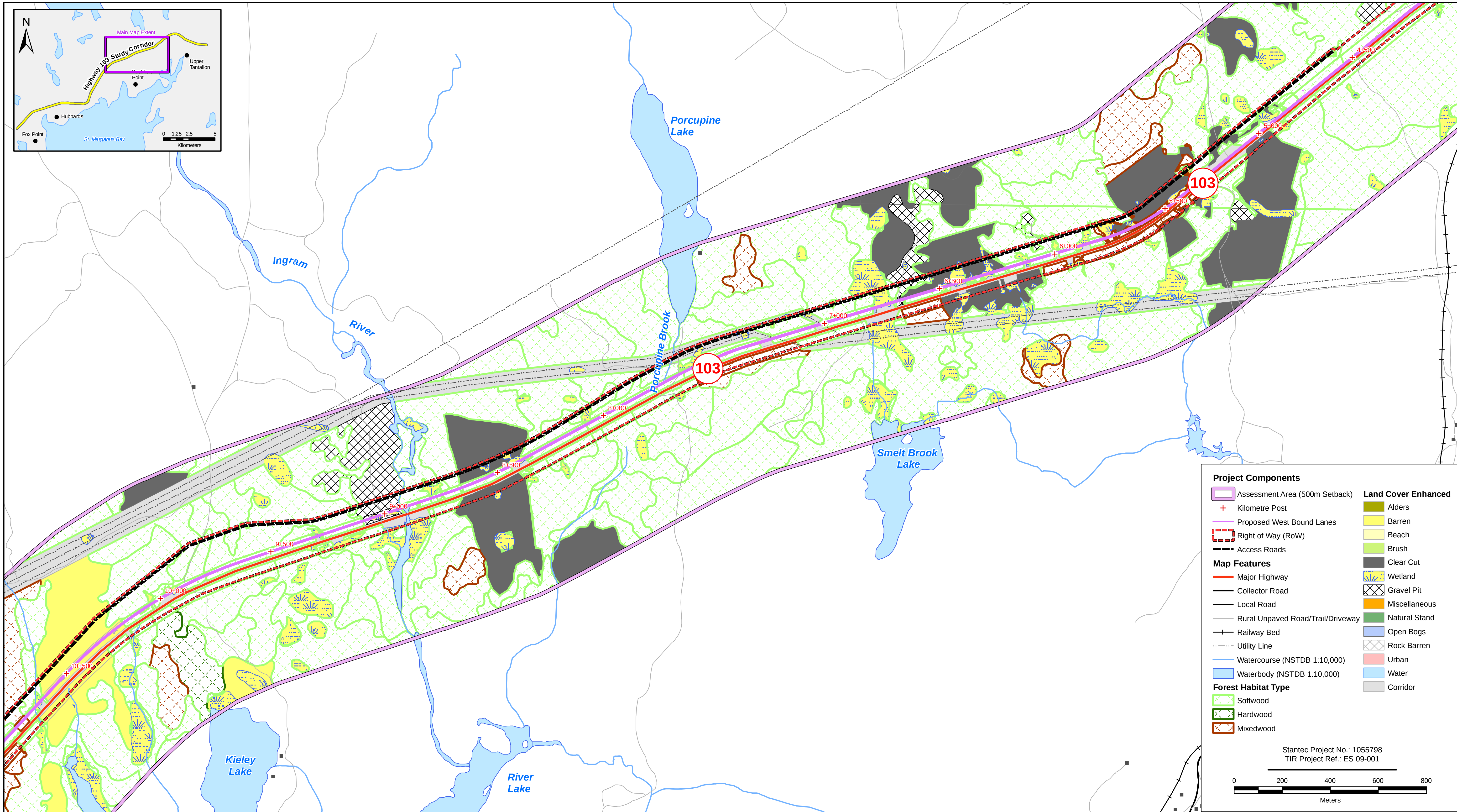
DATE: October 2010	Data Reference: Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997; Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR); Forestry Data: Nova Scotia Department of Natural Resources, Renewable Resources Branch, Forest Inventory.Photography years 1995-present.	Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening	FIGURE NO.: 5.4.1a
PREPARED BY: M. Huskins-Shupe		**Land Classification within the Project Study Area Map 1**	Stantec
NOVA SCOTIA Transportation and Infrastructure Renewal			



DATE: October 2010

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA Transportation and Infrastructure Renewal

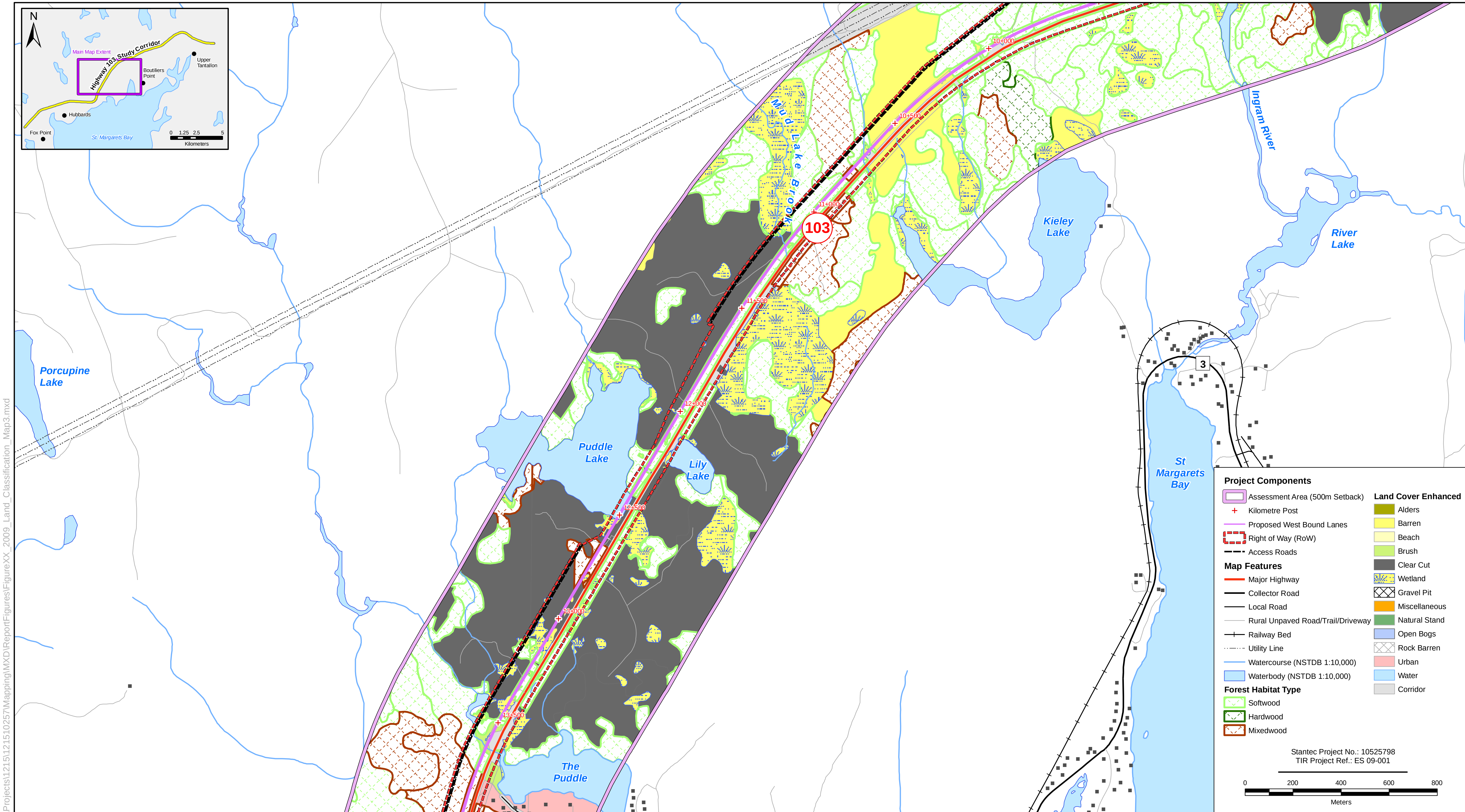
Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
Forestry Data: Nova Scotia Department of Natural Resources, Renewable Resources Branch, Forest Inventory.Photography years 1995-present.

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Land Classification within the Project Study Area
Map 2

FIGURE NO.: 5.4.1b

Stantec



DATE: October 2010

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA Transportation and Infrastructure Renewal

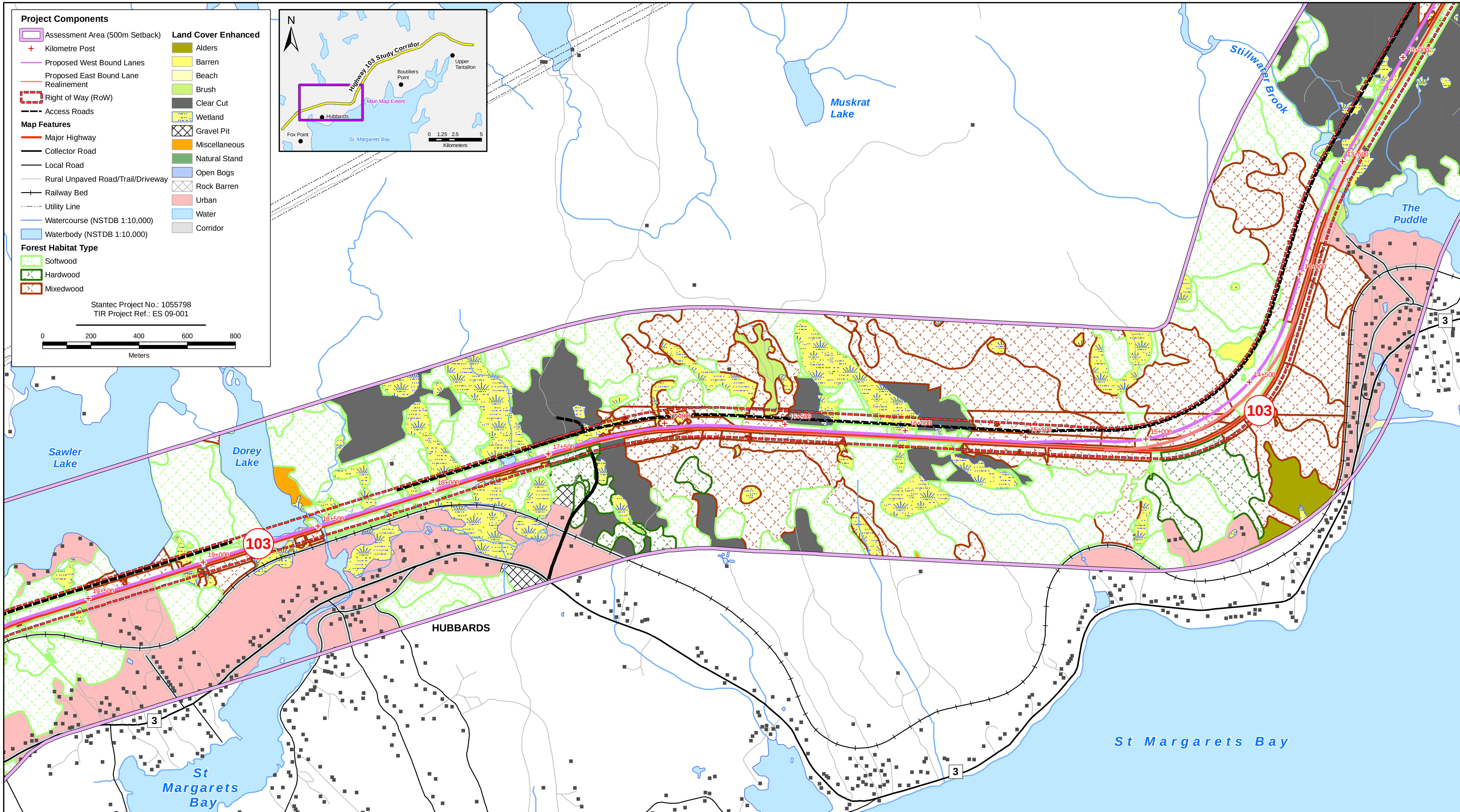
Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
Forestry Data: Nova Scotia Department of Natural Resources, Renewable Resources Branch, Forest Inventory.Photography years 1995-present.

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

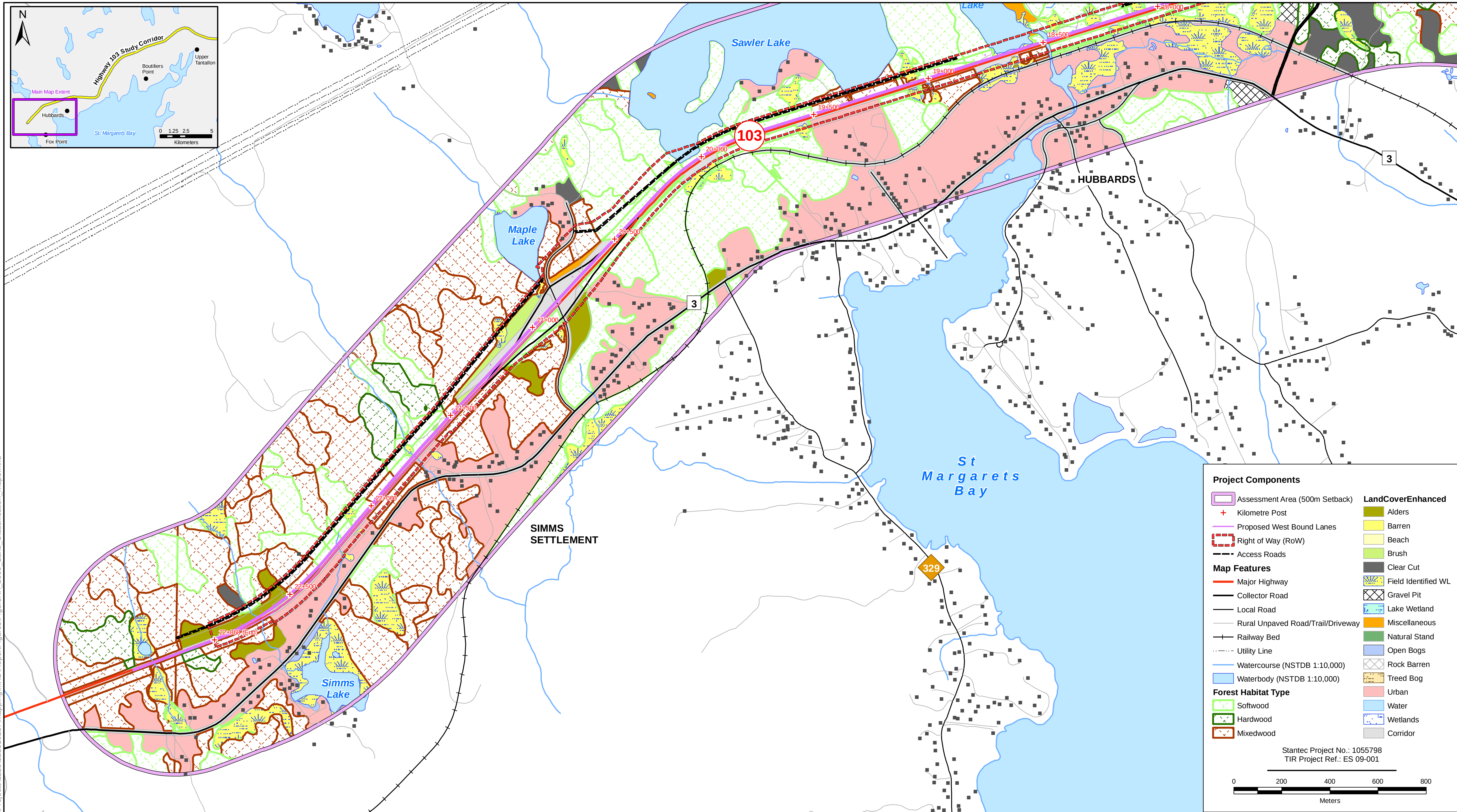
Land Classification within the Project Study Area
Map 3

FIGURE NO.: 5.4.1c

Stantec



DATE: February 2011	Data Reference: Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997 Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) Forestry Data: Nova Scotia Department of Natural Resources, Renewable Resources Branch, Forest Inventory.Photography years 1995-present.	Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening **Land Classification within the Project Study Area** **Map 4**	FIGURE NO.: **5.4.1d**
PREPARED BY: M. Huskins-Shupe			
NOVA SCOTIA Transportation and Infrastructure Renewal			Stantec



DATE:
October 2010

PREPARED BY:
M. Huskins-Shupe

NOVA SCOTIA
Transportation and Infrastructure Renewal

Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
Forestry Data: Nova Scotia Department of Natural Resources, Renewable Resources Branch, Forest Inventory.Photography years 1995-present.

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Land Classification within the Project Study Area
Map 5

FIGURE NO.:
5.4.1e

Stantec

Table 5.50 Land Classification[1]: Distribution and Project Impacts

Land Class	Within Assessment Area*		Within Study Corridor**		Within Proposed Impact Area	
	Area (ha)	% of Total Area	Area (ha)	% of Total	Area (ha)	% of Total
Alders	13.34	0.45	0.92	0.20	1.77	0.91
Barren	30.43	1.03	7.62	1.65	4.36	2.25
Beach	0.29	0.01	0.00	0.00	0.00	0.00
Brush	5.52	0.19	3.33	0.72	2.48	1.28
Clear Cut	271.26	9.15	42.83	9.27	18.89	9.73
Coastal Habitat	0.60	0.02	0.00	0.00	0.00	0.00
Corridor	177.93	6.00	72.94	15.79	20.84	10.74
Gravel Pit	39.82	1.34	3.38	0.73	2.35	1.21
Hardwood	88.51	2.99	10.01	2.17	1.14	0.59
Inland Water	155.18	5.23	11.22	2.43	2.27	1.17
Miscellaneous	8.80	0.30	1.88	0.41	0.93	0.48
Mixedwood	639.85	21.58	86.76	18.78	32.99	17.01
Natural Stand	0.12	0.00	0.00	0.00	0.00	0.00
Ocean	2.42	0.08	0.00	0.00	0.00	0.00
Other	28.75	0.97	3.16	0.68	0.02	0.01
Rock Barren	1.07	0.04	0.00	0.00	0.00	0.00
Softwood	1025.61	34.59	163.69	35.44	87.34	45.02
Urban	267.30	9.02	8.62	1.87	1.16	0.60
Wetlands	208.17	7.02	45.54	9.86	17.47	9.00
Total	2964.98	100.00	461.91	100.00	194.00	100.00

[1]Land classification data based on NSDNR's Forest Inventory but modified based on results of field surveys and air photo interpretation

*The Assessment Area includes that which is within 500 m of the existing highway centerline

** The Study Corridor includes that which is within 120 m north and 85 m south of the existing highway centerline

The landscape in which the Project is located has been moderately influenced by human activities. Anthropogenically disturbed habitat covers approximately 25% of the Assessment Area and consists of corridor (cleared highway and electrical transmission line RoW), gravel pits, clear-cuts, and urban areas. Clear-cuts and urban areas are the most abundant types of disturbed habitat in the Assessment Area.

The major anthropogenic land-use type within the Study Corridor is the existing highway. As is typical of such features, the edges of the highway are characterized by a relatively high diversity of early-successional and weedy species, many of which are not indigenous to the province. This vegetation is a response to the disturbance processes associated with highway maintenance as well as increased dispersal opportunities associated with wind and vehicles. In close proximity to the road edge, the presence of salt-tolerant plants (*i.e.,* halophytes) also reflects the influence of roadway salt application on the adjacent vegetation. Other prominent anthropogenic land-use types include corridors associated with power lines, logging roads, old quarries, and a railway line that has been converted to a hiking trail.

The majority of land surrounding the existing highway is comprised of naturally regenerating habitat (Table 5.50). However, like much of the Atlantic Interior Theme Region, forest management activities have been extensive throughout the area and as a result; much of the forested area is currently in an early-mid successional state. Some late-successional forest stands are present however, such as within the properties at the southern end of Sawler Lake.

Upland forest ecosystems comprise the majority of land cover within the Study Corridor. Softwood stands dominate (~35%), followed by lesser amounts of mixed wood (~22%), and scattered patches of hardwood (~3%). Prominent trees within well-drained areas include red spruce, red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), and paper birch (*Betula papyrifera*). Northern red oak (*Quercus rubra*), eastern white pine (*Pinus strobus*), and white spruce (*Picea glauca*) are important components of some stands and eastern hemlock was present within the mature coniferous and mixed wood stands at the southern end of Sawler Lake. In areas with imperfect and poor drainage, tree composition is primarily comprised of black spruce (*Picea mariana*), red maple, balsam fir, and American larch (*Larix laricina*).

Upland shrub thickets are present in areas which are regenerating following disturbance by anthropogenic activities but only account for approximately 0.6% of the total Assessment Area. For example, speckled alder (*Alnus incana*) and green alder (*Alnus viridis*) are prominent species along the edges of old borrow pits.

Barrens are present at several locations throughout the Assessment Area but account for only 1% of the total area. Those areas identified as barrens within the Study Corridor have an intermittent tree cover comprised predominantly of conifers, including jack pine (*Pinus banksiana*), red pine (*Pinus resinosa*), eastern white pine, and black spruce. They are characterized by very shallow soils overlying granite bedrock and have a high cover of ericaceous shrubs and reindeer lichen (*Cladina spp.*). Glacial erratics are scattered throughout this habitat type. Although some rock barrens are present within the Assessment Area, this habitat type is not represented within the Study Corridor.

Wetlands are relatively common throughout the Assessment Area, accounting for approximately 7% of its area. Swamps are the most abundant wetland type and are predominantly treed. However, many of these treed swamps have been subject to recent tree harvesting practices, and therefore have components which are at an early stage of successional development. Whereas swamps dominated by tall shrubs are also common, those comprised of low-shrub vegetation are relatively scarce. Freshwater marshes, comprised predominantly of graminoids, are scattered throughout the Assessment Area and are often present as part of larger wetland complexes. For example, they are found in association with shallow water wetlands which are dominated by aquatic vegetation and found within and towards the margins of many of the major water bodies of the area. Shallow water wetland types are also present as a minor component within some of the smaller wetland complexes but these tend to lack any characteristic vegetation. One small area of brackish marsh located at the northern end of St, Margaret"s Bay, known as “The Puddle”, is also present within the Assessment Area. Bogs are the second most abundant wetland class within the Assessment Area, accounting for approximately 1% of the total area of the Assessment Area, and are represented by several large occurrences towards the center of the corridor near Puddle Lake. These wetlands are dominated by black spruce and a variety of ericaceous shrubs. Additionally, two areas of graminoid fen were identified within the Study Corridor where they were associated the Little Indian and Ingram rivers. For more detailed descriptions of wetland communities, including their abundance and dominant plants, refer to Section 5.6.

Several lakes are present within the Study Corridor, most notably Mill Lake, Little Indian Lake, Dorey Lake, and Sawler Lake. Although their peripheries are often comprised of shallow water wetland (where water depths are < 2 m) and other fringing wetland types (including swamps, bogs, and marsh), much of their edges show a quick transition from lacustrine conditions to upland habitat types. As a result of their water depth and rocky substrate, such areas provide limited opportunities for vegetative growth.

The large majority of land to be impacted by the proposed twinning is forested (Table 5.50). In particular, softwood, mixed wood, and recently harvested (*i.e.*, clear cut) stands are to be most heavily impacted, respectively. Wetlands are also identified for relatively high amounts of direct impacts, comprising almost 10 % of the area to be affected. Impacts to the land-use type designated as “Corridor” are also known to be high as this classification includes habitats associated with the existing highway (*e.g.*, ditches). Other land-use types which the Project is expected to directly affect (in order from greatest to least impacted) include barrens, brush, gravel pits, inland waters, alders, urban (residential, commercial, *etc.*), and miscellaneous (*i.e.*, other) habitats. The Project is not expected to result in any direct loss of areas identified as beach, coastal habitat, ocean, or rock barren.

Overall, the Assessment Area is characterized by moderate habitat richness but fairly low overall habitat diversity owing to the fact that although a number of habitat types are present, most of the area is composed of only few of these habitat types (Figures 5.4.1a-e and Table 5.50). Approximately 68% of the Assessment Area consists of upland forest habitat with 34% of the entire area covered by “mature” (not necessarily late-successional) softwood forest.

Rare Vascular Plants

A rare plant modeling exercise was performed to determine the likelihood of presence of rare or sensitive plants within the Study Corridor. As part of the modeling exercise, all records of plant species listed by the NSDNR (2010) to be At Risk, May be at Risk, Sensitive to human activities or natural events, or ranked as S1, S2, or S3 by the ACCDC within a radius of 25 km from the Study Corridor were compiled by means of an ACCDC data search. The habitat requirements of these species which had been recorded within 25 km from the center of the proposed development were then compared to the range of environmental conditions within the Study

Corridor to determine if suitable habitat was present for these taxa. In instances where appropriate habitat was present for a particular species, that taxon was considered to be potentially present in the Study Corridor, and the habitat was identified as a target for field surveys. The phenology and ease of identification of each of the species potentially present in the Study Corridor was also incorporated into the model in order to determine when the rare or sensitive taxa would be best identified.

A total of 21 rare or sensitive vascular plant species have been recorded within 25 km of the center of the proposed twinning. Based on the results of the habitat model, there is potential for all but one of these species to be found within the Study Corridor. In addition, three rare non-vascular taxa have been recorded within the vicinity of the proposed project. Table 1 in Appendix G lists these species, their preferred habitats and their phenology.

The results of the habitat modeling exercise indicated that all of the habitat types present in the Study Corridor could potentially harbour rare species. However, because many of the rare or sensitive plants were associated with wetlands, barrens, and the shores of water bodies, these habitats were considered to be most likely to harbor plants of conservation concern. Therefore, although all habitat types present in the Study Corridor were surveyed, with the exception of residential and commercial land, particular attention was paid to the aforementioned areas.

The phenologies of the rare and sensitive vascular plants highlighted by the model suggest that rare plants may be identified at all times during the growing season. Although many of the species have restricted flowering periods, most are readily identified by their seeds and/or general morphological characteristics, such as leaf shape, throughout the growing season. However, confident identification of several species, such as Yellow nodding ladies'-tresse (*Spiranthes ochroleuca*) and Wavy-leaf American-aster (*Symphyotrichum undulatum*), can only be made in the fall due to their late development. Field surveys were conducted during September 2009 and throughout June 2010 and are considered sufficient to allow detection of all of the species identified by the model.

The Study Corridor was surveyed by experienced botanists. All species of vascular plant encountered during the surveys were identified and their population status in Nova Scotia was determined through a review of the species rankings provided by NSDNR (NSDNR 2010), ACCDC (ACCDC 2010), COSEWIC (2009), and those listed under *SARA* and the Nova Scotia *Endangered Species Act*. Table 2 in Appendix G provides location coordinates for rare or uncommon plants (*i.e.*, plants listed as S1 to S3S4 by ACCDC) found within the Study Corridor during field surveys.

A total of 484 vascular plant species were recorded within the Study Corridor. This species richness is a reflection of a variety of habitat types being encountered and the presence of large numbers of non-native and weedy taxa. Approximately 18% of the plant species recorded along the route are not native to the province of Nova Scotia. The results of the vegetation surveys conducted within the Study Corridor are presented in Table 3 of Appendix G.

Figures 5.4.2a-e show the locations of plant species of interest within the Study Corridor.

Species at Risk

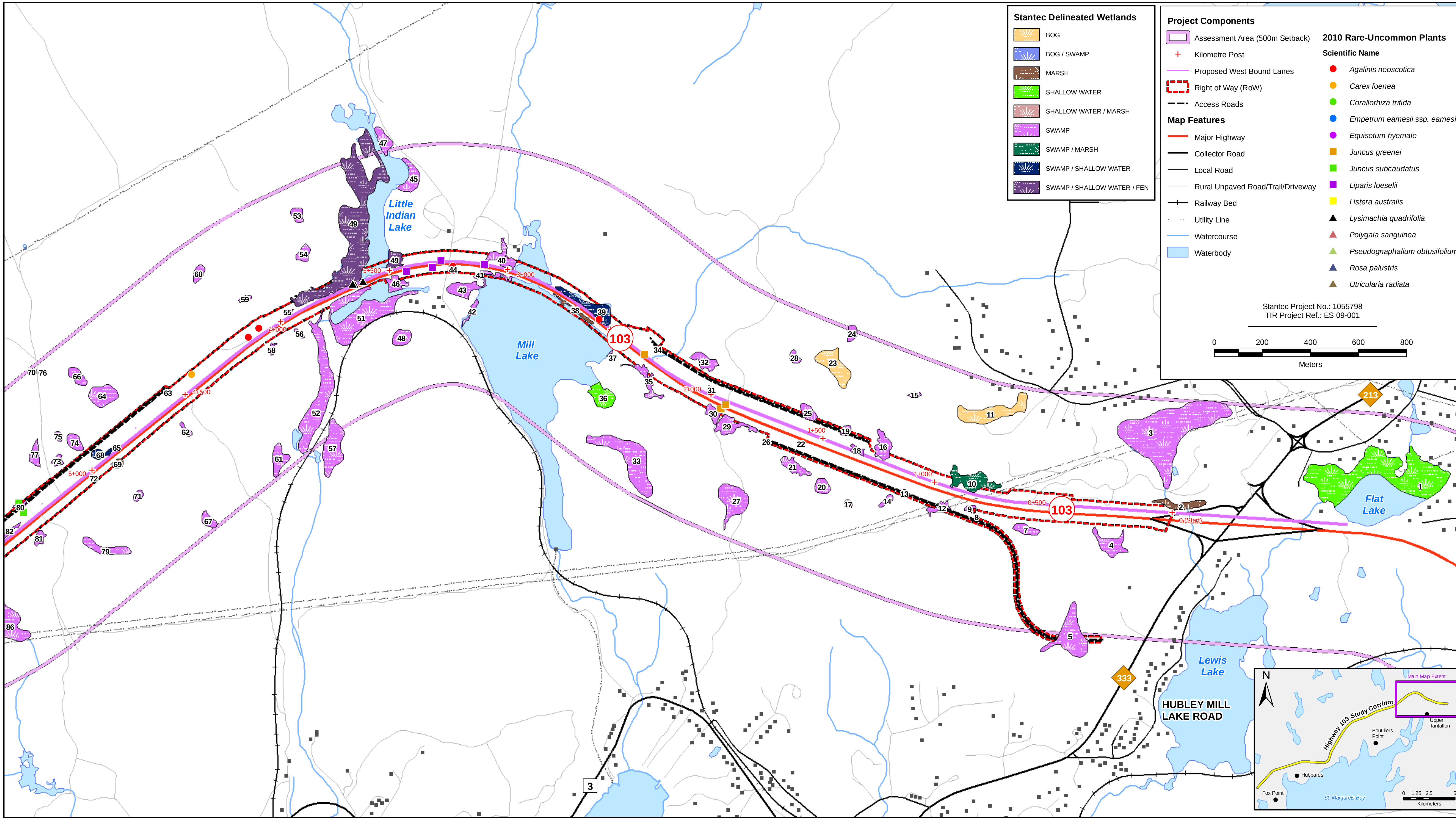
No vascular plant species encountered during the field surveys are considered “At Risk”, as previously defined in Section 5.4.3.

Only one vascular plant “species at risk”, Canada frostweed (*Helianthemum canadense*), was identified by the modeling exercise as being potentially present within the Study Corridor.

Canada frostweed is considered “Endangered” under the Nova Scotia *Endangered Species Act*, given a rank of “May Be At Risk” by NSDNR, and is ranked “S1” by the ACCDC indicating that it is extremely rare throughout its range in the province and considered to be especially vulnerable to extirpation. Canada frostweed is not protected under the federal *SARA* and has not been assessed by COSEWIC. This species is associated with sand barrens and has been found approximately 13 km from the center of the proposed twinning alignment. Field surveys did not encounter this species and it is therefore not expected to inhabit the Study Corridor. Furthermore, locations with potentially suitable habitat for this species were found to be limited to small roadside pockets which had been previously disturbed by anthropogenic activities but which were currently regenerating with some barren-like habitat over a sandy substrate.

One non-vascular species at risk, boreal felt lichen (*Erioderma pedicellatum*), has been recorded within the vicinity of the Study Corridor. Boreal felt lichen is considered “Endangered” by *SARA*, COSEWIC, and the province of Nova Scotia and has been found approximately 13 km from the center of the Study Corridor. Additionally, it is considered “At Risk” by NSDNR and is ranked S1S2 by the ACCDC. This foliose cyanolichen primarily grows on the trunks and branches of balsam fir within moist and mature forest stands (Environment Canada 2007b) and could potentially inhabit the Assessment Area. In particular, results from a boreal felt lichen habitat model for the province; based on tree composition and maturity, distance from coastline, and proximity to peatlands; has been obtained from NSE(NSE 2008) and indicates that 27 areas within the Assessment Area have potentially suitable habitat, accounting for a cumulative area of over 21 hectares. In particular, the model has identified two areas within the Study Corridor which are considered to have “High” potential to harbor this species. These areas include the forested habitats adjacent to Wetland 185 and the northwestern side of Wetland 202. Of the additional 25 areas within the larger Assessment Area, 16 are considered to have “High” potential as habitat for the boreal felt lichen whereas two and seven have been identified as having “Medium” and “Low” potential, respectively.

Like other cyanolichens, boreal felt lichen is very sensitive to air pollution, particularly nitrous oxides and sulphur dioxide. Although nitrous oxides and sulphur dioxide currently comprise a minor component of car emissions, this stressor could act to inhibit populations of the boreal felt lichen within close proximity to the existing twinning. As such, boreal felt lichen would be less likely to be found within the Study Corridor than farther away from the existing highway (Cameron 2010).



DATE: October 2010

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA
Transportation and Infrastructure Renewal

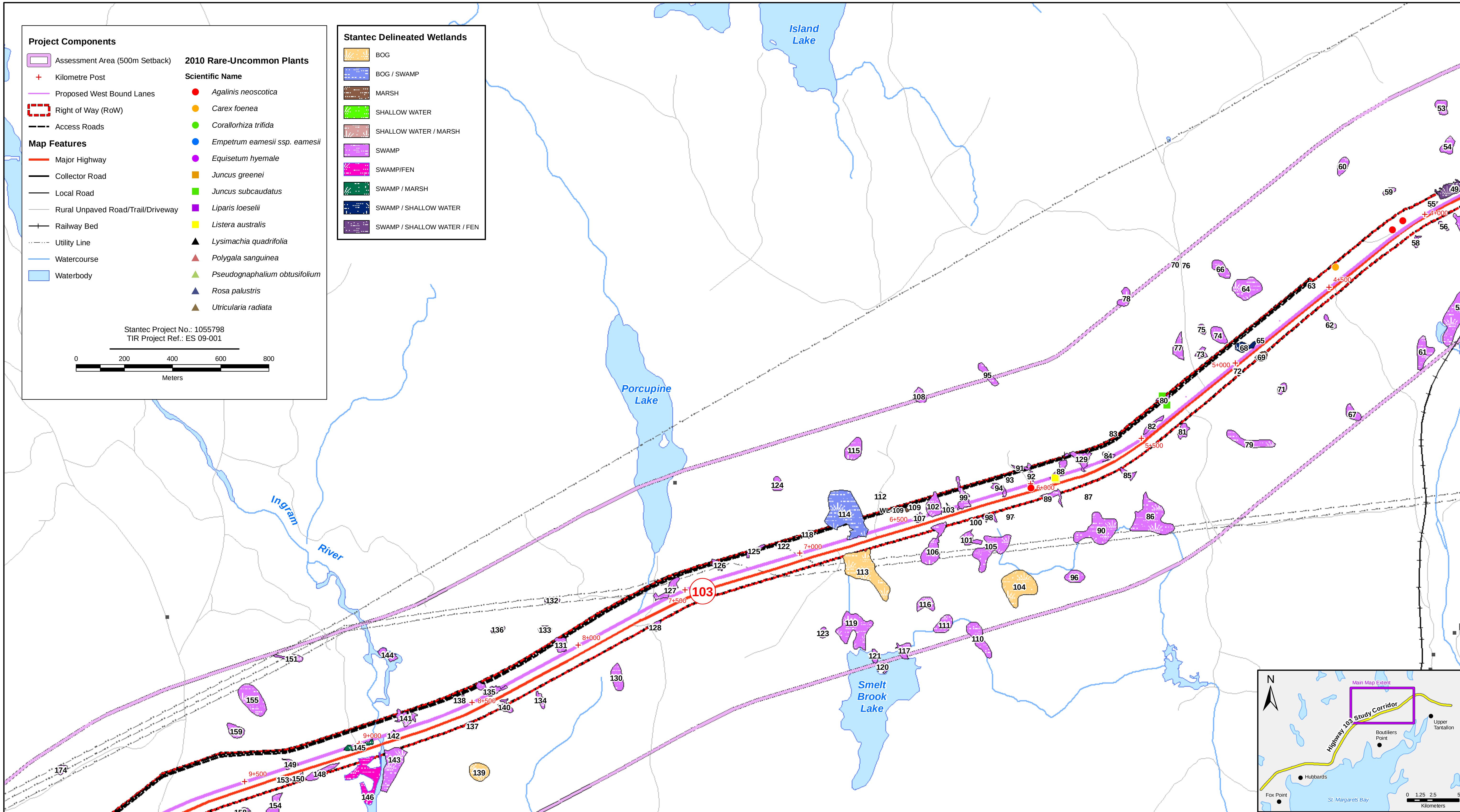
Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Plant Species of Interest and Wetlands within the Project Study Area
Map 1

FIGURE NO.: 5.4.2a

Stantec



DATE: October 2010

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA Transportation and Infrastructure Renewal

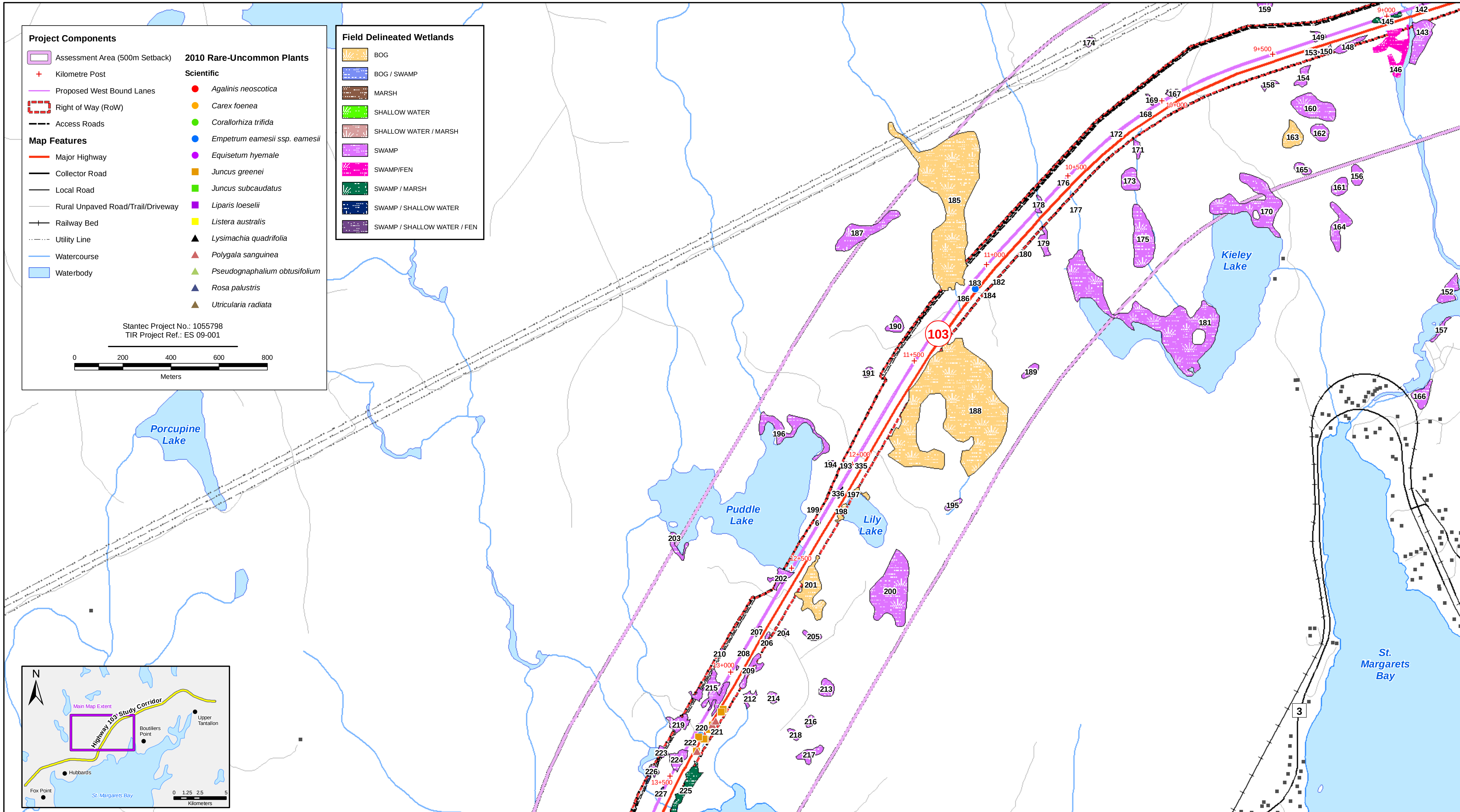
Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Plant Species of Interest and Wetlands within the Project Study Area
Map 2

FIGURE NO.: 5.4.2b

Stantec



DATE: October 2010

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA Transportation and Infrastructure Renewal

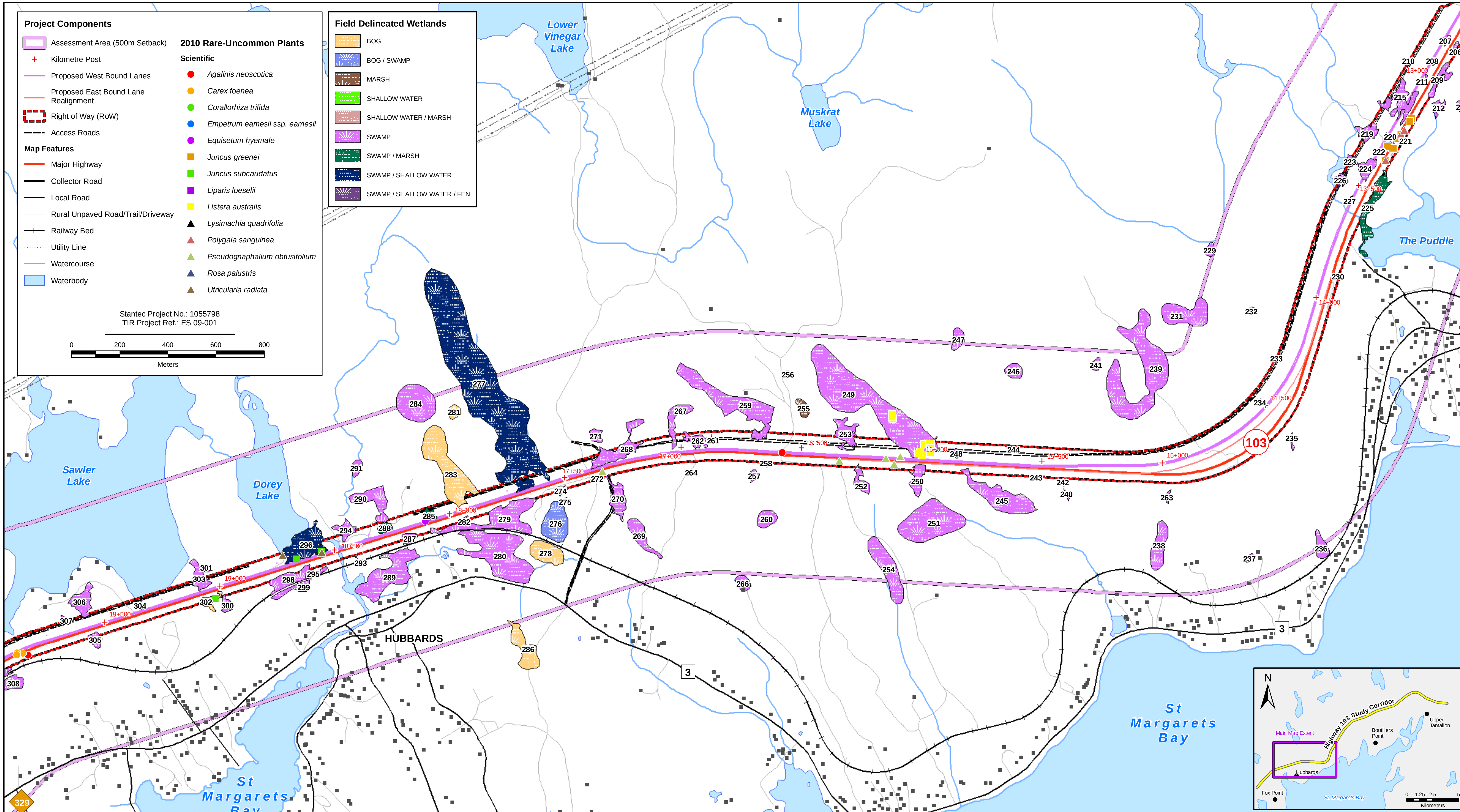
Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Plant Species of Interest and Wetlands within the Project Study Area
Map 3

FIGURE NO.: 5.4.2c

Stantec



DATE: February 2011

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA
Transportation and Infrastructure Renewal

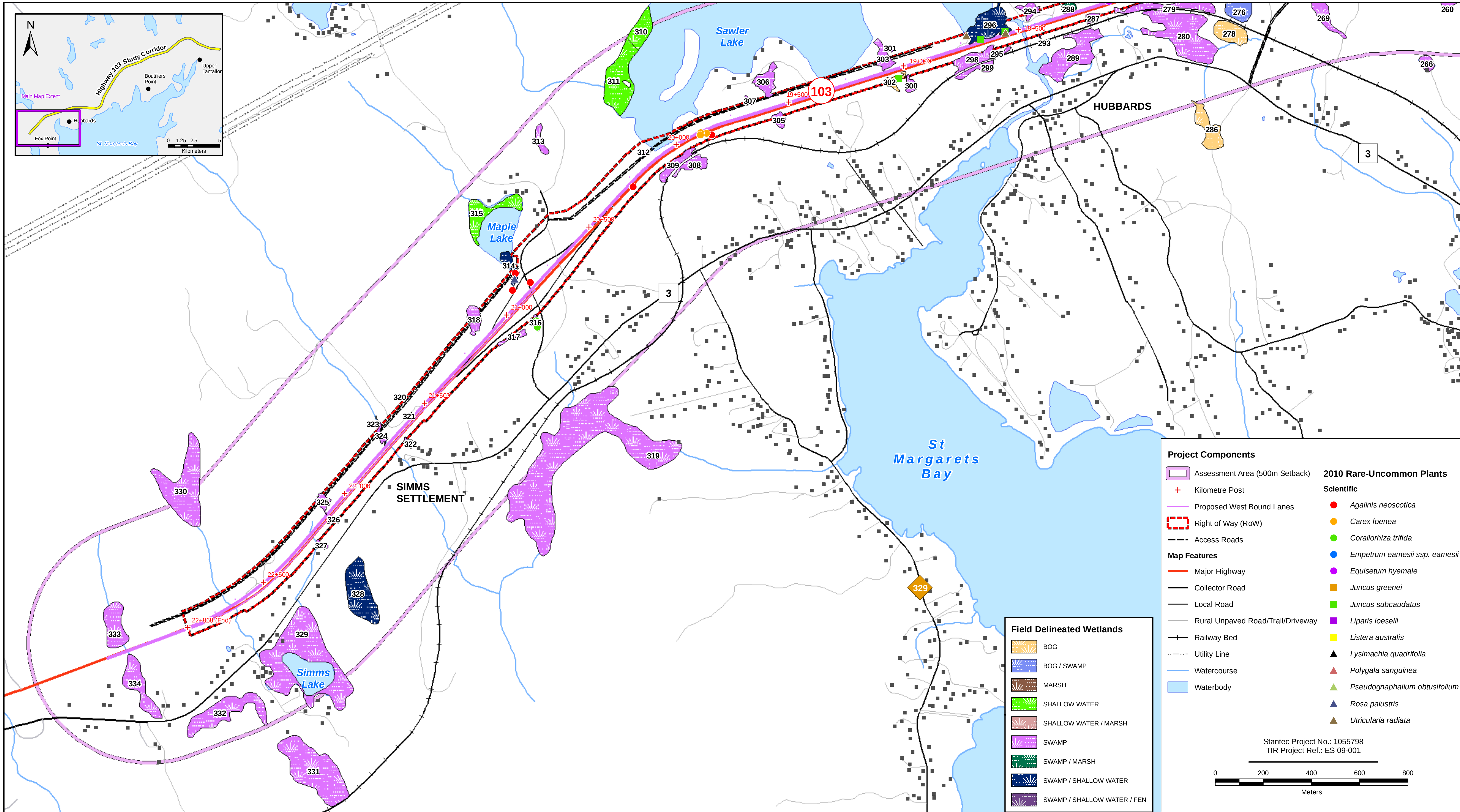
Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Plant Species of Interest and Wetlands within the Project Study Area
Map 4

FIGURE NO.: 5.4.2d

Stantec



DATE: October 2010	Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening	FIGURE NO.: 5.4.2e
PERPARED BY: M. Huskins-Shupe	Data Reference: Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997. Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)	
NOVA SCOTIA Transportation and Infrastructure Renewal	**Plant Species of Interest and Wetlands within the Project Study Area Map 5**	Stantec

Species of Conservation Concern

The rare plant modeling exercise identified a total of 18 vascular Species of Conservation Concern that have been recorded in the vicinity of the Assessment Area. Of these, NSDNR considers the populations of two to be “May be at Risk”, nine to be “Sensitive”, six to be “Undetermined”, and one to be “Secure”. None are currently listed by *SARA*. Those whose populations are considered by NSDNR to be either “Secure” or “Undetermined” are considered to be “Species of Conservation Concern” as a result of being assigned ACCDC ranks S1, S2 or S3 indicating that their populations are considered to be extremely rare to uncommon within the province. In addition, one rare lichen was identified by the model as being potentially present in the Assessment Area.

A total of 10 Species of Conservation Concern were found during the field surveys. Two of these species, Greene's rush (*Juncus greenei*) and southern twayblade (*Listera australis*) are considered “May be at Risk” by NSDNR and are therefore considered here to be of high conservation concern within the province. Three of the species are assigned a “Sensitive” ranking by NSDNR indicating they are potentially susceptible to human activities or natural events, and include field milkwort (*Polygala sanguinea*), purple crowberry (*Empetrum eamesii ssp. eamesii*), and woods-rush (*Juncus subcaudatus*). The populations of the remaining five species are considered “Secure” by NSDNR but have been assigned rankings varying from “S2S3” to “S3” by the ACCDC indicating that they are uncommon throughout the province and are of long term concern. These taxa include Fernald's hay sedge (*Carex foenea*), Nova Scotia false-foxglove (*Agalinis neoscotica*), early coralroot (*Corallorhiza trifida*), swamp rose (*Rosa palustris*), and small swollen bladderwort (*Utricularia radiata*). Of the aforementioned species, two (field milkwort and small swollen bladderwort) had previously been identified by the modeling exercise as being potentially present within the Assessment Area.

Greene's rush is considered “May Be At Risk” by NSDNR and is ranked as “S1S2” by the ACCDC indicating that its population is rare within the province and may be vulnerable to extirpation. Known populations of Greene's rush are scattered along the coast of the province where they are associated with sandy soil and dune hollows (Zinck 1998). ACCDC records indicate that the closest known population of Greene's rush is approximately 31 km from the center of the Study Corridor. Within the Study Corridor, over 50 clumps (each having approximately 3 – 10 stems each) of this species were found along the edge of the existing highway. These plants were distributed amongst two general localities, one being the southern side of the highway near the water body known as “The Puddle” and the other being just east of Mill Lake. As indicated by the habitat in which Greene's rush was found, its population along the existing Highway 103 is likely the result of anthropogenic introduction, either by seed from travelling vehicles or in association with material used for highway maintenance and/or construction. The majority of the plants were found on the southern side of the existing highway, and would therefore not be impacted by activities associated with the proposed twinning alignment. However, approximately 25 % of the population encountered was found on the northern side of the highway (east of Mill Lake).

Southern twayblade is a small orchid that is typically associated with the shaded sphagnum moss of bogs or treed swamps (Zinck 1998). It is considered “May Be At Risk” by NSDNR and is given a ranking of “S2” by the ACCDC. This species is only visible above ground for several weeks during early summer (mostly in June) and then it senesces. According to ACCDC records, the nearest population of this species is approximately 40 km away from the center of the Study Corridor and five other populations are present within 100 km. However, although not yet incorporated into the ACCDC records, a Stantec botanist has encountered this species within 30 km of the current Study Corridor in 2008. Due to the short period within which it may be observed and its small stature, southern twayblade may occur more frequently than current sources indicate. Within the current Assessment Area, this species was encountered amongst two coniferous treed swamps, Wetlands 88 and 249, both of which are found on the north side of the existing highway. The large majority of those encountered were within Wetland 249 (approximately 50 stems) whereas only a few were encountered within Wetland 88. Individuals within Wetland 249 were restricted to the micro-depressions of the swamp and were not found in association with hummocks or in areas that were more readily inundated (*i.e.*, it appeared to be restricted to a rather specific moisture regime). Southern twayblade was also observed within a portion of Wetland 249 which was outside of the Study Corridor (*i.e.*, beyond 120 m from the existing highway centerline). Although only six of the individuals were encountered in this area, a thorough population survey was not conducted and the amount of potentially suitable habitat appeared abundant. This species is considered to be vulnerable to local changes in hydrology, nutrient status, and land use in other parts of its range (Hoy 2003) and it is expected that this would also be true of Nova Scotian populations.

Field milkwort is an annual herb that is considered “Sensitive” by NSDNR and is ranked “S2S3” by the ACCDC. It is associated with a variety of habitats within Nova Scotia, including poor or acidic fields, damp slopes, and open woods or brush (Zinck 1998). ACCDC records indicate that the closest record of this species is approximately six kilometers away from the center of the Study Corridor. During field surveys, approximately 92 field milkwort plants were found in an area along the southern side of the existing highway where they were growing within the exposed substrate of the highway shoulder (in close proximity to the previously discussed Greene's rush). Due to their proximity to the road edge, the habitat of this population is likely periodically disturbed by on-going road maintenance activities. However, because all observations of field milkwort were restricted to the southern side of the existing highway, the proposed twinning on the northern side of the highway is not expected to interact with this species.

Purple crowberry is a low-lying evergreen shrub, which in Nova Scotia, is restricted to the northern coast of Cape Breton and along the Chebucto Peninsula. At these localities it is associated with exposed headlands, on top of lichen-bearing rocks with thin soil (Zinck 1998). ACCDC records indicate that the closest known population (*i.e.,* of the Chebucto Peninsula) is approximately 37 km away from the center of the Study Corridor. This species is considered “Sensitive” by NSDNR and ranked as “S2S3” by the ACCDC indicating that it is rare to uncommon within the province. A single occurrence of purple crowberry (occupying an area of approximately 1 m^2) was found within the Study Corridor where it was growing on the northern side of the highway shoulder near the area known as “The Puddle” (the previously discussed Greene's rush and field milkwort were found across the highway from this species). The presence of this individual is likely to have resulted from a seed deposited by a bird, which are attracted to its reddish fruit.

Woods-rush is found throughout wet boggy woods and in the openings of spruce swamps in the province (Zinck 1998). Although previously assigned a rank of “Undetermined” by NSDNR (indicating that there was uncertainty regarding its population status), it is now considered “Sensitive” by the province. ACCDC records indicate that the closest record of woods-rush is approximately 46 km away from the Study Corridor but Stantec botanists have found this species at several localities around Halifax (as well as elsewhere in the province). Within the current Study Corridor, this species was recorded in three general localities – within the swamp bordering the southern end of Dorey Lake (Wetland 296), within Wetland 302 on the southern side of the existing highway, and in close proximity to a stream edge approximately 1.5 km west of Little Indian Lake.

The population of Fernald's hay sedge in Nova Scotia is considered “Secure” by NSDNR and is assigned a ranking of “S3?” by the ACCDC indicating that it is considered uncommon, but that there is some uncertainty regarding its abundance. Fernald's hay sedge is found scattered throughout the province where it is found in dry barrens and sandy areas (Zinck 1998) and ACCDC records indicate that the closest record of this species is approximately 26 km away. The majority of this species within the Study Corridor was found along the southern roadside shoulder by Sawler Lake, but it was also encountered within a clearcut towards the eastern end of the Project. Because this species is difficult to identify while in the field (it closely resembles other species within the *Carex* section Ovales and is best identified with the aid of a microscope), it is expected to be more abundant within the Study Corridor than current records indicate.

Nova Scotia false-foxglove is a small herb that is endemic to Nova Scotia. Although not found elsewhere, it is fairly common within the province where its population is considered “Secure” by NSDNR and is assigned a ranking of “S3” by the ACCDC. Typically associated with moist, especially sandy soil (Gleason and Cronquist 1991), it was found throughout the length of the Study Corridor where it was scattered along the side of the existing highway and was also found within Wetland 314.

Early coralroot is a small saprophytic (*i.e.*, feeds on dead organic matter) orchid that is scattered throughout the province and associated with moist and well-shaded coniferous woods (Zinck 1998). Its population is considered to be “Secure” by NSDNR and is ranked “S3” by the ACCDC, indicating that it is uncommon and of long-term concern. Over 20 stems of this species were observed within Wetland 316 where they were associated with a channel that flows through the wetland.

The population of swamp rose within Nova Scotia is considered “Secure” by NSDNR and is ranked “S3” by the ACCDC. This species is associated with wet ground, lake shores, and swamps within the province (Zinck 1998) and has been found approximately 74 km away from the Study Corridor, as evidenced by ACCDC records. A single occurrence of this species was observed within the Study Corridor where it was within the tall shrub swamp component of Wetland 314, located at the southern end of Maple Lake.

Small swollen bladderwort is an aquatic herb associated with ponds and sluggish waters (Zinck 1998). This species has been previously known to occupy the vicinity of the Study Corridor, and has been recorded at approximately nine km from its center point. Field surveys identified this species within the water of Wetland 296, at Dorey Lake. The provincial population of small swollen bladderwort is currently considered Secure by NSDNR and is ranked “S3” by the ACCDC.

Although field surveys for non-vascular plants (*i.e.*, bryophytes and lichens) were not conducted, records indicate that the rare ghost antler lichen (*Pseudevernia cladonia*) has been recorded in proximity to the Study Corridor. Ghost antler lichen is a white, finely branched macrolichen that, within Nova Scotia, is found on the twigs of conifers in coastal spruce-fir forests which are frequently subject to prolonged immersion in fog or cloud. It is listed as a species of “Special Concern” by COSEWIC and at the provincial level is given a ranking of “Sensitive” by NSDNR and “S2S3” by the ACCDC. Seven locations for this species are known from Nova Scotia (COSEWIC 2006) with the nearest record being within the Blandford Game Sanctuary, approximately 16 km from the center of the Study Corridor. The coastal regions of Nova Scotia are at the northeastern periphery of its range and the absence of this species from many sites that appear to provide suitable habitat is considered to reflect its limited capacity for dispersal (COSEWIC 2006). Within the Maritime provinces, logging and housing development have been attributed to some loss of its population (COSEWIC 2006). Whereas the Study Corridor does support an abundance of spruce-fir forests, the proposed twinning alignment is outside of the Atlantic Coastal Ecoregion (Neily *et al.* 2003) which is primarily defined by its proximity to the Atlantic Ocean and the presence of vegetation which reflects the oceanic climate. As such, this species is unlikely to occupy the Study Corridor.

Secure Species

The vast majority of vascular species identified during the field surveys are considered here to have “Secure” populations within the province. Included here are those whose populations are considered “Secure”, “Exotic”, or have not been assessed, and whose ACCDC rank does not qualify them as a “Species of Conservation Concern”, as defined in Section 5.3.3. Of the 472 species considered to have secure populations, 372 have been given a ranking of Secure by NSDNR, 88 are considered Exotic, and 12 have not been assessed to date. No species whose status is considered as Undetermined by NSDNR were encountered. Several of the species whose populations are considered “Secure” by NSDNR have been assigned a ranking of “S3S4” by the ACCDC indicating that their populations are considered uncommon to fairly common within Nova Scotia, including; fragrant cudweed (*Pseudognaphalium obtusifolium*), Loesel's twayblade (*Liparis loeselii*), and rough horsetail (*Equisetum hyemale*).

Additionally, a species which had not previously been recorded in the province, whorled loosestrife (*Lysimachia quadrifolia*), was encountered. Whorled loosestrife is a rhizomatous herb which was found growing along a road slope which graded towards Little Indian Lake on the northern side of the existing highway. At this location, over 200 stems of this species were observed, occupying an area of approximately 5 x 3 m. A native throughout much of eastern North America, this species is generally associated with moist or dry upland soils and is often found in open woods (Gleason and Cronquist 1991). In New Brunswick, whorled loosestrife is considered to be of conservation concern, being assigned a status of “May be at Risk” by the province and a ranking of “S1” by the ACCDC. Coincidently, although not previously known from Prince Edward Island, whorled loosestrife has just also just recently been found within that province (Blaney 2010). Based on the anthropogenic nature of the habitat in which it was found and the lack of historical records for this species within the province, the population of whorled loosestrife within the province is probably best considered to be non-native and recently introduced.

5.4.5 Potential Interactions, Issues and Concerns

This section evaluates the potential for Project-related activities to affect Vegetation. Table 5.51 provides a summary of the potential environmental effects resulting from the Project-VEC interactions, which are discussed below.

Table 5.51 Project Activity – Environmental Effects Interactions Matrix for Vegetation

Potential Interactions Between Project Activities, Including Other Projects and Environmental Effects Valued Environmental Component: VEGETATION			
Project Activities and Physical Works†	Potential Environmental Effects		
	Change in Habitat Quantity	Change in Habitat Quality	Loss of Species at Risk or of Conservation Concern
Construction			
Site Preparation	✓	✓	✓
Roadbed Preparation			
Watercourse Crossing Structure Construction	✓	✓	✓
Surfacing and Finishing			
Operation and Maintenance			
Project Presence			
Infrastructure Maintenance	✓	✓	✓
Winter Maintenance	✓	✓	✓
Vegetation Management	✓	✓	✓

Table 5.51 Project Activity – Environmental Effects Interactions Matrix for Vegetation

Potential Interactions Between Project Activities, Including Other Projects and Environmental Effects Valued Environmental Component: VEGETATION			
Project Activities and Physical Works†	Potential Environmental Effects		
	Change in Habitat Quantity	Change in Habitat Quality	Loss of Species at Risk or of Conservation Concern
Other Projects and Activities			
Existing and Planned Linear Features	✓	✓	✓
Residential and Commercial Land Use	✓	✓	✓
Recreational Land Use			
Resource Land Use	✓	✓	✓

† See Table 4.1 and Section 2.3 for list and details of specific activities and works.

5.4.5.1 Construction

There are several construction activities related to the Project that could affect vegetation. The most substantive and likely interactions are a change in habitat quantity or quality and possible loss of Species at Risk or of Conservation Concern as a result of site preparation activities and the construction of watercourse crossing structures.

Clearing and grubbing during site preparation will directly remove vegetation whereas infilling of wetlands will cause permanent loss of wetland vegetation. In addition, a number of indirect effects can result from these site preparation activities. Clearing of forested areas can change the quality of the habitat along the edge of the Project Footprint as a result of increased side lighting or drying of what was previously forest interior habitat. This may enable more light-tolerant and disturbance-tolerant species to penetrate into adjacent forest habitat. Vegetation located within the RoW will be removed during the construction phase of the Project. Construction activities in the RoW have the potential to disturb vegetation habitat and cause direct mortality of vascular plants through off-road and off RoW activity. This may occur when vehicles are accessing the work site along tertiary roads, by the gradual widening of the thoroughfare, as well as through non-motorized activity in undisturbed areas adjacent to the RoW.

The Project will require the installation of culverts and bridges. Improper installation of watercourse crossings can alter aquatic or wetland habitat on which some plant species are dependent. Improperly installed crossings can result in flooding or extensive erosion. Additionally, construction activities have the potential to introduce sediment or silt into wetlands, watercourses, and surface water in the Study Corridor, and this could have an adverse effect on Species of Conservation Concern.

5.4.5.2 Operation and Maintenance

Several activities related to the operation and maintenance of the Project could affect vegetation. In particular, maintenance of the Project infrastructure and vegetation management initiatives have potential to adversely affect vegetation, including Species at Risk or of Conservation Concern. The potential for interaction between these activities and Species of Conservation Concern are quite likely considering that many of these plants were found in close proximity to the highway edge and some occupied the roadside shoulder itself.

As part of infrastructure maintenance, the roadside shoulder will be periodically graded and ditched to improve water flow, reduce erosion and/or to deter excessive vegetative growth. Species of Conservation Concern are known to reside in these habitats and/or have potential to colonize them, and as such, maintenance activities have potential to cause a direct loss of these plants. Furthermore, the release of sediment into wetlands could have a detrimental effect on the survivability of rare plants in these habitats. The effects of infrastructure maintenance on wetlands are also discussed in Section 5.6.

Vegetation management will consist primarily of mechanical control of vegetation, although the use of herbicides may be considered where undesirable species persist. Regular mowing will occur on the shoulder of the road and occasional mowing of the RoW will occur on an as needed basis to control the growth of trees and tall shrubs. Vegetation control during operations could pose a hazard to some rare plant species found along the proposed RoW of the highway. In particular, many of the rare species encountered along the route were found in association and/or are able to colonize disturbed habitats such as road edges. These plants could be impacted by vegetation maintenance activities.

The use of road salts for de-icing during the winter is an important concern for vegetation. During winter, salt is used by NSTIR on road surfaces to aid in melting snow, and to provide clear road conditions. Road salt can enter into the environment (surface water, groundwater and soil) through storage and application of these salts. The highest concentrations are usually associated with winter and spring thaws. Environment Canada (2001a) cites a number of studies attributing vegetation damage and changes in plant community composition to road salt application. In particular, road salt applications can damage plants located immediately adjacent to highways and increase the salinity of soils. The effects of road salt are generally observed within 10 m of the edge of the road, although salt related injuries have been detected at distances of up to 80 m from the road. Damage to vegetation includes osmotic (*i.e.*, concentration induced dehydration) injuries as well as direct chloride ion toxicity. Salt deposited on soils can adversely affect plant growth by changing the structure of soil (development of salt crusts) or reducing soil fertility (replacement of calcium and potassium ions by sodium ions). In some areas between 5% and 10% of trees within 30 m of highways have salt damage (Transportation Research Board 1991). If it is assumed that salt damage could occur up to 80 m from the highway, road salt applications could potentially affect all of the plant Species of Conservation Concern found growing within the RoW of the highway.

5.4.6 Other Projects and Activities

Existing and Planned Linear Features

Linear features, including power line corridors, railways, and various types of roads, cause direct vegetation loss (through infilling and disturbance) and also influence plants in a number of indirect ways. The construction of linear features has caused obvious changes to vegetation within the Assessment Area, for example through hydrological changes to wetlands. Additionally, ongoing operation and maintenance activities also have important affects on vegetation. For example, herbicide applications along power line corridors are an obvious stressor to some plants, and increased levels of roadside sedimentation and/or salinity as a result of winter safety applications can cause changes to adjacent vegetative communities. Additionally, fragmentation is an important consequence of linear (and other) developments and has important implications for vegetation, particularly those relating to edge influences and the spread and establishment of exotic species.

Residential and Commercial Land Use

Existing residential and commercial land use has affected vegetation within the Assessment Area through the direct loss and disturbance of plants and their habitats, as well as indirectly through the introduction of non-native species, off-site effects of herbicide drift, and fragmentation. Future developments will continue to influence vegetation both directly and indirectly.

Resource Land Use

Several areas on the north side of the existing highway have been subject to quarrying activities. During their operation, quarries result in the direct loss of vegetation and may also have indirect effects on plants - for example, through sedimentation events if appropriate erosion and runoff control measures have not been implemented. Following their abandonment, pits and quarries may offer unique habitat conditions for regenerating plants as a result of altered environmental properties, particularly to substrate conditions.

Forestry activities have been extensive throughout the area and as a result, much of the vegetation is currently in an early-mid seral stage. Although with time, successional processes recover many of the vegetation attributes that are lost following tree harvesting practices; the frequency and intensity of forestry operations can have important long-term effects. For example, within the region they have been attributed to a decrease in the abundance of certain trees, particularly red spruce and eastern hemlock, and research shows that the long-term persistence of other taxa can be compromised by intensive forestry operations.

5.4.7 Environmental Effects Assessment

This section provides an evaluation of key potential Project-VEC interactions as summarized in the environmental effects assessment matrix (Table 5.52).

Table 5.52 Environmental Effects Assessment Matrix for Vegetation

Environmental Effects Assessment Matrix Valued Environmental Component: VEGETATION							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** **(A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Construction							
Site Preparation	• Change in habitat quality (A) • Change in habitat quantity (A) • Loss of Species at Risk or of Conservation Concern (A)	• Project design (narrow medians) • Flagging and avoidance of Species of Conservation Concern • Transplanting of Species of Conservation Concern • Limit Project-related off road activity • Follow EPP • Employee environmental awareness training	2-3	3	2/1	I	2
Watercourse Crossing Structure Construction	• Change in habitat quality (A) • Change in habitat quantity (A) • Loss of Species at Risk or of Conservation Concern (A)	• Follow Watercourse and Wetland Alterations permit conditions • Erosion control measures • Follow EPP • Minimize area of disturbance • Ensure that culverts are properly installed to prevent flooding or draining of wetlands, particularly those that provide habitat for Species of Conservation Concern	1	2	2/1	I	2
Operation and Maintenance							
Infrastructure Maintenance	• Change in habitat quality (A) • Change in habitat quantity (A) • Loss of Species at Risk ir of Conservation Concern (A)	• Follow EPP • Employee environmental awareness training • Apply adaptive management	1	1	2/1	R	2

Table 5.52 Environmental Effects Assessment Matrix for Vegetation

Environmental Effects Assessment Matrix Valued Environmental Component: VEGETATION							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** **(A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Winter Maintenance	• Change in habitat quality (A) • Change in habitat quantity (A) • Loss of Species at Risk or of Conservation Concern (A)	• Follow EPP • Follow NSTIR Salt Management Plan • Apply drainage controls	1	3	2/1	R	2
Vegetation Management	• Change in habitat quality (A) • Change in habitat quantity (A) • Loss of Species at Risk or of Conservation Concern (A)	• Modify mowing heights in areas where Species of Conservation Concern are present • Control of woody vegetation within wetlands will be performed without the use of vehicles within wetland boundaries • Relevant sections of Wetland 249 will be surveyed to determine the distribution of southern twayblade prior to any vegetation management activities • Maintain the current frequency, timing, and intensity of maintenance activities along the roadside shoulder to avoid impacts to Species of Conservation Concern within this habitat • Follow EPP • Employee environmental awareness training • Apply adaptive management	1	3	5/6	R	2

Table 5.52 Environmental Effects Assessment Matrix for Vegetation

Environmental Effects Assessment Matrix Valued Environmental Component: VEGETATION							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**

Key

Magnitude:
1 = Low: *e.g.,* specific group, habitat, or ecosystem localized one generation or less, within natural variation
2 = Medium: *e.g.,* portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability
3 = High: *e.g.,* affecting a whole stock, population, habitat or ecosystem, outside the range of natural variation

Geographic Extent:
1 = <1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101 - 1,000 km^2
5 = 1,001 - 10,000 km^2
6 = >10,000 km^2

Duration:
1 = <1 month
2 = 1 - 12 months
3 = 13 - 36 months
4 = 37 - 72 months
5 = >72 months

Frequency:
1 = <11 events/year
2 = 11 - 50 events/year
3 = 51 - 100 events/year
4 = 101 – 200 events/year
5 = >200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not Applicable
(A) = adverse
(P) = positive

5.4.7.1 Construction

Site Preparation

Infilling, clearing, and grubbing for site preparation of the new highway RoW will result in the most important adverse effects of the Project on vegetation. In particular, of the ten vascular plants identified as Species of Conservation Concern, all but one are found within the Project RoW and may therefore be directly impacted by the aforementioned construction activities; including southern twayblade, woods-rush, small swollen bladderwort, swamp rose, Greene's rush, field milkwort, purple crowberry, Fernald's hay sedge, and Nova Scotia false-foxglove. Within the Assessment Area, each of the Species of Conservation Concern was found to be primarily associated with either wetlands or the roadside shoulder of the existing highway. As such, measures for mitigating the effects of site preparation activities on the plants of conservation concern are discussed in relation to these associated habitats. Additionally, if the boreal felt lichen is present within or in close proximity to the RoW, construction activities could have a significant adverse effect on this species.

Species associated with wetlands

Wetlands provide important habitat for rare or sensitive plants within the Assessment Area. In particular, six of the wetlands were found to support plant Species of Conservation Concern, including Wetland 88 (southern twayblade), Wetland 249 (southern twayblade), Wetland 296 (small swollen bladderwort and woods-rush), Wetland 302 (woods-rush), Wetland 314 (swamp rose and Nova Scotia false-foxglove) and Wetland 316 (early coralroot). The use of narrow medians may mitigate the effects of site preparation on some of these plants whereas a follow-up survey is recommended for gaining a better appreciation of the proposed effects of the Project on one of the species (southern twayblade). Additional impacts to wetland vegetation will be minimized through the use of a number of design and construction practices – for more detailed information on these practices refer to Section 5.6.

Narrow medians are slated for two sections of the proposed twinning alignment and, to some degree, will mitigate the effect of the Project on vegetation within wetlands of these areas. In particular, Wetland 296 provides habitat for both small swollen bladderwort and woods-rush and is within a narrow-median zone. Both of the recorded locations for woods-rush are within the Project RoW and will be directly impacted by construction activities. However, one of the small swollen bladderwort localities is removed from the proposed twinning alignment such that it should not be directly impacted. Although the known occurrences of woods-rush within Wetland 296 will not benefit from the narrow median design proposed for the area, this species was also found in Wetland 302 which is located approximately 300 m away on the southern side of the existing highway. No construction activities will take place within Wetland 302 so as to minimize further impacts to the local population of woods rush.

The two populations of southern twayblade that were encountered within the Study Corridor are located in Wetlands 88 and 249, both of which are located on the northern side of the existing highway and are currently slated to be directly impacted by construction activities. Of these two locations, Wetland 249 is considered to be of greatest importance as a result of providing habitat for a higher number of southern twayblade plants than Wetland 88. Whereas existing data suggested that the original Project footprint would result in the direct disturbance of approximately 88% of the known occurrences of this species within the Study Corridor, the use of a narrow median design in the vicinity of Wetland 249 has reduced this estimate to 70%. However, due to the potential for interaction between Project activities and this species, it is recommended that a more complete population survey of southern twayblade be conducted prior to construction.. Such a survey would focus on documenting the number of plants throughout the extent of Wetland 249 that are both inside and outside of the RoW (including those outside the Study Corridor). Although only several individuals of southern twayblade were encountered in Wetland 88, this area should also be re-surveyed as monitoring records indicate that the number of southern twayblade stems within a defined area can exhibit considerable variability amongst years (Stantec 2009) and it is uncertain whether the records identified during spring 2010 are a reasonable estimate of the abundance of this species within the area. Additionally, wetlands which have potentially suitable habitat and are within the vicinity of those with known populations of southern twayblade should also be surveyed (*e.g.*, Wetland 250). By providing a better estimate of the abundance of this species within the Assessment Area and the likely impacts of the Project thereon, these surveys would help to establish whether additional mitigative measures (*e.g.*, re-routing of access roads) are necessary to avoid causing a significant adverse effect to this species. In addition to the potential for direct loss of this plant and its habitat, southern twayblade is considered to be sensitive to indirect changes to its habitat, such as may be brought about by changes in hydrology or nutrient status. However, such impacts are to be minimized through the use of a number of design and construction practices aimed at minimizing wetland degradation. For more detail on these initiatives, refer to Section 5.6.

Wetland 314, located on the southern end of Maple Lake, was found to support swamp rose. Whereas a portion of this wetland is slated to be directly impacted by construction of an access road in the area, the current location of this proposed road suggests that direct impacts to swamp rose may be avoidable. As such, it is recommended that construction activities minimize disturbance and infilling practices within Wetland 314 and that existing hydrological conditions within the wetland be maintained through the use of appropriately sized and placed culverts.

Wetland 316 provides habitat for the only encountered population of early coralroot within the Study Corridor. This wetland is located to the south of the Project RoW and is therefore removed from the major construction activities of the Project. Although rare plants located outside of the RoW have potential to be affected by off -RoW vehicle traffic, this area will be documented in the EPP and mechanized activity will not be permitted within it.

Although Nova Scotia false-foxglove was found within Wetland 314 this species was much more commonly associated with upland conditions, particularly roadside shoulders. As such, this species is addressed in the following section and no wetland-related measures are recommended for the conservation of this species.

Species associated with the existing highway shoulder

Many of the Species of Conservation Concern encountered in the RoW were found to be associated with the gravelly roadside shoulder of the existing highway. Such species include Greene's rush, field milkwort, purple crowberry, Fernald's hay sedge, and Nova Scotia false-foxglove. Due to the ability of these species to utilize habitats which are created by highway developments, it is not expected that Project activities should have a long-term adverse affect on their populations, should appropriate mitigative measures be followed.

Given that the proposed twinning alignment is slated for the northern side of the existing highway for the entire extent of the Project, areas of the gravelly roadside shoulder which harbor Species of Conservation Concern along the southern side should be avoided during construction activities. In particular, three areas along the southern side of the existing highway are considered to be of particular conservation importance and will be avoided by all construction activities. Of particular importance is the area north of “The Puddle” (between approximately 13+100 m and 13+400 m), which provides habitat for the only population of field milkwort (listed as “Sensitive” by NSDNR) encountered in the Study Corridor and the majority of Greene's rush (considered “May be at Risk” by NSDNR). Additionally, the area east of Mill Lake where Greene's rush is also known to occur (at approximately 2+350 m) as well as the population of Fernald's hay sedge located south of Sawler Lake (at approximately 19+850 m) will be clearly demarcated. “No-go” zones with a 50 m buffer will be established around the aforementioned rare plants at these locations, and avoided by construction activities.

Due to the location of the twinning alignment, avoidance of Species of Conservation Concern along the northern roadside shoulder is not possible. However, because the environmental properties (particularly substrate type, moisture levels, and salinity) of the two opposing sides of the existing highway are very similar, it is recommended that plants of conservation concern along the northern side of the existing highway be transplanted to the southern roadside shoulder where they will be removed from the immediate stressors related to construction activities. In particular, the locations of purple crowberry and Greene's rush will be flagged during the growing season and then transplanted during late fall (mid October to early November) using a backhoe to preserve, as much as possible, their associated substrate in an intact state. A botanist whom is familiar with the general habitat requirements of the species of interest will be present on site during transplanting initiatives to aid in the identification of the plants and to select appropriate donor sites. Areas along the southern side of the existing highway which receive the species of interest will be designated “no-go” zones (including 50 m buffers) and avoided by construction activities.

Although individuals of Nova Scotia false-foxglove will be directly impacted by Project activities, no species-specific mitigative measures are considered necessary for this plant. Nova Scotia false-foxglove was scattered along the extent of the existing highway and was generally abundant (the locations of this species on Figures 5.4.2a-e only represent a small number of the areas where it was found). The population of this species is considered “Secure” by NSDNR and the Project is highly unlikely to cause any significant adverse affect on this plant.

Watercourse Crossing Structure Construction

Vegetation composition and structure is strongly influenced by hydrological conditions and is therefore potentially sensitive to the construction of watercourse crossing structures. As previously discussed, six wetlands along the proposed RoW provide habitat for plant Species of Conservation Concern, including Wetland 88 (southern twayblade), Wetland 249 (southern twayblade), Wetland 296 (small swollen bladderwort and woods-rush), Wetland 302 (woods-rush), Wetland 314 (swamp rose) and Wetland 316 (early coralroot). Four of these wetlands will be at least partially impacted by infilling (Wetlands 88, 249, 296, and 314) care must be taken in the placement of infill in these wetlands to maintain existing hydrological conditions and avoid indirect effects to the remaining vegetation . Additionally, because culvert installation can adversely affect the hydrology of wetlands and result in changes in their plant composition, all culverts must be properly sized and placed. Particular care must be taken for Wetlands 88 and 249 because they contain populations of southern twayblade – a species considered “May be at Risk” by NSDNR. Additionally, because two Species of Conservation Concern area associated with the watercourse that flows out of Maple Lake towards the south (swamp rose and early coralroot) it is especially important to maintaining the hydrological character of associate wetlands (particularly Wetlands 314 and 316). In addition, woods-rush was also found outside of a wetland but in close proximity to the edge of a stream (Watercourse 9) and particular care will be necessary when constructing the twinning alignment and associated access road within this area. Construction workers will be made aware of the sensitivity of these areas during environmental awareness training.

Based on available data and assumptions and consideration of the potential environmental effects of the activities required for construction activities, the proposed mitigation, and the residual environmental effects significance ratings criteria, the environmental effects of Project construction on vegetation are currently considered not significant. However, a low level of confidence is assigned to this evaluation due to a lack of data regarding the population abundance of southern twayblade and boreal felt lichen within the Assessment Area.

5.4.7.2 Operation and Maintenance

Infrastructure Maintenance

As part of infrastructure maintenance, ditching may be required to improve water flow, reduce erosion and/or to deter excessive vegetative growth. The release of sediment into wetlands during ditch maintenance could have a detrimental effect on the survivability of rare plants within adjacent wetlands. In particular, southern twayblade is considered to be sensitive to indirect changes to its habitat and it is therefore recommended that maintenance workers be notified of the presence of this species and the importance of minimizing impact to its habitat. The effects of infrastructure maintenance on wetlands are also discussed in Section 5.6.

Grading of the roadside shoulder is also a periodic activity associated with infrastructure maintenance and has potential to interact with the Species of Conservation Concern located in proximity to the highway edge, including Greene's rush, field milkwort, purple crowberry, Fernald's hay sedge, and Nova Scotia false-foxglove. The presence of these species along the roadside shoulder suggests, however, that they are somewhat tolerant of the types of disturbance activities that are currently being practiced along the existing highway. To avoid adversely impacting these species, it is important that the frequency, timing, and intensity of these maintenance activities do not increase. Should NSTIR wish to alter such maintenance activities, contingency plans will be developed in consultation with NSDNR to minimize adverse affects to the aforementioned plants. Furthermore, monitoring efforts will be used as a basis for adaptive management of these species (see Section 5.4.9).

Winter Maintenance

Road salt applications can adversely affect salt sensitive plants growing near the edge of the RoW. The overall salt loading will be minimized by following the NSTIR Salt Management Plan, which specifies application rates. Mitigation measures include following the EPP (Section 3.18), applying drainage controls, employee environmental awareness training prior to commencement of operation activities (*e.g.,* salt and sand application during winter), and increased vigilance and inspection of permanent erosion and sediment control structures, particularly in areas identified as being sensitive. It is important to note that several of the species identified during field surveys and which are considered to be of “conservation concern” were found within close proximity to the existing highway, often along the highway shoulder itself. As such, it is expected that these species are tolerant of the types and intensities of road salt applications that are currently typical along the existing Highway 103. Furthermore, the presence of certain Species of Conservation Concern would be promoted by some degree of salt application - in particular, Greene"s rush is restricted to coastal areas within the province and is likely dependent on the halophytic conditions promoted by winter maintenance activities.

Techniques that reduce the amount of road salt used will be employed. These include the use of road weather information systems to monitor road surface conditions, pre-wetting of salt, and the use of anti-icing systems such as brine solutions to minimize the amount of salt required. These techniques would benefit other VECs in addition to the rare plants found along the proposed highway including groundwater and surface water quality and freshwater aquatic life. However, many of the plant Species of Conservation Concern encountered within the Study Corridor were found in close proximity to the existing highway suggesting that they are tolerant of the halophytic conditions that associated with highway edges. Although additional mitigative measures are not likely required for these plants, other areas, particularly wetland habitats, where plant Species of Conservation Concern are known to reside are to be considered salt sensitive areas and considered for pre-wetting and anti-icing agents.

Vegetation Management

Vegetation management will consist primarily of mechanical control of vegetation. Although the use of herbicides may be considered where undesirable species persist, these applications would be in accordance with applicable legislation and in consideration of sensitive areas. In particular, the locations of plant Species at Risk or of Conservation Concern within the RoW will be noted in the EPP and only mechanical vegetation control will be permitted in these areas. Regular mowing will occur on the shoulder of the road and occasional mowing of the RoW will occur on an as needed basis to control the growth of trees and tall shrubs.

As previously discussed, five of the plant Species of Conservation Concern were associated with the roadside shoulder, including Greene's rush, field milkwort, purple crowberry, Fernald's hay sedge, and Nova Scotia false-foxglove. Their presence within this habitat suggests that they are somewhat tolerant of the types and intensities of disturbances already associated with vegetation management along the existing highway. However, to further mitigate the effects of the Project on these plants, mowing heights along the shoulder of the road will be increased to 50 cm above the ground in locations where Greene's rush, field milkwort, Fernald's hay sedge, and purple crowberry are found. Adjustments to mowing heights will be made for a period of 5 years following Project construction and will be part of an adaptive management plan for these taxa (see Section 5.4.9). Due to the abundance of Nova Scotia false-foxglove along the existing highway shoulder, and its low height (rarely over 30 cm) mowing heights will not be adjusted to accommodate this species.

Mowing of vegetation within the RoW has potential to adversely affect wetland habitat in a number of ways. As such, no vehicles will be permitted to operate from within the boundaries of wetlands for the purpose of controlling the growth of their trees and tall shrubs (*i.e.*, they will be operated from outside the edge of wetlands or hand tools will be used). Furthermore, to minimize potential impacts to southern twayblade, relevant sections of Wetland 249 will be surveyed for this species prior to any vegetation management initiatives. Such surveys will be used to identify the location and abundance of southern twayblade within the area designated for vegetation maintenance and will help identify whether additional precautionary initiatives can be taken to avoid disturbance to those plants.

Based on available data and assumptions and consideration of the potential environmental effects of the activities required for the operation and maintenance phase of the Project, the proposed mitigation, and the residual environmental effects significance ratings criteria, the environmental effects of operation and maintenance on vegetation is not predicted to be significant.

5.4.7.3 Assessment of Cumulative Environmental Effects

Removal or disturbance of vegetation as a result of Project activities can contribute to cumulative environmental effects when other developments in the area also adversely affect the quantity and/or quality of vegetation. The key potential cumulative environmental effects of the Project in combination with those of other initiatives are increased habitat loss and fragmentation, including a greater prominence of edge-influenced habitat. In addition to the direct loss of vegetation cover within the vicinity of the Project, these stressors can result in indirect changes to plant species composition and structure - for example, by encouraging the spread and persistence of non-native plants (including invasives) and the loss of Species of Conservation Concern.

The most apparent potential source of cumulative effects are those associated with the Project and existing linear infrastructure, particularly the existing Highway 103 lanes. Existing linear features, such as roads, railroads, and power lines contribute to habitat loss, fragmentation of forest habitats, and the promotion of adverse edge effects. These features create substantial edge effects because they are long narrow structures that have an extremely high ratio of edge to area. The influence of edges on vegetation may be enhanced when more than one edge is in close proximity– a process known as “positive edge interaction”. For example, vegetation within close proximity to multiple edges may be comprised of greater abundances of exotic plants or exhibit a greater degree of tree blow-down then that which is only exposed to a single edge. Although such cumulative effects may result from the Project, the twinning component of the Project will have a minimal effect on the production of edge effects because it is to be directly adjacent to the existing highway infrastructure (which already exhibits edge influences). However, vegetation within close proximity to the Project alignment and/or access roads in addition to other linear features may be susceptible to cumulative edge influences.

Due to the prominence of resource land use within the Assessment Area, there is potential for these activities and those of the Project to result in cumulative effects on vegetation. In particular, forestry and to a lesser extent quarrying activities have historically resulted in the loss and/or change in the quantity and quality of vegetation. Although impacts of forestry activities on vegetation are potentially temporary, semi-permanent loss of some vegetation attributes can result depending on the intensity and periodicity of management initiatives. Whereas the independent effects of the Project and activities associated with resource land use will be greatest in areas which are not subject to other anthropogenic disturbances, cumulative effects resulting from these initiatives will be greatest when they are in close proximity to one another.

New residential, commercial, and industrial land uses would result in further loss of vegetation quantity and/or reductions in quality due to habitat fragmentation, edge effects, and contamination of terrestrial and aquatic habitats. The Project may potentially promote development along its entire extent as a result of improved highway conditions and access to adjacent properties. However, in the near future the most pronounced increases in development are likely to be observed at the eastern and western ends of the Assessment Area.

5.4.8 Determination of Significance

Table 5.53 evaluates the significance of potential residual environmental effects resulting from interactions between Project activities and Vegetation, after taking into account any proposed mitigation and compensation associated with the Project. Mitigation includes limiting area of disturbance by reducing the width of the RoW in the part of the Study Corridor through the use of narrow medians; site specific EPPs for environmentally sensitive areas (including avoidance and transplanting Species of Conservation Concern), awareness training, as well as implementation of the EPP. The table also considers the level of confidence of the study team in this determination and the likelihood of potential environmental effects.

The residual environmental effects, including cumulative environmental effects, are rated not significant for construction, operation and maintenance, and the effects of the Project overall. However, low levels of confidence are associated with the construction phase and overall Project impacts because the distribution and abundance of southern twayblade and boreal felt lichen are currently not well understood. Additionally, a medium level of confidence is associated with operation and maintenance activities due to uncertainty regarding their effects on those Species of Conservation Concern found along the roadside shoulder.

Table 5.53 Residual Environmental Effects Summary Matrix for Vegetation

Residual Environmental Effects Summary Matrix Valued Environmental Component: VEGETATION				
Phase	Residual Environmental Effects Rating, Including Cumulative Environmental Effects*	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Construction	NS	1	N/A	N/A
Operation and Maintenance	NS	2	N/A	N/A
Project Overall	NS	1	N/A	N/A

Key

Residual Environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Level of Confidence
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence
N/A= Not Applicable

Scientific Certainty: based on scientific information and statistical analysis or professional judgment
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence
N/A= Not Applicable

*As determined in consideration of established residual environmental effects rating criteria.

5.4.9 Follow-up and Monitoring

In order to obtain a better understanding of the effects of Project activities on vegetation and identify additional constraints that NSTIR should take into account during Project planning, both follow-up surveys and vegetation monitoring are required. It is recommended that follow-up surveys be conducted to obtain more information on the abundance and distribution of two species within the Assessment Area – southern twayblade and boreal felt lichen. Furthermore, a survey of the Species of Conservation Concern which were associated with the existing highway shoulder is recommended before Project Construction is initiated so as to inform an adaptive management approach for these plants. Similarly, monitoring should be conducted to evaluate the efficacy of mitigative measures as they relate to Project activities and potential effects on plant Species of Conservation Concern.

Boreal felt lichen has been recorded within the vicinity of the Study Corridor and is considered “Endangered” by SARA, COSEWIC, and the province of Nova Scotia. Although no survey for this species has been completed in relation to the Project, results from a habitat model obtained from NSE indicate that a number of areas within the Assessment Area have potentially suitable habitat. In particular, the model has identified two areas within the Study Corridor which are considered to have “High” potential to harbor this species. An additional 25 polygons, which range from “Low” to “High” potential, are also present within the larger Assessment Area. As a minimum level of effort, it is recommended that the two areas within the Study Corridor that have been identified as potential habitat for this species be surveyed by a recognized lichenologist. Such a survey is required to evaluate whether Project activities will have a significant adverse affect on this Species at Risk.

Southern twayblade is considered “May be at Risk” by NSDNR and was encountered within two wetlands of the Study Corridor (Wetlands 88 and 249). Both of these wetlands are located on the northern side of the existing highway and are currently slated to be directly impacted by construction activities, including their associate southern twayblade populations. Although this species is known to occur within portions of Wetland that are outside of direct impacts of the Project, a thorough survey of southern twayblade outside of the Study Corridor has not been conducted and as a result, the effects of the Project on this species are not currently well understood. As such, it is recommended that a more complete population survey of southern twayblade be conductedprior to construction. Such a survey would focus on documenting the number of plants within Wetland 249 that are both inside and outside of the RoW as well as search for additional populations in nearby wetlands with suitable habitat (*e.g.*, Wetland 250). Additionally, the population of southern twayblade within Wetland 88 should be re-surveyed as monitoring records indicate that the abundance of this species within an area can exhibit considerable variability amongst years and it is uncertain whether the records identified during spring 2010 are a reasonable estimate of this species‟ abundance. By providing a better estimate of the abundance of this species in the area and the likely impacts of the Project thereon, these surveys would help to establish whether mitigative measures (*e.g.*, narrow medians or re-routing of access roads) are necessary to avoid causing a significant adverse effect to this species.

Southern twayblade is considered to be sensitive to indirect changes to its habitat, such as may be brought about by changes in hydrology or nutrient status. As such, it is recommended that the population of this species within portions of Wetland 249 which are not directly lost as a result of Project activities be monitored for a period of five years following construction. Monitoring should commence in the June immediately following construction and occur on a semiannual basis, during year three and five following Project construction. It is important that monitoring efforts be preceded by a detailed survey of the species before any construction activities are initiated (as previously outlined above), so as to establish a baseline condition.

Prior to Project initiation, it will be necessary to complete surveys for the plant Species of Conservation Concern which are associated with the roadside shoulder (particularly Greene's rush, field milkwort, purple crowberry, Fernald's hay sedge). Such surveys will determine if the aforementioned species have continued to persist despite disturbance associated with the existing highway infrastructure maintenance and vegetation management practices. Results of the survey will be used to help identify whether any of the species-specific mitigative practices outlined in this report are no longer necessary (*i.e.*, if certain species are no longer present) and will also serve as a basis for evaluating the appropriateness of current management activities (particularly the frequency, timing, and intensity of grating and mowing initiatives). Should important declines in the distribution or abundance of the Species of Conservation Concern be observed during this survey, NSTIR will develop an adaptive management plan for these taxa in consultation with NSDNR. However, should the distribution and abundance of these plants be similar or greater than observed during 2009 – 2010 surveys, activities associated with infrastructure maintenance and vegetation management practices will continue as-is, pending monitoring results.

Monitoring the populations of Species of Conservation Concern that are associated with the roadside shoulder of the highway is necessary to evaluate the efficacy of transplanting initiatives as well as effects associated with Project operation and maintenance practices. As such, it is recommended that the populations of Greene's rush and purple crowberry, which are to be transplanted to the south side of the existing highway, as well as the existing populations of Greene's rush, Fernald's hay sedge and field milkwort along this side of the highway be monitored for a period of five years following Project construction. Monitoring should take place in mid-September when all species are readily identifiable and continue on a semiannual basis (during year three and five following construction of the Project). Monitoring efforts will serve as a basis for evaluating the appropriateness of operating and maintenance activities (particularly the frequency, timing, and intensity of grating and mowing initiatives). Should important declines in the distribution or abundance of the Species of Conservation Concern be observed during the monitoring period, NSTIR will develop an adaptive management plan for these taxa in consultation with NSDNR.

5.5 Wildlife and Wildlife Habitat

5.5.1 Rationale for Selection as Valued Environmental Component

Wildlife and Wildlife Habitat was selected as a VEC because of the potential for interactions between Project activities and wildlife, in particular, wildlife that are considered as Species at Risk or Species of Conservation Concern, and their habitat.

5.5.2 Environmental Assessment Boundaries

5.5.2.1 Spatial

The spatial boundaries (the "Assessment Area") for the assessment of the potential environmental effects of the Project on wildlife and wildlife habitat, includes an approximately 200 m wide field survey area (“Study Corridor”) along the proposed Highway 103 twinning route extending from Exit 5 to Simms Settlement. Where field observations are discussed, they are usually in the context of the Study Corridor. Habitat descriptions were extrapolated beyond the 200 m wide Study Corridor to a wider 1 km wide area, using available data (refer to technical boundaries and methods below); this wider area is considered the “Assessment Area”. However, the Atlantic Interior Theme Region (Davis and Browne 1997) is also considered with respect to habitat and biodiversity effects. With respect to Species at Risk and Species of Conservation Concern (defined in Section 5.5.3), population effects are considered on a larger scale outside the Assessment Area and Theme Region, depending on the particular species.

5.5.2.2 Temporal

The temporal boundaries for the assessment of the potential environmental effects of the Project on Wildlife and Wildlife Habitat include the duration of Project construction, and operation and maintenance of the Project in perpetuity.

5.5.2.3 Administrative and Technical

Information used in support of the assessment of wildlife and wildlife habitat, including the potential of the area for harboring rare and endangered species, was obtained from aerial photography, Atlantic Canada Data Conservation Centre (ACCDC), NSDNR, COSEWIC, Maritime Breeding Bird Atlas (online resource), and other information from stakeholders and government departments with applicable expertise. Field data was gathered in the fall of 2009 and spring of 2010.

Migratory birds are protected federally under the *Migratory Birds Convention Act, 1994* which states that “no person shall disturb, destroy or take a nest, egg, nest shelter, either duck shelter or duck box of a migratory bird” without a permit. The Act includes prohibition of “incidental take” of migratory birds or their nests as a result of activities such as those required for the proposed Project.

Endangered wildlife species that are protected federally under *SARA* are listed in Schedule 1 of the Act. As defined in *SARA*, "wildlife species" means a species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and (a) is native to Canada; or (b) has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. The purpose of this Act is to protect wildlife Species at Risk and their critical habitat. The *SARA* is administered by Environment Canada, Parks Canada Agency, and DFO. Those species listed as “Endangered” or “Threatened” in Schedule 2 or 3 of *SARA* may also be considered as Species at Risk, pending regulatory consultation.

Certain wildlife species are also protected under the Nova Scotia *Endangered Species Act*. Species identified as seriously at risk of extinction in Nova Scotia are identified by a provincial status assessment process through the Nova Scotia Endangered Species Working Group. Once identified, they are protected under the Nova Scotia *Endangered Species Act*. The conservation and recovery of species assessed and legally listed under the Nova Scotia *Endangered Species Act* is coordinated by the Wildlife Division of the NSDNR. There is also a provincial General Status assessment process that serves as a first alert tool for identifying species in the province that are potentially at risk. Under this process, species are assigned to one of four categories that designate their population status in Nova Scotia. These include “Secure”, “Sensitive”, “May be at Risk”, and “At Risk”. Although species assessed under this process are not granted legislative protection, the presence of species ranked as “Sensitive”, “May be at Risk” and “At Risk” is an indication of concern by provincial regulators.

5.5.3 Residual Environmental Effects Rating Criteria

There are both federal (*SARA*) and provincial (Nova Scotia *Endangered Species Act*) Acts for the protection of Species at Risk and Species of Conservation Concern, and there are different levels of protection afforded a species within these acts pending the species rarity ranking. For example, only those species currently listed in Schedule 1 of *SARA* are protected by that Act. To further complicate matters, *SARA* listed species designated as “Special Concern” are not protected by the prohibitions of Sections 32-36 of *SARA*, but do require that provincial or regional management plans are developed to protect the species. Also, there are multiple agencies that provide lists of “Species of Conservation Concern” that are not protected by an Act, but that do require special consideration for the purpose of environmental assessment. As a result, multiple significance criteria are required to accommodate the different levels of protection afforded by these various acts, agencies and listings. Definitions of rarity ranks referred to in the significance criteria are summarized in Appendix G.

Species at Risk

A **significant residual adverse environmental effect** on all wildlife species listed in Schedule 1 of *SARA* as “Extirpated”, “Endangered” or “Threatened” or listed by NSDNR as “At Risk” is:

- One that results in a non-permitted contravention of any of the prohibitions stated in Sections 32-36 of *SARA*, or in contravention of any of the prohibitions stated in Section 3 of the Nova Scotia *Endangered Species Act*.

Species of Conservation Concern

A **significant residual adverse environmental effect** on listed wildlife species not under the protection of *SARA* or the Nova Scotia *Endangered Species Act* (*i.e.,* listed as “Special Concern” in Schedule 1 of *SARA*; listed in Schedule 2 or 3 of *SARA*; or ranked as S1, S2, or S3 by ACCDC; and/or ranked “May Be At Risk” or “Sensitive” by NSDNR (2007c)) is:

- One that alters the terrestrial habitat within the assessment boundaries physically, chemically, or biologically, in quality or extent, in such a way as to cause a change or decline in the distribution or abundance of a viable population that is dependent upon that habitat such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Atlantic Interior Theme Region is substantially reduced as a result; or
- One that results in the direct mortality of individuals or communities such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure wildlife population(s) within the Atlantic Interior Theme Region is substantially reduced as a result; or
- In the case of wildlife species of “Special Concern” listed in Schedule 1 of *SARA*, where the Project activities are not in compliance with the objectives of management plans (developed as a result of Section 65 of *SARA*) that are in place at the time of relevant Project activities.

Secure Species

A **significant residual adverse environmental effect** on all secure wildlife species (including those ranked S4 or S5 by ACCDC, and/or designated as “Secure” by NSDNR) is:

- One that affects wildlife (*e.g.,* direct mortality, change in migratory patterns, habitat avoidance) or wildlife habitat (loss or change) in such a way as to cause a decline in abundance or change in distribution of these common and secure population(s) of indicator/representative species such that the likelihood of the long-term survival of these species may be reduced within the assessment boundaries, defined as the Atlantic Interior Theme Region, and natural recruitment may not re-establish the population(s) to its original level.

5.5.4 Baseline Conditions

Information regarding use of the Assessment Area by wildlife was derived from several sources including field surveys and reviews of existing data sources. Field surveys were conducted during late September / early October 2009 and late May, June, and early July 2010 by three terrestrial ecologists). During these surveys, information was collected regarding the presence of birds, mammals and herpetiles (amphibians and reptiles).

Existing sources of data were also consulted. An ACCDC data search was conducted to determine if any rare or sensitive wildlife species have been recorded in the vicinity of the Assessment Area. The ACCDC data were also incorporated into a wildlife model to determine the likelihood of the presence of rare or sensitive wildlife species within the Assessment Area. As part of the modelling exercise, all records of wildlife species listed by NSDNR as “At Risk” (“Red” listed) or “Sensitive” to human activities or natural events (“Yellow” listed) (NSDNR 2007c) within a radius of 100 km were compiled. The habitat requirements of these species were compared to the habitat descriptions compiled for the Assessment Area to determine if suitable habitat was present for these species. In instances where appropriate habitat was present for a particular species, that species was considered to be potentially present and the suitable habitat in the Assessment Area was identified as a target for field surveys.

Reference sources such as the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992), Amphibians and Reptiles of Nova Scotia (Gilhen 1984) and interviews conducted with regulatory agencies such as NSDNR, CWS and the Nova Scotia Museum were also used.

5.5.4.1 General Habitat

A description of habitat types present within the Assessment Area is presented in Section 5.4 (Vegetation).

5.5.4.2 Birds

Methods

Breeding bird surveys were conducted at the site on June 1 and June 9, 2010. Additional bird observations were recorded during the early vegetation and wetland surveys conducted between May 17 and June 30, 2010. The breeding bird surveys were conducted between the hours of 05:30 and 12:00. During the breeding bird surveys all habitats found within the Study Corridor were visited by birders experienced in conducting auditory breeding bird surveys. Birds were recorded on both the north and south side of the existing highway; however, data collection was most intensive on the north side where the highway twinning is planned. Table 4 in Appendix G lists the number of birds of each species observed in each of the habitats present in the Assessment Area. Figures 5.4.1a-e present the distribution of habitats in the Assessment Area. Examples of all habitat types present in the Assessment Area were surveyed. The breeding status of each species recorded was determined using the methodology employed by the Atlas of Breeding Birds of the Maritimes program (Erskine 1992). Species identified but not exhibiting signs of breeding (such as flyovers) were classified as non-breeders. Species observed or heard singing in suitable nesting habitat was classified as possible breeders. Species exhibiting the following behaviours were classed as probable breeders:

- Courtship behaviour between a male and female;
- Birds visiting a probable nesting site;
- Birds displaying agitated behaviour; and
- Male and female observed together in suitable nesting habitat.

Species were confirmed as breeding if any of the following items or activities were observed:

- Nest building or adults carrying nesting material;
- Distraction display or injury feigning;
- Recently fledged young;
- Occupied nest located; and
- Adult observed carrying food or faecal sac for young.

The population status of each species was determined from existing literature. Lists of provincially rare or sensitive birds were derived from the General Status of Wildlife in Nova Scotia (NSDNR 2010) and Species at Risk in Nova Scotia (NSDNR 2009) while nationally rare species were derived from COSEWIC (2010) and the *SARA*.

Breeding Bird Survey Results

The breeding status and population status of each bird species recorded during the breeding bird surveys is presented in Table 5, Appendix G. A total of 1982 birds of 83 species were recorded during the two breeding bird surveys. The most abundant species in descending order of abundance were Golden-crowned Kinglet (7.5% of all birds recorded), Black-throated Green Warbler (7.4%), Yellow-rumped Warbler (6.7%), Dark-eyed Junco (6.0%), Magnolia Warbler (5.5%), Black-capped Chickadee (4.8%), White-throated Sparrow (4.5%), Common Yellowthroat (4.0%), American Black Duck (3.1), and Blackburnian Warbler (3.0%). Together these species accounted for 53% of the total number of birds recorded during the survey. The species composition of the dominant species reflects the abundance of coniferous and mixedwood forest in various age classes ranging from recent clear-cuts to mature stands. The relatively high numbers of American Black Ducks is attributable to the presence of good waterfowl habitat at several locations as well as repeat observations of American Black Ducks with broods. Of the 83 species recorded during the breeding bird surveys, 31 species were confirmed as breeding on the site, 19 were listed as probable breeders, 21 were listed as possible breeders, and no evidence of breeding activities were found for 12 species.

None of the bird species recorded during the breeding bird surveys is listed under the Nova Scotia *Endangered Species Act*. Two species listed under *SARA* were recorded during the field surveys. These included Canada Warbler which is listed as “Threatened” and Rusty Blackbird which is listed as a “Species of Special Concern”. Canada Warbler is ranked as “At Risk” under the NSDNR General Status Ranks while Rusty Blackbird is ranked as “May be at Risk”. Common Loon is also listed by NSDNR as “May be at Risk” but is not listed under *SARA*. Eleven species ranked as “Sensitive” species under the NSDNR General Status Ranks (NSDNR 2010) were recorded during the breeding bird surveys. These included Golden-crowned Kinglet, Ruby-crowned Kinglet, Boreal Chickadee, Pine Siskin, Black-backed Woodpecker, Barn Swallow, Tree Swallow, Cape May Warbler, Bay-breasted Warbler, Yellow-bellied Flycatcher, and Turkey Vulture. Scarlet Tanager, a species assessedas Rare (“S2”) by ACCDC and considered to be status “Undetermined” in Nova Scotia by NSDNR was also encountered during the breeding bird surveys. Each of these species is discussed below. All other species recorded during the breeding bird survey are considered to be “Secure” in Nova Scotia by NSDNR.

Canada Warbler

Canada Warblers have recently been assigned a “Threatened” status by COSEWIC and are listed under Schedule 1 of the *SARA*, but are not listed as a “Species at Risk” under the Nova Scotia *Endangered Species Act*. They are, however, considered “At Risk” by NSDNR and are ranked as “S3B” by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern. Breeding Bird Survey (BBS) data (CWS 2010) indicates that in Nova Scotia, Canada Warbler abundance has decreased steadily since the early 1980s and is currently at the lowest level recorded since monitoring began in 1966. Although this species has undergone significant population declines, it is still widely distributed in Nova Scotia. The factors responsible for the decline of the Canada Warbler are not fully understood. It is believed that loss or degradation of habitat in the wintering grounds in the northern Andes Mountains is likely the most important factor in the decline of this species. Human activities in the breeding grounds may also contribute to the decline of the Canada Warbler including urbanization, forest harvesting, silvicultural activities that remove or thin the forest understory, as well as road and pipeline construction.

Canada Warblers use a variety of habitat for nesting including both upland and wetland habitats. The key features of breeding habitat for Canada Warblers is a forested area with an open tree canopy with a dense understory and a structurally complex forest floor to provide sheltered nest sites. Canada Warblers will nest in both mature and immature forest stands provided the conditions described above are present. In Nova Scotia, treed swamps with dense understory shrub or tree cover are one of the habitats most frequently used by Canada Warblers.

Canada Warblers were encountered at three locations during the field surveys. Two of the locations are situated approximately 500 m east of the outflow of Dorey Lake. One of these birds was observed on the south side of Highway 103 on June 2, 2010. The second bird was recorded on the north side of Highway 103 on June 9, 2010. These two records are only 130 m apart, so it is likely that the same male was heard singing on both occasions. The June 2 record was associated with Wetland 283 while the June 9 record was associated with Wetland 279. Both wetlands contain forested wetland characterized by an open tree canopy underlain by a dense tall shrub understory. It is likely that these two wetlands provide nesting habitat for Canada Warbler. The third record of Canada Warbler was from Wetland 226 which is located along Stillwater Brook (chainage 13+500 m). This wetland is coniferous treed swamp that has a relatively open tree canopy and a dense shrub understory composed mainly of advanced regeneration of balsam fir. At this site an agitated Canada Warbler was observed near the northern boundary of the Study Corridor. Given the breeding evidence collected during the field surveys, this species is considered to be a probable breeder in the Study Corridor.

Rusty Blackbird

Rusty Blackbirds are listed as a "Species of Concern" under *SARA*. They are also ranked as "May be at Risk" by NSDNR. BBS data indicate that the Canadian Rusty Blackbird population has declined significantly since the early 1970s although the rate of decline has slowed since the late 1980s. The Nova Scotia population follows a similar trend. Several factors are believed to be responsible for the decline of this species in North America. The most important factor is believed to be the loss of forested wetland wintering habitat along the drainage basin of the Mississippi River. Other contributing causes for the decline are the loss of coniferous treed wetland breeding habitat and mortality of Rusty Blackbirds in blackbird control programs in the United States.

Rusty Blackbirds were recorded at four locations during the field surveys. An adult with newly fledged young was observed at one of the sites; consequently, this species was confirmed as breeding in the Study Corridor. All Rusty Blackbird observations were made in the vicinity of

Dorey Lake between chainages 17+600 m and 18+500 m (Figure 5.5.1d) in wetland habitat including Wetlands 277, 279, 288, and 294 (Figure 5.4.2d). Rusty Blackbirds typically nest in wetlands containing a mixture of coniferous forest, open water and areas of shrub or graminoid cover. These habitat types were present in the four wetlands where the Rusty Blackbirds were found although Wetland 279 was the only wetland that contained all three features of good Rusty Blackbird breeding habitat. Wetland 279 was the location where fledged Rusty Blackbirds were observed. The area where the four Rusty Blackbird observations were made is characterized by high interspersion of relatively large wetlands that are structurally complex compared to most wetlands along the route. It is likely that the Rusty Blackbirds in the area incorporate more than one wetland as part of their home range and are therefore able to find all of the required habitat features in a relatively small area. Another feature of wetlands in this area is the relative abundance of stillwaters and pools compared to most other wetlands along the route. Rusty Blackbirds typically construct their nests over or near water.

Common Loon

Common Loons nest on islands in freshwater lakes. This species is ranked as “May be at Risk” under the NSDNR General Status Ranks but is not listed under *SARA* or the Nova Scotia *Endangered Species Act*. BBS data for Nova Scotia reveals that Common Loons increased in abundance from the late 1960s to the late 1990s then began to decline. Factors that may contribute to this decline include mercury contamination, ingestion of lead sinkers, swamping of nests by power boat traffic, acidification of lakes, and residential development around lakes.

Common Loons were regularly observed at Mill Lake and Sawler Lake. Two Common Loons were present at both Lakes. An occupied Common Loon nest was found on a small swampy island along the northern shore of Mill Lake (chainage 2+600m). No evidence of breeding was observed on Sawler Lake although a local resident indicated that Common Loons nest on an Island on the lake. Suitable nesting habitat was not present in the portion of Sawler Lake located within the Study Corridor.

Golden-crowned Kinglet

Golden-crowned Kinglets have just recently been assigned a status of “Sensitive” by NSDNR. The ACCDC assigns a rank of “S4” to this species indicating that although they are fairly common throughout their range in the province, they are of long-term concern. BBS data (CWS 2010) indicate that Golden-crowned Kinglet abundance has declined over the past 20 years although abundance is still within ranges present in the 1970s and 1980s. There are concerns that extensive harvesting of softwood forest in recent decades and other factors such as possible reduction in softwood forest cover as a result of climate change could result in substantial long term reductions in the abundance of this species in Nova Scotia.

Golden-crowned Kinglets are typically found in dense coniferous stands of the province where they are year-round residents. Golden-crowned Kinglets were the most abundant species encountered during the breeding bird surveys, accounting for 7.5% of all of the birds recorded during the surveys. The high abundance of Golden-crowned Kinglets in the Assessment Area is not unusual since the Atlantic Interior Theme Region in which the Assessment Area is located is characterized by extensive areas of softwood forest. The distribution of Golden-crowned Kinglets detected during the field surveys is presented in Figures 5.5.1a-e. It was recorded at 92 locations and was distributed throughout the Study Corridor mainly in areas where softwood or mixedwood forest was present. During the field surveys Golden-crowned Kinglets were found in a variety of habitat types including softwood forest (mature and immature), mixedwood forest (mature and immature), deciduous forest (mature), coniferous treed swamp, mixedwood treed swamp, and semi-barrens. Most records were in mature mixedwood forest and mature softwood forest. Newly fledged Golden-crowned kinglets were observed at a number of locations during the field surveys indicating that this species breeds in the Study Corridor.

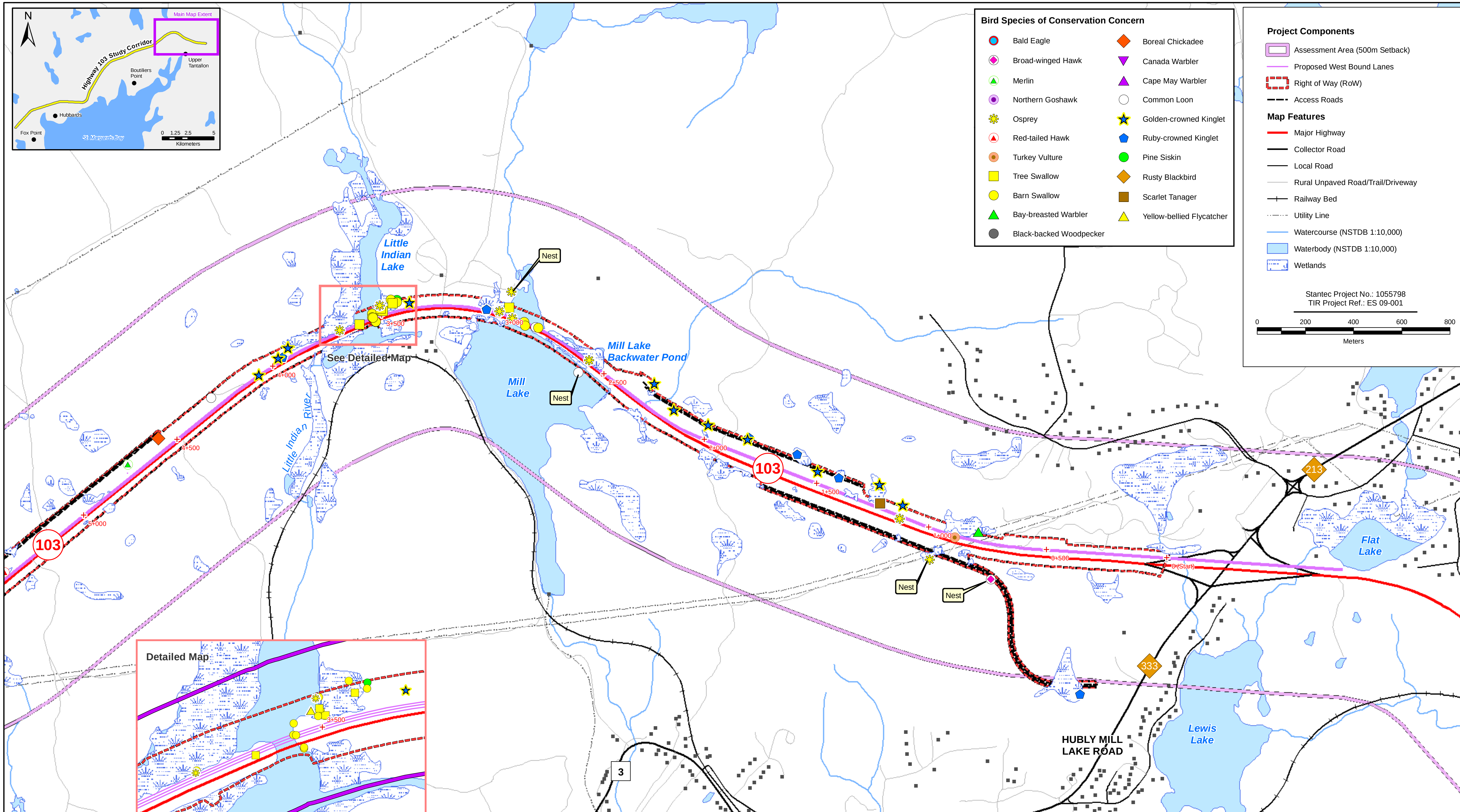
Ruby-crowned Kinglet

Ruby-crowned Kinglets have also been recently ranked as “Sensitive” by NSDNR and are given a rank of “S4B” by the ACCDC indicating that they are fairly common throughout their range in the province, but are of long-term concern. For reasons unknown, the population of this species has shown a steady decline in Nova Scotia during the last several decades (CWS 2010). The population for Canada as a whole has remained relatively stable.

Ruby-crowned Kinglets were relatively abundant in the Study Corridor, comprising 2.1% of all of the birds recorded during the field surveys. This species was recorded throughout the Study Corridor but was most frequently encountered in the area between chainage 16+000 to 18+000 m near Hubbards. This area differed from other areas along the proposed route mainly in the presence of a cluster of relatively large forested wetlands. Ruby-crowned Kinglet was observed in the same habitat types as Golden-crowned Kinglet (softwood forest (mature and immature), mixedwood forest (mature and immature), deciduous forest (mature), coniferous treed swamp, mixedwood treed swamp, and semi-barrens) but did not show the same marked preference for mature mixedwood forest and mature softwood forest that was noted for Golden-crowned Kinglet. Agitated Ruby-crowned Kinglets were observed during the field surveys and as such, this species is listed as probably breeding in the Study CorridorStudy Corridor.

Boreal Chickadee

Boreal Chickadees are associated mainly with mature coniferous forest habitats. Both mature and immature conifer stands are used; however, older stands typically provide more nesting and winter shelter opportunities in the form of tree cavities as well as better feeding opportunities. BBS data indicates that Boreal Chickadee abundance in Nova Scotia has declined since the late 1960s. Loss of mature coniferous forest habitat as a result of timber harvesting is probably an important factor in the decline of Boreal Chickadee populations in Nova Scotia. NSDNR has ranked this species as a “Sensitive” species.



DATE: January 2011

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA Transportation and Infrastructure Renewal

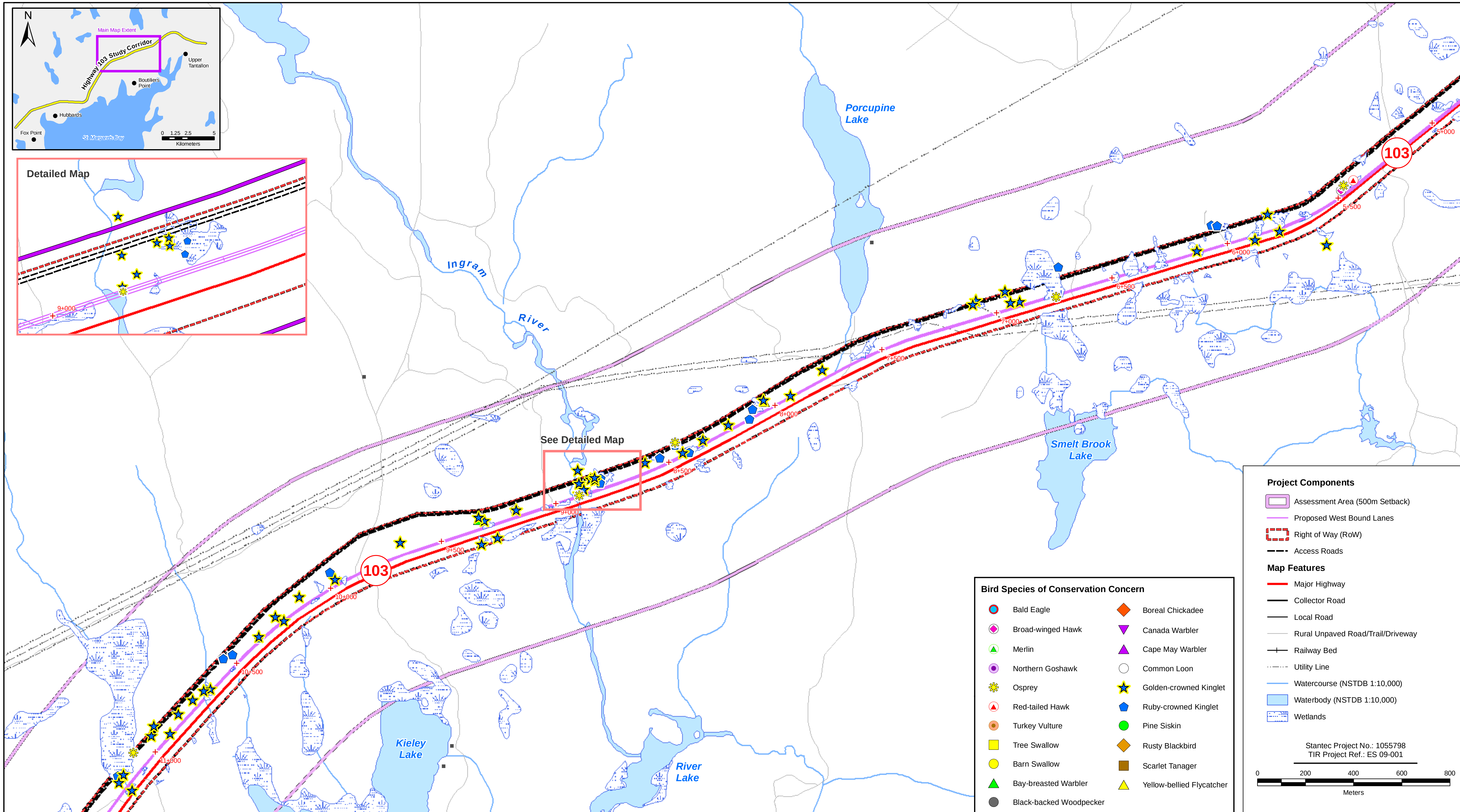
Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
Wetlands: NSDNR, Wetland Mapping Inventory, 2007
Aerial Photography: NSDNR, 2002-2003

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Bird Species of Conservation Concern
Map 1

FIGURE NO.: 5.5.1a

Stantec



DATE: December 2010

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA
Transportation and Infrastructure Renewal

Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
Wetlands: NSDNR, Wetland Mapping Inventory, 2007
Aerial Photography: NSDNR, 2002-2003

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Bird Species of Conservation Concern
Map 2

FIGURE NO.: 5.5.1b

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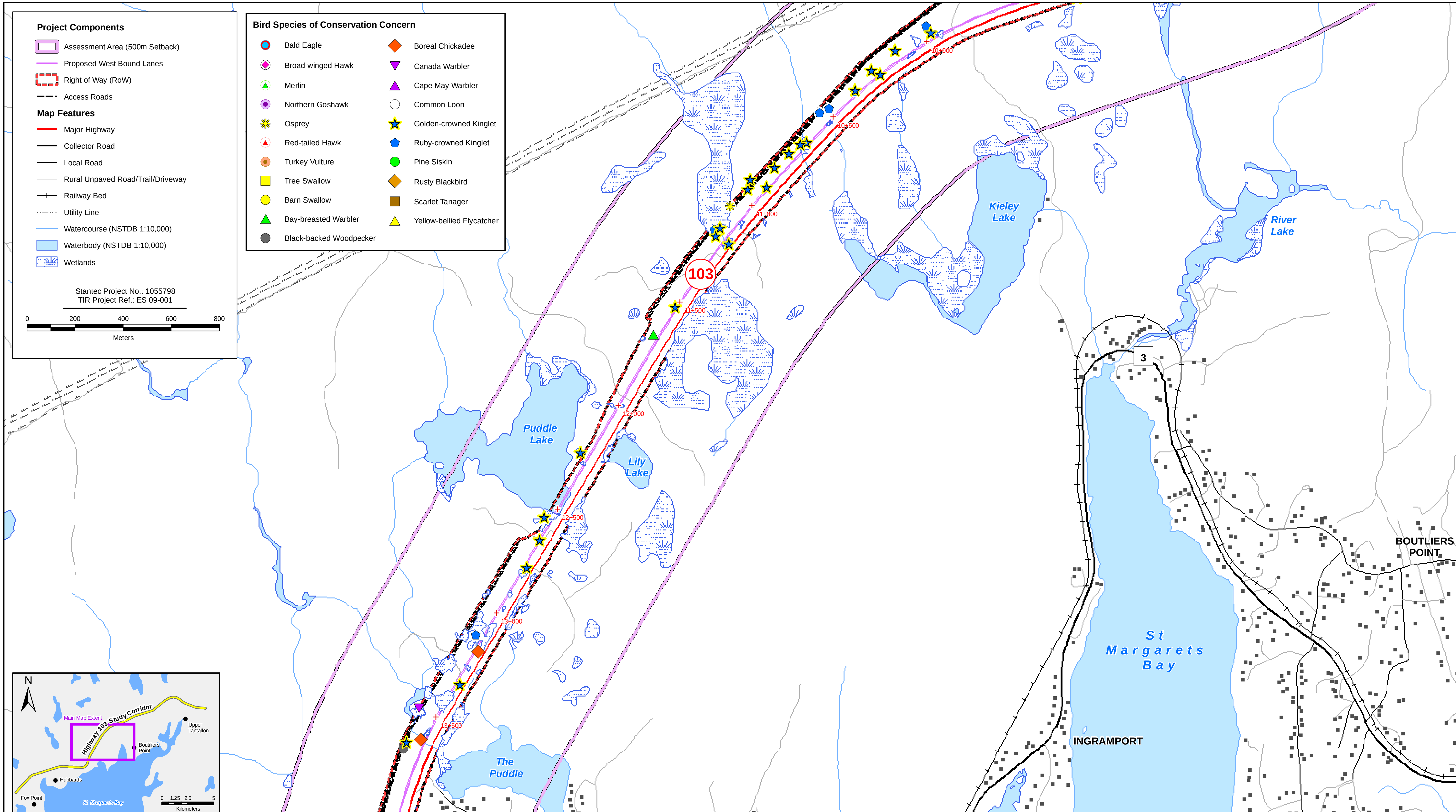


DATE: October 2010

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA
Transportation and Infrastructure Renewal

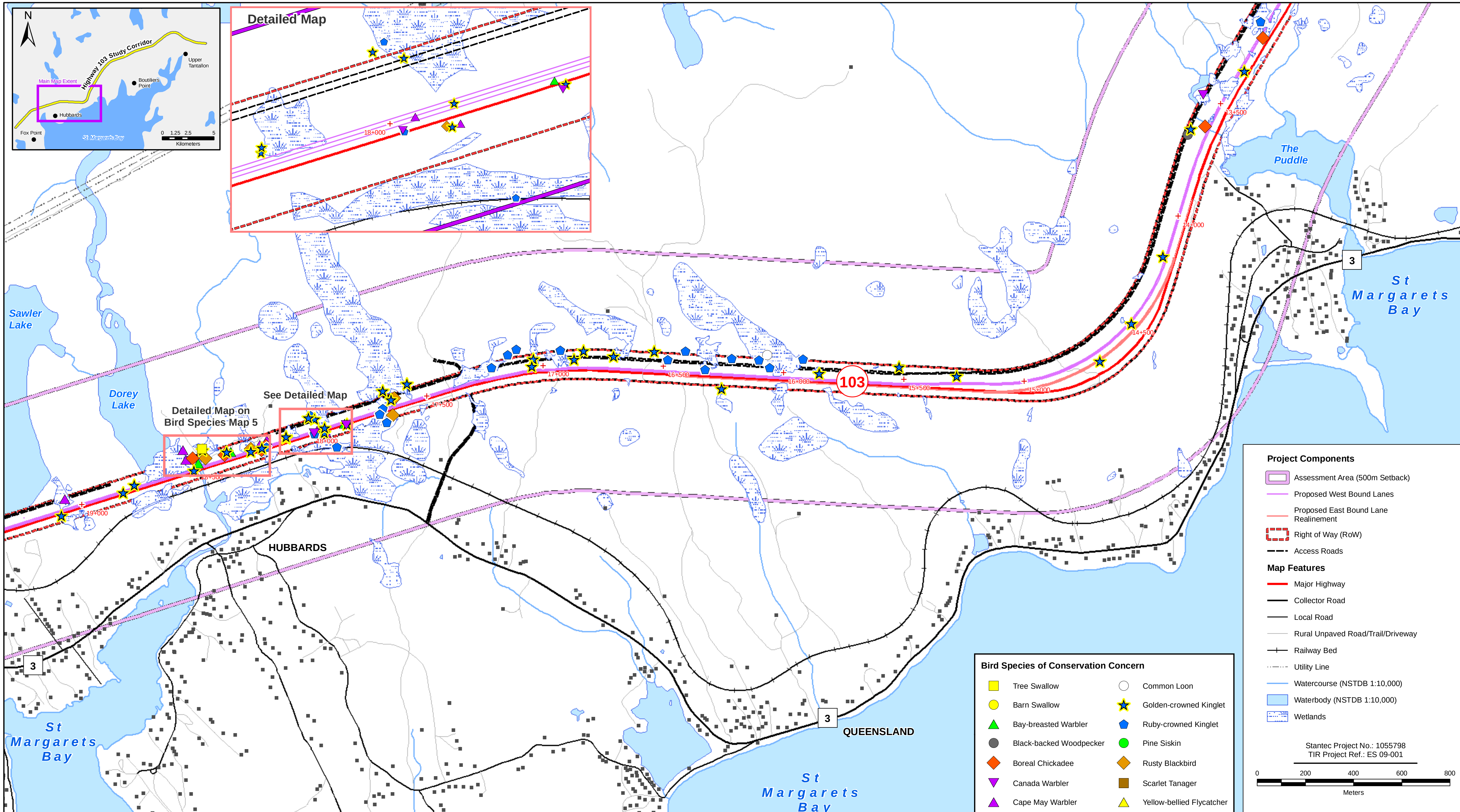
Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
Wetlands: NSDNR, Wetland Mapping Inventory, 2007
Aerial Photography: NSDNR, 2002-2003

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Bird Species of Conservation Concern
Map 3

FIGURE NO.: 5.5.1c

Stantec



DATE: January 2011

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA Transportation and Infrastructure Renewal

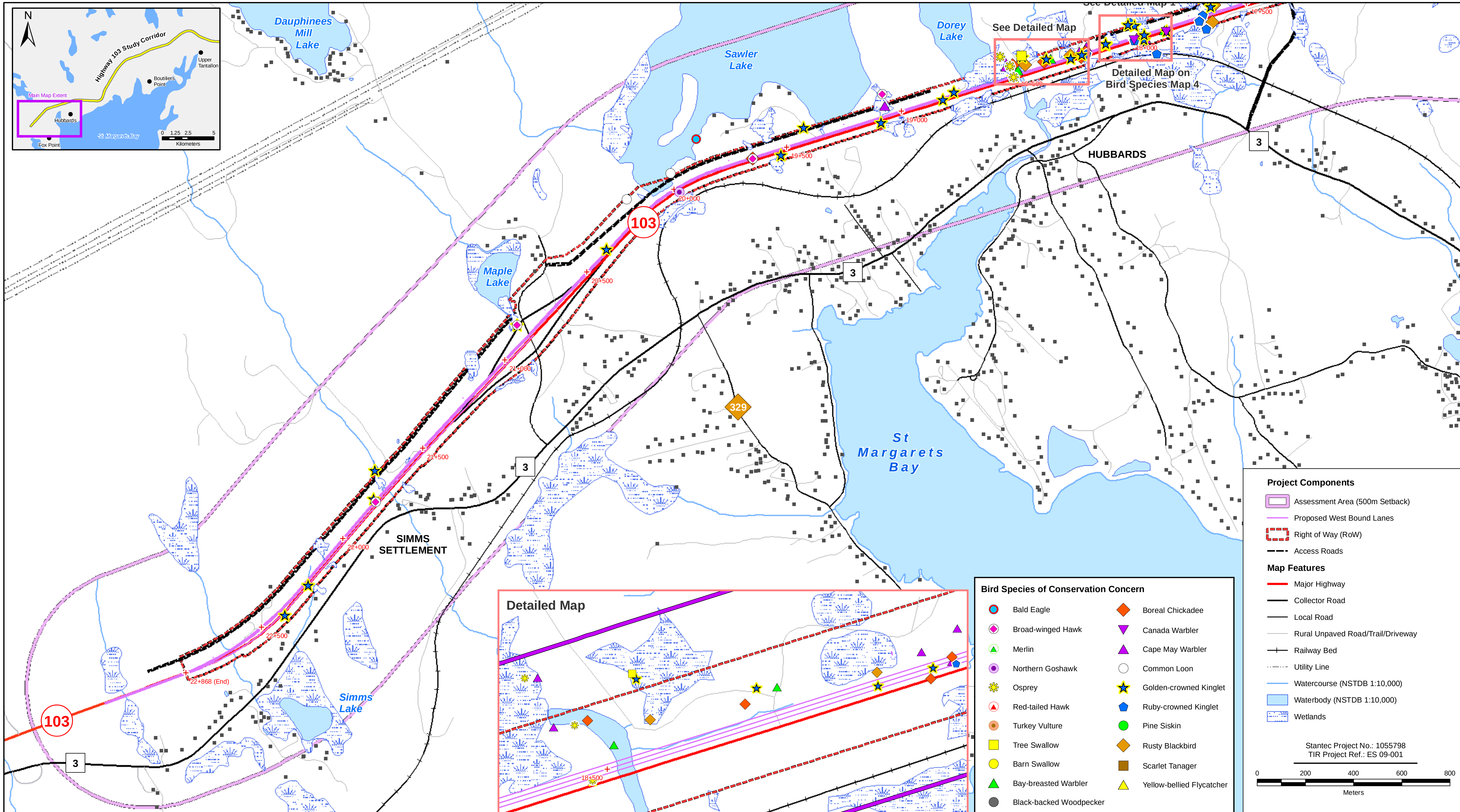
Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
Wetlands: NSDNR, Wetland Mapping Inventory, 2007
Aerial Photography: NSDNR, 2002-2003

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Bird Species of Conservation Concern
Map 4

FIGURE NO.: 5.5.1d

Stantec



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PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA Transportation and Infrastructure Renewal

Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
Wetlands: NSDNR, Wetland Mapping Inventory, 2007
Aerial Photography: NSDNR, 2002-2003

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Bird Species of Conservation Concern
Map 5

FIGURE NO.: 5.5.1e

Stantec

A total of 24 Boreal Chickadees were recorded at nine locations in the Study CorridorStudy Corridor. Most Boreal Chickadee records were in mature softwood forest; however, other habitats used included mature mixedwood forest, bog and immature softwood forest. Fledged young were present at four of the locations where Boreal Chickadee were recorded; consequently, this species is listed as a confirmed breeder in the Study Corridor. Four of the nine locations where this species was found and eight of the 24 Boreal Chickadees recorded were found in the area near Dorey Lake (chainage 18+500 to 19+500 m) where high concentrations of “Sensitive” bird species including Canada Warbler and Rusty Blackbird have been found.

Pine Siskin

Pine Siskins typically nest in mature conifer stands or in ornamental conifer plantings. BBS data indicate that this species has undergone a gradual decrease in abundance from the late 1980s to the mid-2000s. Since 2005 there has been a more substantial decline. This species has recently been ranked by NSDNR as a “Sensitive” species.

During the field surveys, Pine Siskins were encountered at only one location. Two Pine Siskins were observed feeding in coniferous forest adjacent to Little Indian Lake (chainage 3+400 m). This area was visited on three other occasions; however, Pine Siskins were observed only once. The presence of a pair of Pine Siskins resulted in this species being listed as a Probable breeder. However, given the facts that males and females have similar plumage and nesting can occur at various times during the year, the presence of a pair of Pine Siskins may not be indicative of breeding activity. Given the paucity of Pine Siskin records at this location, it is unlikely that this species nests within the RoW at this location. Better nesting habitat is present to the north of the RoW.

Black-backed Woodpecker

Black-backed Woodpeckers are typically found in mature softwood stands and in burned areas where dead trees are plentiful. No BBS data for Black-backed Woodpecker are available for Nova Scotia but are available for New Brunswick. In New Brunswick, Black-backed Woodpecker abundance has decreased from the mid-1980s to the mid-1990s then stabilized at a low level over the past 15 years. Current abundance levels are similar to those encountered in the 1960s and 1970s. Reductions in Black-backed Woodpecker abundance may be attributable to increased harvesting of mature coniferous forests, shorter rotation timber harvesting, and fire suppression.

One Black-backed Woodpecker was observed during the field surveys. This bird was observed foraging in mature mixedwood forest at the northern edge of the Study Corridor near Stillwater Brook (chainage 13+600 m). No evidence of breeding activity was noted at this location. Evidence of Black-backed Woodpecker feeding activity was noted at a number of locations in the Study Corridor in areas where dead trees were present.

Yellow-bellied Flycatcher

Yellow-bellied flycatchers have also been recently assigned a status of "Sensitive" by NSDNR. In addition, they are assigned a rank of "S3S4B" by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province and are of long-term concern. This species is associated with a variety of habitats, including swamps and damp coniferous woods. Yellow-bellied Flycatcher abundance in Nova Scotia has generally decreased since the mid-1980s.The sensitive ranking assigned to this species by NSDNR is expected to reflect loss of lowland coniferous forest and possible long term loss of coniferous forest habitat as a result of climate change.

Yellow-bellied Flycatchers were observed at two locations in the Study Corridor. The first location was in tall shrub swamp habitat on Little Indian Lake (chainage 3+500 m, Wetland 49). The second Yellow-bellied Flycatcher was recorded in a coniferous treed swamp near Porcupine Lake (chainage 8+000 m, Wetland 131). This species was listed as a possible breeder in the Study Corridor. The coniferous treed swamp at Wetland 131 would provide suitable nesting habitat for this species and a singing male was recorded at this location. The tall shrub swamp habitat at Wetland 49 would not provide good nesting habitat. The Yellow-bellied Flycatcher observed at this location did not exhibit any behavior that would indicate that it was nesting nearby. This bird may have been foraging in the wetland but was nesting in an adjacent area. This wetland was surveyed on three other occasions during the breeding season; however, Yellow-bellied Flycatchers were not noted during any of these surveys.

Barn Swallow

Barn Swallows typically nest in or on man-made structures such as buildings and culverts. In Nova Scotia they only rarely nest on natural nesting sites such as caves or overhanging cliffs (Erskine 1992). Although this species has generally benefitted from human activities, its Nova Scotia population has been in decline since the mid-1980s. It was assessed as a "Sensitive" species in Nova Scotia by NSDNR in 2006. It is believed that modern buildings and farming practices may reduce the suitability of nest sites.

Barn Swallows were regularly observed at Mill Lake (chainage 2+900 m) and Little Indian Lake (chainage 3+500 m) (Figure 5.5.1a). Two Barn Swallows were observed near the bridge over Mill Lake and up to six were observed at one time flying over Little Indian Lake. An inspection of the bridge structures revealed the presence of one active nest on each of the two bridges. A second nest was observed at the Little Indian Lake Bridge; however, it was not possible to determine if it was occupied. Both nests were placed on steel I beam girders under the bridge deck. The presence of suitable nest sites and hatches of aquatic insects makes these two locations good breeding habitat for Barn Swallows.

Tree Swallow

Tree Swallows were ranked as a “Sensitive” species in Nova Scotia by NSDNR in 2010. Tree Swallows nest in unoccupied woodpecker holes and will also use nest boxes. They feed largely over lakes, rivers and wetlands containing open water. Their nests are often situated near these foraging sites. The Nova Scotia population has been in decline since the early 1990s. Two Tree Swallows were observed at Little Indian Lake (chainage 3+500 m). One was observed at Mill Lake (chainage 3+000 m) and another was observed foraging over a beaver flooding near the outflow of Dorey Lake (chainage 18+500 m, Wetland 294). A pair of Tree Swallows was observed at Little Indian Lake; consequently, the breeding status of this species in the Study Corridor is listed as probable. It is likely that Tree Swallows nest in forest habitat adjacent to Little Indian Lake, Mill Lake and Dorey Lake.

Cape May Warbler

Cape May Warbler was added to the list of “Sensitive” species in Nova Scotia in 2010. In Nova Scotia, the Cape May Warbler has declined in abundance over the past 10 years. This species nests in mature coniferous forests and over harvesting of mature coniferous forest is likely a factor in the decline of this species. The abundance of this species is often correlated with outbreaks of spruce budworm. Suppression of spruce budworm populations to prevent mortality of balsam fir and spruce may also be a factor contributing to reduced abundance of this species. In the Study Corridor, 16 Cape May Warblers were recorded at nine locations. All Cape May Warblers were recorded between chainages 18+000 and 19+000 m. All but one of the records occurred in the same area where Canada Warblers and Rusty Blackbirds were observed. The Cape May Warbler records were distributed in four distinct clusters suggesting that the same birds had been counted on two or three occasions. It is likely that the number of birds actually recorded was closer to 10 than 16. An adult Cape May Warbler was observed at nest site at chainage 18+500 m. All other records were of singing males or observations of Cape May Warblers in suitable nesting habitat.

Bay-breasted Warbler

Bay-breasted Warblers nest in mature conifer stands and like the Cape May Warbler, population trends for this species are often correlated with spruce budworm abundance. In Nova Scotia, BBS data indicates that the abundance of Bay-breasted Warbler has steadily decreased since the mid-1970s. In 2010 it was ranked as a “Sensitive” species by NSDNR. There are a number of factors that are believed to have contributed to the decline of this species including suppression of spruce budworm outbreaks, habitat fragmentation, large-scale harvesting of mature conifer stands, deforestation in the wintering grounds, as well as the potential for reductions in the abundance of coniferous forest in the future as a result of climate change.

Bay-breasted Warblers were recorded at seven locations in the Study Corridor at chainages 1+000, 9+300, 11+700, 18+000 and 18+500 m(Figures 5.5.1a-e). All of the birds observed were either singing males or males observed in unsuitable nesting habitat. This species is listed as a possible breeder in the Study Corridor. Bay-breasted warblers were most frequently observed in mature softwood forest but were also observed in immature softwood forest, and mature mixedwood forest. Three of the six Bay-breasted Warbler records were from the same area where most of the Canada Warbler, Rusty Blackbird and Cape May Warbler records were collected (chainages 18+000 to 18+500 m).

Turkey Vulture

Nova Scotia is at the northern limit of the range of the Turkey Vulture. This species is regularly encountered in southwestern Nova Scotia but is not commonly encountered in central Nova Scotia. It is rare in Nova Scotia but its abundance is increasing over time. Given the low numbers of Turkey Vultures present in the province, NSDNR has ranked this species as Sensitive. Turkey Vultures typically nest on ledges on cliffs and may occasionally nest in abandoned buildings. A single Turkey Vulture was observed at the eastern end of the Study Corridor (chainage 1+000 m) in late May. The bird was observed soaring over the Study Corridor and was not observed in any subsequent surveys in the area. Suitable cliff nesting sites are not present in the Study Corridor so it is unlikely that this species nests along the highway twinning route.

Scarlet Tanager

Scarlet Tanagers are characteristic of the northern hardwood forest ecosystem and are rarely encountered in Nova Scotia. When encountered they are typically found in mature hardwood or mature mixedwood forests. BBS data indicates a sudden reduction in the abundance of this species that occurred in 1997 following a 30 year period of steady population increase. The Nova Scotia population has remained low and is comparable to population levels of the late 1960s and early 1970s. This species has been ranked as a “Sensitive” species by NSDNR.

The Scarlet Tanager that was observed during the field surveys was found in a mixedwood treed swamp (Wetland 16, chainage 1+300 m) adjacent to a mature softwood stand and a mature mixedwood stand. The male Scarlet Tanager was observed on one occasion but was not recorded during the three other visits made to this site during the breeding season. Mature hardwood forest is present approximately 100 m north of Wetland 16 outside of the Study Corridor. This bird may have been nesting in this area.

Raptors

Six raptor species were encountered in the Study Corridor during the field surveys including Bald Eagle, Osprey, Northern Goshawk, Red-tailed Hawk, Broad-winged Hawk, and Merlin. None of these species is listed as Sensitive in Nova Scotia by NSDNR; however, they typically occur in low numbers and are often sensitive to anthropogenic disturbance, particularly around their nest sites. Figures 5.5.1a-e show the locations where these species were encountered. Two of the raptor species, Broad-winged Hawk and Osprey were confirmed as nesting in or near the Study Corridor. No evidence of breeding activity was observed for the remaining four species. These species were observed flying over the Study Corridor. Osprey was the most frequently encountered raptor species in the Study Corridor. Most Osprey observations were made near Mill Lake, Little Indian Lake and Dorey Lake.

A single occupied Broad-winged Hawk nest was found at the eastern end of the Study Corridor near chainage 0+600 m. This nest was outside of the Study Corridor but was located within the RoW of a proposed access road.

Two occupied Osprey nests were found during the field surveys. The first nest was found on a power pole located on the south side of Highway 103 outside of the Study Corridor (chainage 1+000 m). The second nest was located at the northern end of Mill Lake at the Nova Scotia Power hydroelectric facility. This nest was constructed on an artificial Osprey nest platform and was located near the northern edge of the Study Corridor (chainage 3+000 m).

Maritime Breeding Bird Atlas

Additional information regarding use of the area by bird species of concern was derived from a review of the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992), online data derived from the current BBA program, as well as through an ACCDC data request. A total of 125 bird species have been recorded within the five, 10 km x 10 km breeding bird atlas squares within which the Assessment Area is situated. These species along with their breeding status in the square and their provincial population status are listed in Table 5 of Appendix G. Thirty-six of these species are listed as Species of Concern in Nova Scotia by ACCDC, NSDNR or *SARA.* These species are listed in Table 5.54. No suitable breeding habitat is present in the Study Corridor for 14 of the species including Killdeer, Baltimore Oriole, Chimney Swift, Bank Swallow, Blackpoll Warbler, Tennessee Warbler, Bobolink, Brown-headed Cowbird, Cliff Swallow, Common Tern, Gray Catbird, Ring-billed Gull, Rose-breasted Grosbeak, and Turkey Vulture. Suitable breeding habitat is present for 26 of the species of which 14 were recorded during the field surveys and have been discussed earlier in the text. The remaining 12 species could potentially nest in the Study Corridor but were not detected during the various field surveys. These species included Common Nighthawk, Eastern Wood Pewee, Gray Jay, Greater Yellowlegs, Least Sandpiper, Long-eared Owl, Olive-sided Flycatcher, Pine Grosbeak, Red-breasted Merganser, Spotted Sandpiper, Wilson‟s Snipe, and Wilson‟s Warbler.

These species can be placed into several categories based on their breeding habitat preferences. Greater Yellowlegs, Least Sandpiper, Olive-sided Flycatcher, Wilson‟s Snipe, and Wilson‟s Warbler typically nest in wetlands. All wetlands present in the Study Corridor were searched on at least two occasions and most of the larger wetlands were visited three to four times. It is unlikely that these species would have escaped detection.

Spotted Sandpipers and Red-breasted Mergansers nest along the shores of rivers and lakes. Areas in the Study Corridor where these species could potentially nest include Mill Lake, Little Indian Lake, Ingram River, Dorey Lake, and Sawler Lake. Spotted Sandpipers are easily detected. They were not noted during the field surveys suggesting that they are probably not present in the shoreline habitat present within the Study Corridor. The shoreline habitat along the existing Highway 103 RoW would not provide optimal Red-breasted Merganser nesting habitat given the close proximity of heavy traffic. This habitat was walked several times during the field surveys and no Red-breasted Mergansers were observed. No Red-breasted Merganser broods were observed in the adjacent open water areas. These observations would suggest that there is a low probability that Red-breasted Mergansers nest in the Study Corridor.

Common Nighthawk, Eastern Wood Pewee, Long-eared Owls, and Olive-sided Flycatchers are often associated with the clear-cuts or the edges of clear-cuts. All of these species with the exception of Long-eared Owl are easily detected by song or are conspicuous when foraging and it is unlikely that they would be missed during the various field surveys. Long-eared Owls are typically active only at night and roost in dense conifer stands. Suitable Long-eared Owl habitat is present at a number of locations within the Study Corridor where recent clear-cuts are surrounded by dense stands of mature conifers. There is a relatively high likelihood that Long-eared Owls nest in the Study Corridor.

Pine Grosbeaks and Gray Jays nest in coniferous forest which is widespread throughout the Study Corridor. Both species are relatively tame and are usually easily observed. If these two species are present in the Study Corridor they are probably present in low numbers. This is to be expected for Gray Jays which maintain very large home ranges.

The ACCDC habitat model identified six rare or sensitive bird species as being potentially present in the Assessment Area (Table 5.54). These species were the Long-eared Owl, Least Sandpiper, Rusty Blackbird, Red-breasted Merganser, Scarlet Tanager, and Greater Yellowlegs. All of these species were encountered in either the Breeding Bird Atlas data or during the field surveys and have been already been discussed.

Table 5.54 Potential Presence of Rare or Uncommon Wildlife Species in the Assessment Area

Scientific Name	Common Name	Habitat	S Rank	NSDNR	Likely Present
Asio otus	Long-eared Owl	Dense coniferous forest bordered by open habitats such as pasture or shrubby areas.	S2	May be at Risk	Possible
Calidris minutilla	Least Sandpiper	Breeds in wetlands such as bogs and beaver floodings. Migration habitat includes mud flats, shores of pools and lakes, edges of salt marshes, river sandbars and beaches.	S2B, S5M	Secure	Possible
Euphagus carolinus	Rusty Blackbird	Boreal forest; forest wetlands, such as slow flowing streams, peat bogs, sedge meadows, marshes, swamps, beaver floodings and pasture edges.	S2S3B	May be at Risk	Possible

Table 5.54 Potential Presence of Rare or Uncommon Wildlife Species in the Assessment Area

Scientific Name	Common Name	Habitat	S Rank	NSDNR	Likely Present
Mergus serrator	Red-breasted Merganser	Coastal ponds and inland waters.	S3B, S5M	Secure	Possible
Piranga olivacea	Scarlet Tanager	Mature deciduous forest	S2B	Undetermined	Possible
Tringa melanoleuca	Greater Yellowlegs	Nests in large bogs. Migration habitats include mud flats, salt marshes, and beaches.	S3B, S5M	Sensitive	Possible

5.5.4.3 Mammals

Information regarding the presence of rare mammals and sensitive mammal habitat within the Assessment Area was derived from field surveys and a review of Nova Scotia significant habitat mapping data base (NSDNR 2007b). Field surveys were conducted concurrently with vegetation, wetland and breeding bird surveys in June and August of 2007. The field surveys provide a good indication of the presence of large mammal species in the Assessment Area. Knowledge of the distribution of small mammals in the Assessment Area is limited by their secretive nature. Fortunately, many small, rare mammals have very specific habitat requirements, which can be used to predict areas where they are likely to be found.

The mammal species recorded in the Assessment Area are a mixture of species characteristic of forest and wetland habitats. Species recorded during the field surveys included Cinereus Shrew (*Sorex cinereus*), Water Shrew (*Sorex palustris*), Meadow Vole (*Microtus pennsylvanicus*), Southern Red-backed Vole (*Myodes gapperi*), Muskrat (*Ondatra zibethicus*), , American Red Squirrel (*Tamiasciurus hudsonicus*), Eastern Chipmunk (*Tamias striatus*), Snowshoe Hare (*Lepus americanus*), American Beaver (*Castor canadensis*), North American Porcupine (*Erethizon dorsatum*), Eastern Coyote (*Canis latrans*), Red Fox (*Vulpes vulpes*), Northern Raccoon (*Procyon lotor),* Mink (*Neovison vison*), Northern River Otter (*Lutra canadensis*), Short-tailed Weasel (*Mustella erminea*), and White-tailed Deer (*Odocoileus virginianus*).

A review of the NSDNR significant habitat mapping database (NSDNR 2007b) did not reveal the presence of any known rare or sensitive mammal species in the vicinity of the Assessment Area or critical habitat such as deer wintering areas. All of the habitats present in the Assessment Area are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species. There are no limestone or gypsum deposits in the area so it is unlikely that any caves are present in the area that would provide hibenaculum sites for hibernating bats such as Little Brown Bats (*Myotis lucifugus*) and Eastern Pipistrelles (*Pipistrellus subflavus*). A review of the abandoned mine opening data base (NSDNR 2008b) did not reveal the presence of any known abandoned mine shafts in the area that could be used as hibernacula. The nearest abandoned mine shaft is located approximately 9 km south of the Study Corridor near French Village. The ACCDC data search did not reveal the presence of any mammals of conservation concern in the vicinity of the Study Corridor.

5.5.4.4 Herpetiles

Information regarding amphibians and reptiles and their habitat within the Assessment Area was also derived during the field surveys. Field surveys were conducted concurrently with wetland, vegetation and bird surveys conducted between May 17 and June 30, 2010.

Fourteen herpetile species were encountered during the surveys including Yellow Spotted Salamander (*Ambystoma maculatum*), Redback Salamander (*Plethodon cinereus*), Pickerel Frog (*Rana palustris*), Mink Frog (*Rana septentrionalis*), Green Frog (*Rana clamitans*), Wood Frog (*Rana sylvatica*), Northern Spring Peeper (*Pseudacris crucifer*), American Toad (*Bufo americanus*), Common Garter Snake (*Thamnophis sirtalis*), Redbelly Snake (*Storeria occipitomaculata*), Ringneck Snake (*Diadophis punctatus*), Smooth Green Snake (*Liochlorophis vernalis*), Snapping Turtle (*Chelydra serpentina*), and Northern Painted Turtle (*Chrysemys picta*). None of these species is considered to be uncommon, rare or sensitive in Nova Scotia by ACCDC (2010) or NSDNR (2010).

The Snapping Turtle is listed as a species of Special Concern by COSEWIC. This concern is related to the life history traits of the Snapping Turtle which make it sensitive to even small increases in mortality. Snapping Turtles are slow to mature, have high rates of egg and nestling mortality, are long lived, and in pristine habitats have low adult mortality rates. Populations are maintained as a result of the great longevity of this species which allows adults to reproduce many times during their life to compensate for low levels of recruitment. Any factor which increases the mortality rate of adults in a given population even to a small degree can have an adverse effect on the ability of the population to persist. Currently, Snapping Turtles are not listed under *SARA*. In Nova Scotia the population is considered to be Secure and there is a hunting season for Snapping Turtles.

During the field surveys, Snapping Turtles were observed in Little Indian Lake on two occasions, once in 2009 and once in 2010. A landowner also reported this species as present in Sawler Lake.

The ACCDC data search revealed records of three herpetile species of conservation concern including Leatherback Turtle (*Dermochelys coriacea*), Wood Turtle (*Glyptemys insculpta*) and Four-toed Salamander (*Hemidactylium scutatum*). Leatherback Turtles are a marine species and would not occur in the Study Corridor.

Wood Turtle (*Gleptemys insculpta*), has been recorded in the general vicinity (ACCDC 2010). Wood turtles are a species of concern; they are ranked as S3 by ACCDC (2010). Provincially, they are currently ranked as a “Sensitive” species, as well as being listed as “Vulnerable” under the Nova Scotia *Endangered Species Act* (NSDNR 2009). The wood turtle is also listed as Threatened under Schedule 1 of *SARA*.

Wood turtles are almost invariably associated with streams, creeks, and rivers and the associated rich intervale forest, shrub communities, as well as with the meadows and farmland terrestrial habitat associated with these watercourses. Streams with sand and/or gravel bottoms are preferred, but rocky streams are used occasionally. Wood turtles may wander some distance from watercourses during summer foraging but characteristically remain within linear home ranges. These home ranges are 1 to 6 ha in size and are centred on a suitable river or stream where non-vegetated or sparsely vegetated sandy beaches and banks are present that serve as nesting sites. Natural nesting sites consist of sandy river beaches but may also include select disturbed sites such as railway grades and roadsides. Some turtles may travel considerable distances up small tributaries that lack suitable nesting sites and hibernacula during the summer months but offer good foraging opportunities. These smaller streams may serve as dispersal corridors between populations on different river systems.

The Study Corridor does not provide good habitat for wood turtles. The Study Corridor is located is an area that has stony infertile soils and frequent bedrock outcropping. Water courses in the Study Corridor are characterized by stony banks with few sandy beaches. Potential nesting and good quality foraging habitat is rare in this area. Given these conditions it is unlikely that the proposed RoW provides good wood turtle habitat.

The Four-toed Salamander is not listed under *SARA* or the Nova Scotia *Endangered Species Act*. NSDNR has rankeded the Nova Scotia population as “Secure”. The ACCDC lists the Nova Scotia Four-toed Salamander population as “S3”. Four-toed Salamanders are highly fossorial (live underground) and are difficult to detect. They nest in sphagnum moss hummocks at the edges of small pools in swamps and bogs. The adults forage in forested areas surrounding these wetlands. This species can only be reliably detected during the breeding season which encompasses May and June. The Study Corridor contains large numbers of swamps and bogs, many of which contain the small pools and sphagnum moss hummocks required for reproduction. Not all of these wetlands were searched; however, a subset of wetlands having excellent breeding habitat were searched by a herpetologist with extensive experience in finding Four-toed Salamander nests. No Four-toed Salamanders were encountered during the searches. This would suggest that Four-toed Salamanders are not present in the area or are present in very low numbers.

5.5.5 Potential Interactions, Issues and Concerns

This section evaluates the potential for Project-related activities to affect Wildlife and Wildlife Habitat. Table 5.55 provides a summary of the potential environmental effects resulting from the Project-VEC interactions, which are discussed below.

Table 5.55 Project Activity – Environmental Effects Interaction Matrix for Wildlife and Wildlife Habitat

Potential Interactions Between Project Activities, Including Other Projects and Environmental Effects Valued Environmental Component: WILDLIFE AND WILDLIFE HABITAT				
Project Activities and Physical Works†	Potential Environmental Effect			
	Change in Habitat Quantity	Change in Habitat Quality	Direct Mortality	Loss of Species of Conservation Concern
Construction				
Site Preparation	✓	✓	✓	✓
Roadbed Construction		✓		✓
Watercourse Crossing Structure Construction	✓	✓		✓
Surfacing and Finishing		✓		
Operation and Maintenance				
Project Presence		✓	✓	✓
Infrastructure Maintenance		✓		
Winter Maintenance		✓	✓	
Vegetation Management	✓			✓
Other Projects and Activities				
Existing and Planned Linear Features	✓	✓	✓	✓
Residential and Commercial Land Use	✓	✓		✓
Resource Land Use	✓	✓	✓	✓
Recreational Land Use				

†See Table 4.1 and Section 2.3 for a list and details of specific activities and works.

5.5.5.1 Construction

Wildlife habitat directly within the cleared RoW will be eliminated during construction. Clearing and grubbing for site preparation will remove vegetation, reducing the quantity of terrestrial habitat, and will affect the quality of habitat bordering the RoW. The Project will result in more edge area, which can increase predation on birds and small mammals but also has potential benefits related to habitat, and food availability. Linear developments also have the potential to fragment habitats.

Small mammal and herpetile populations which have limited dispersal capabilities are particularly susceptible to habitat fragmentation. Populations isolated from other populations in small habitat fragments are more prone to local extirpation since these fragments may be too small to support a population. Fragments may be large enough to support a population, but may not be large enough to provide enough animals to rebuild the population should it be heavily impacted by disease or predators. Isolation of the fragment can also impair the immigration of new animals into an area where a local population has been extirpated. Impaired immigration can also adversely affect populations by restricting gene flow between populations leading to inbreeding.

Habitat fragmentation can also affect highly mobile animals such as birds. During the breeding season some species may be reluctant to cross clearings causing populations to be isolated in resultant habitat fragments. Studies of bird use of forest patches in agricultural areas by the CWS in Quebec found that bird movement between patches decreased with increasing distance between patches (CWS Undated). The CWS determined that the influence of edge environmental effects extended as far as 300 m, from the forest edge. It also observed that 97.7% of the movements between habitat patches were concentrated in gaps smaller than 200 m and some species traveled up to three times as far to avoid a gap. Physical isolation of a population combined with the deleterious environmental effects of edge may eliminate species in habitat fragments.

Twinning of the existing highway actually helps to minimize habitat fragmentation associated with the Project since no new islands of habitat are created by the linear feature. Twinning also minimizes the loss of forest interior habitat since new edge effects are only generated on one side of the proposed RoW. The Assessment Area consists mainly of forested land that has been moderately fragmented by recent clear-cutting and road construction (both the existing Highway 103 and forestry roads). Habitat fragmentation associated with residential development is present at the eastern end of the proposed route at Timberlea where large housing developments have been established to the north of the Study Corridor. At the southern end of the Study Corridor residential development is present in the Hubbards area. Most residences in this area are located on the south side of the existing Highway 103; however, a few homes and cottages are present north of the highway around Sawler Lake and Maple Lake.

Construction activities will permanently remove wildlife habitat via clearing and preparation of the site and the construction of watercourse crossing structures. The total amount of habitat that will be lost to highway construction is 194 ha. Approximately 91% of the lost habitat consists of a combination of softwood forest (87 ha), mixedwood forest (33 ha), clear-cut (19 ha), corridor (21 ha), and wetlands (17 ha). Corridor consists of the cleared RoWs of existing linear features such as highways, railroads and transmission lines. In the Assessment Area this consists mainly of the previously cleared portion of the Highway 103 RoW. This habitat consists mostly of areas dominated by grasses and forbs or shrubs.

Potential adverse effects on wildlife species associated with construction activities include direct mortality, habitat loss and disturbance of wildlife during critical periods such as nesting. Direct mortality could occur mainly to small species such as herpetiles, small mammals and the eggs or flightless young of birds. Larger species of hibernating mammal could also be affected by direct mortality during the construction phase of the project. Habitat loss will affect all vertebrate species that make use of the habitat present within the expanded RoW. Species that are sensitive to the presence of humans or activities associated with humans could be disturbed by construction activities possibly resulting in some species abandoning otherwise suitable habitat adjacent to the proposed highway twinning. The adverse affect of disturbance would be limited by the fact that the area of twinning is located immediately adjacent to the existing highway.

5.5.5.2 Operation and Maintenance

Noise and several forms of pollution (light, sound, air) are capable of adversely affecting the quality of the surrounding habitat. In particular, traffic could disturb birds and mammals nesting or foraging in habitats near the new road. The presence of traffic would enhance the efficacy of the road as a barrier to wildlife movement intensifying the effect of habitat fragmentation caused by construction of the road. Some wildlife species may be less able to cross the road than others. Species most affected by the presence of traffic would include those particularly sensitive to anthropogenic activity, species reluctant to cross open habitat and species that are not fast enough to cross the road and successfully avoid traffic. Given the fact that Highway 103 already exists, species particularly sensitive to anthropogenic activity are not likely to be common in the area where the proposed highway will be established. With twinning of the road, the width of the road will double so the effect of the road as a deterrent for species reluctant to cross open areas will be enhanced. The effect on slow species should remain the same since traffic volume is not expected to be substantially increased as a result of twinning.

Periodic infrastructure maintenance on bridges or culverts has the potential to disrupt birds and mammals, especially during the breeding season and lower the habitat quality by the addition of noise, disturbance and possible vibrations of the equipment being used to carry out the maintenance.

Vegetation management will be conducted by mechanical clearing during highway operation (*e.g.,* road shoulders and interchanges). It is possible, despite the disturbance from passing vehicles, that the open habitats in medians, ditches, and/or side slopes may be used as breeding habitat by species such as Common Yellowthroats and Song Sparrows. Mowing and brush cutting of the vegetated slopes and drainage ditches could destroy the nests of these birds. The maintenance branch of NSTIR mows the grassy edges and medians of the Province"s highways, as required, usually once per year, for safety and partially for aesthetic reasons. Vegetation cutting will occur within the highway RoW in areas that had already been disturbed as a result of construction activities. Vegetation cutting (mowing) can result in fewer vehicle/animal interactions when viewing conditions for motorists are maximized.

Highway maintenance and repair work will typically be limited to the paved and immediately adjacent areas of the highway (*e.g.*, guide rail, lighting and shoulder). Maintenance involving watercourse crossing structures or culverts will be limited to the cleared portion of the highway and thus is not anticipated to interact with the terrestrial environment beyond the Project RoW.

Winter maintenance of the Project after completion may have a potential negative effect through degradation of wildlife habitat quality and possible direct mortality of wildlife. Salt or other de-icing agents may affect water/habitat quality for wildlife adjacent to the RoW. Consumption of deicing brine by birds can cause narcosis that can result in increased rates of collision with automobiles. Adherence to the NSTIR Salt Management Plan, which specifies application rates and designates vulnerable areas, will reduce the environmental effects to wildlife habitat.

5.5.6 Other Projects and Activities

Existing and Planned Linear Features

Existing linear features have affected birds and bird habitat through clearing which has changed the characteristics of the habitats and increased fragmentation in the Assessment Area. Linear developments may also pose a barrier to wildlife movement. These activities have contributed to the current level of wildlife habitat fragmentation in the Assessment Area. Linear features such as roads can cause direct mortality of wildlife as a result of collisions between vehicles and animals. These features can also contribute contaminants to the environment which can adversely affect wildlife populations such as heavy metals from past use of leaded gasoline and wear of automobile parts and hydrocarbons from treated railroad ties. Linear features that currently exist in or near the Assessment Area include 100 and 200 series highways, roads associated with housing developments, woods roads, electrical transmission lines, a flume to transport water to a hydroelectric facility, and an abandoned railroad line.

Residential and Commercial Land Use

Existing residential and commercial land use has caused habitat loss and fragmentation through changes in vegetation, and road development. These activities have contributed to the current level of habitat fragmentation in the Assessment Area. The presence of this new habitat has permitted the establishment and expansion of non-native animal species such as European Starlings, House Sparrows and Norway Rats that displace native species. Domestic animals such as dogs and cats can also adversely affect local wildlife populations by applying heavy predation pressure in wild areas adjacent to developed areas. Residential and commercial land uses can also be sources of contaminants that can adversely affect wildlife species.

Planned commercial and municipal development can affect wildlife and wildlife habitat through clearing which results in the direct loss of habitat and alteration of the quality of remaining habitat as a result of edge effects and habitat fragmentation. The degree to which these stressors operate depends on the size, shape and location of the development. Development of this type may also increase access to areas of wildlife habitat which may result in further changes to habitat quality and quantity through human use.

Residential and commercial development is restricted to the northern and southern ends of the Assessment Area at Timberlea and Hubbards. Development activities are most intense in the Timberlea area.

Resource Land Use

Forestry activities have occurred over most of the Assessment Area. Forestry related activities can cause habitat fragmentation through changes in vegetation, and road development. These activities have contributed substantially to the current level of habitat fragmentation in the Assessment Area. Forestry practices can result in direct mortality of wildlife as a result of timber harvesting and road construction. The effects of forestry activities are typically temporary and forest succession eventually restores the lost habitat. However, over harvesting and shorter harvesting cycles can cause an overall reduction in the availability of some important wildlife habitats such as mature forest habitat. The use of herbicides or silvicultural activities such as precommercial thinning can alter the course of succession resulting in the development of forest habitat that is quite different from the original harvested stand. The establishment of woods roads contributes to habitat fragmentation and these roads are often maintained for considerable periods of time. The presence of woods roads also allows humans to penetrate further into forested habitat resulting in disturbance of sensitive species or increased mortality of some species. These roads can also act as conduits for generalist predators to penetrate into forest habitat.

Several borrow pits are present in the Assessment Area. Most of these pits are relatively small and were used as sources of fill during the construction of Highway 103. Only one of the pits present along the route is still active. This pit appears to be used infrequently. Quarrying activity results in the direct loss of wildlife habitat and the creation of habitat edge and some habitat fragmentation. The operation of machinery such as excavators and trucks can result in the disturbance of wildlife species.

5.5.7 Environmental Effects Assessment

This section provides an evaluation of key potential Project-VEC interactions as summarized in the environmental effects assessment matrix (Table 5.56).

Table 5.56 Environmental Effects Assessment Matrix for Wildlife and Wildlife Habitat

Environmental Effects Assessment Matrix Valued Environmental Component: WILDLIFE AND WILDLIFE HABITAT							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Construction							
Site Preparation	• Change in habitat quantity (A) • Change in habitat quality (A) • Direct mortality (A) • Loss of Species of Conservation Concern (A)	• Limit Project-related off road activity • Follow EPP • Clear outside of breeding bird season • Employee environmental awareness training • Clear only the area required for the Project • Reduce the width of the cleared RoW in areas having high concentrations of Species of Conservation Concern	1-2	3	2/6	I	2
Roadbed Preparation	• Change in habitat quality (A) • Direct mortality (A) • Disturbance of Species at Risk and Species of Conservation Concern (A)	• Limit Project-related off road activity • Follow EPP • Employee environmental awareness training • Erect silt fencing along the toe of slope of roadbeds at Little Indian and Sawler Lakes to keep nesting Snapping Turtles out of construction site • Replace median strip with Jersey/cable in areas having high concentrations of Species of Conservation Concern • Place artificial Loon nesting platform in Mill Lake to provide an alternative nest site during construction • Where feasible, schedule blasting in the Mill Lake area and the Dorey Lake area outside of the bird breeding season (May 1 to August 31)	1	3	2/6	I	2

Table 5.56 Environmental Effects Assessment Matrix for Wildlife and Wildlife Habitat

Environmental Effects Assessment Matrix Valued Environmental Component: WILDLIFE AND WILDLIFE HABITAT							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Watercourse Crossing Structure Construction	• Change in habitat quantity (A) • Change in habitat Quality (A) • Direct mortality (A) • Loss of Species of Conservation Concern (A)	• Clear outside of bird breeding season wherever possible • Minimize area of disturbance • Use designated roadways and access • Follow EPP • Employee environmental awareness training • Provide artificial nesting sites for Barn Swallows during construction • Where possible, construct new bridges using steel I beam trusses to provide additional Barn Swallow nesting habitat	1	1	2/6	R	2
Operation and Maintenance							
Project Presence	• Change in habitat quality (A) • Direct mortality (A) • Loss of Species of Conservation Concern (A)	• No mitigation recommended	1	3	5/6	1	2
Infrastructure Maintenance	• Change in habitat quality (A) • Disturbance of Species at Risk and Species of Conservation Concern (A)	• Follow EPP • Where possible schedule maintenance activities on Mill and Little Indian Lake bridges to periods outside of the breeding season for Barn Swallows (mid-April to mid-September) • Keep activities to disturbed RoW where feasible	1	2	5/1	R	2
Winter Maintenance	• Change in habitat quality (A) • Direct mortality (A)	• Adherence to Salt Management Plan	1	3	2/2	R	2

Table 5.56 Environmental Effects Assessment Matrix for Wildlife and Wildlife Habitat

Environmental Effects Assessment Matrix Valued Environmental Component: WILDLIFE AND WILDLIFE HABITAT							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Vegetation Management	• Change in habitat quantity (A) • Direct mortality (A)	• Follow EPP • Employee environmental awareness training • Schedule vegetation management for periods outside of the nesting season for most bird species (May 1 to August 31)	1	3	5/1	R	2

Key

Magnitude*: 1 = Low: *e.g.,* specific group, habitat, or ecosystem localized one generation or less, within natural variation 2 = Medium: *e.g.,* portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability 3 = High: *e.g.,* affecting a whole stock, population, habitat or ecosystem, outside the range of natural variation	Geographic Extent: 1 = <1 km^2 2 = 1-10 km^2 3 = 11-100 km^2 4 = 101 - 1,000 km^2 5 = 1,001 - 10,000 km^2 6 = >10,000 km^2 Duration: 1 = <1 month 2 = 1 - 12 months 3 = 13 - 36 months 4 = 37 - 72 months 5 = >72 months	Frequency: 1 = <11 events/year 2 = 11 - 50 events/year 3 = 51 - 100 events/year 4 = 101 – 200 events/year 5 = >200 events/year 6 = continuous Reversibility: R = Reversible I = Irreversible •	Ecological/Socio-cultural and Economic Context: 1 = Relatively pristine area or area not adversely affected by human activity. 2 = Evidence of adverse environmental effects. N/A = Not Applicable (A) = adverse (P) = positive

5.5.7.1 Construction

Construction activities will permanently remove bird habitat from the cleared RoW. The RoW area will be reduced by minimizing clearing, and traffic outside of the Project RoW.

The environmental effects of clearing and grubbing are most severe when these activities are conducted during the period when most bird species are breeding (May 1 to August 31). Clearing and grubbing at this time could result in the direct mortality of eggs and unfledged nestlings. The killing of birds or the destruction of their nests, eggs, or young is an offence under the *Migratory Birds Convention Act, 1994*. NSTIR plans to conduct clearing during the fall/winter, which should avoid potential direct adverse environmental effects on most nesting birds. It is important to note that some species of bird such as White-winged Crossbills, Pine Siskins and Common Ravens nest outside of this period and could be affected by clearing and grubbing. Other species such as Killdeer nest on bare ground and Dark-eyed Juncos and White-throated Sparrows nest in recent clear-cuts. These species could occupy sites that have been cleared and/or grubbed during the winter months. Although NSTIR plans to conduct clearing during the fall/winter, some minimal clearing of watercourse buffer zones (typically 30 m either side of the watercourse; approximately 5% of the total) may take place during the May to August timeframe. In addition, some clearing activities such as surveying and clearing for alignment adjustments may also be required during this period. Alignment adjustments may be required as mitigation for other VECs (*e.g.,* avoidance of an unforeseen important archaeological site) or due to engineering and design limitations (*e.g.,* slope stability). Due to construction timing restrictions as a result of other legislation (*e.g., Fisheries Act*), site preparation activities other than clearing (*e.g.,* grubbing and grading) will take place during the May to September period. This may result in the disturbance of some ground-nesting birds for a period of up to 30 days, which is the time in which grading activities must be completed (within a given work area) as specified by the Work Progression Schedule (Section 3.1 of the Generic EPP). If nesting birds are observed, then work in that area will be avoided and NSDNR, CWS and the Project Engineer will be consulted for direction (see Section 2.2 of the Generic EPP).

Clearing activities will also result in some fragmentation. Forest interior birds are particularly sensitive to habitat loss since they are affected both by direct habitat loss and through the adverse effects of habitat edge. Forest interior habitat for the purpose of this report is defined as mature forest that is free of edge and is greater than 10 ha in size (D. Busby, pers. comm. 2006). The distribution of mature forest habitat in the Assessment Area was determined using habitat mapping developed by the Maritime Breeding Bird Atlas program. The amount of forest interior habitat in the Assessment Area was determined by establishing 100 m buffers around edge producing features such as the existing highway, heavily disturbed non-forested habitat, borrow pits, woods roads and recent clear-cuts. Areas remaining after buffering these features were classed as forest interior habitat if they were 10 ha or greater in size. Eighteen patches of forest interior habitat are present in the 1 km wide Assessment Area (Table 5.50). Forest interior habitat is scattered throughout the assessment area but is most concentrated in the vicinity of Sawler Lake near the southern end of the route, Little Indian and Mill Lakes near the northern end of the route and near the Ingramport River in the center of the route. The total area of forest interior habitat within the Study Area is 469 ha which represents 16% of the total area within the Assessment Area. Twinning of the highway will result in the shifting of the existing edge habitat associated with the existing highway approximately 25 m into surrounding habitat. The property access roads associated with the highway twinning will also create habitat edge. However, these roads are located within the RoW for the highway. It is assumed that the edge effects will extend approximately 100 m into the surrounding habitat from the edge of the cleared RoW. The total amount of forest interior habitat lost as a result of twinning of the highway is 53.5 ha. NSTIR plans to reduce the width of a portion of the western end of the route (chainages 15+200 to 20+600 m) by using Jersey or cable barriers rather than a median strip. This will reduce the amount of forest interior habitat lost to 50.7 ha. As discussed above, twinning of the existing highway actually helps to minimize habitat fragmentation associated with the Project since no new islands of habitat are created by the linear feature.

Fifteen species of conservation concern were encountered during the field survey including Canada Warbler, Rusty Blackbird, Cape May Warbler, Common Loon, Yellow-bellied Flycatcher, Turkey Vulture, Bay-breasted Warbler, Scarlet Tanager, Golden-crowned Kinglet, Ruby-crowned Kinglet, Boreal Chickadee, Black-backed Woodpecker, Barn Swallow, Tree Swallow and Pine Siskin. Mitigative measures that can be used to reduce construction phase project related adverse effects on these species are presented in the following text.

Canada Warbler

Canada Warblers have recently been assigned a “Threatened” status by COSEWIC and are listed under Schedule 1 of *SARA*, but are not listed as a “Species at Risk” under the Nova Scotia *Endangered Species Act*. They are, however, considered “At Risk” by NSDNR and are ranked as “S3B” by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern.

Canada Warblers were encountered at three locations during the field surveys. Two of the locations are situated approximately 500 m east of the outflow of Dorey Lake. One of these birds was observed on the south side of Highway 103 on June 2, 2010. The second bird was recorded on the north side of Highway 103 on June 9, 2010. These two records are only 130 m apart, so it is likely that the same male was heard singing on both occasions. The June 2 record was associated with Wetland 283 while the June 9 record was associated with Wetland 279. Both wetlands contain forested wetland characterized by an open tree canopy underlain by a dense tall shrub understory. It is likely that these two wetlands provide nesting habitat for Canada Warbler. Wetland 283 is located north of the existing Highway 103 and will be directly affected by construction activities. Wetland 279 is located south of the existing Highway 103 and will not be directly affected by construction activities.

The third record of Canada Warbler was from Wetland 226 which is located along Stillwater Brook (chainage 13+500 m). This wetland is coniferous treed swamp that has a relatively open tree canopy and a dense shrub understory composed mainly of advanced regeneration of balsam fir. At this site an agitated Canada Warbler was observed near the northern boundary of the Study Corridor outside of the area physically disturbed by construction of the new lane and access road.

Twinning of Highway 103 and construction of an access road will result in the loss of probable breeding habitat for Canada Warblers in the Dorey Lake area. Probable nesting habitat near Stillwater Brook will not be lost. Several mitigation measures can be employed to reduce adverse effects of the project on this species. Clearing of the RoW outside of the breeding season will prevent direct mortality of Canada Warblers associated with the destruction of eggs and nestlings.

In addition, the cleared RoW in the area between chainages 15+200 and 20+600 m will be narrowed by replacing the median strip with a Jersey or cable barrier. This will reduce the width of the Project impact area by by 21 m. Narrowing of the Project impact area will result in the reduction of wetland habitat lost in Wetland 283 from 0.4 ha to 0.2 ha.

The wetlands that provide nesting habitat for Canada Warblers could be adversely affected by improper sizing and placement of culverts for the highway or access road. This could result in ponding of water on the upstream side of the culvert which could result in flooding and subsequent heavy tree mortality in the wetlands. Loss of tree cover would negatively affect the value of the wetland as habitat for Canada Warblers. Culverts will be of the appropriate type and properly sized and positioned to maintain existing flow patterns through the wetlands.

Rusty Blackbird

Rusty Blackbirds are listed as a “Species of Concern” under *SARA*. They are also listed as “May be at Risk” by NSDNR. Rusty Blackbirds were recorded at four locations during the field surveys. All Rusty Blackbird observations were made in the vicinity of Dorey Lake between chainages 17+600 and 18+500 (Figure 5.5.1d) in wetland habitat including Wetlands 277, 279, 288, and 294 (Figure 5.4.1d). Rusty Blackbirds typically nest in wetlands containing a mixture of coniferous forest, open water and areas of shrub or graminoid cover. Another feature of wetlands in this area is the relative abundance of stillwaters and pools compared to most other wetlands along the route. Rusty Blackbirds typically construct their nests over or near water.

Rusty Blackbirds could be adversely affected by the construction phase of the Project in a number of ways including direct mortality of eggs and flightless young, loss of suitable nesting habitat and disruption of nesting activity by noise and visual stimuli. The mitigative measures used to reduce the adverse effects of the construction phase of the Project on Canada Warbler will also be used to reduce adverse effects on Rusty Blackbirds. These would include clearing outside of the breeding season, narrowing of the cleared RoW by replacing the median strip with a Jersey or cable barrier, and proper installation of culverts in wetlands. In addition, it is recommended that the pond habitat in Wetland 277 lost to widening of the RoW be replaced by either expanding the size of the existing pond or by constructing a new pond in or immediately adjacent to the wetlands in which Rusty Blackbirds were encountered in the Study Corridor. Rusty Blackbirds are typically found in areas remote from human activities so it is unusual to have them breeding in close proximity to a busy highway and an area inhabited by humans. Little can be done to effectively reduce the adverse effects of disturbance on this species other than to schedule construction activities in the area between chainages 17+000 and 19+000 m outside of the most sensitive periods of their breeding season which extends from early May to early June.

Common Loon

Common Loons nest on islands in freshwater lakes. This species is ranked as “May be at Risk” under the NSDNR General Status Ranks but is not listed under *SARA* or the Nova Scotia *Endangered Species Act*.

Common Loons were regularly observed at Mill Lake and Sawler Lake. Two Common Loons were present at both Lakes. An occupied Common Loon nest was found on a small swampy island along the northern shore of Mill Lake (chainage 2+600 m). No evidence of breeding was observed on Sawler Lake although a local resident indicated that Common Loons nest on an Island on the lake. Suitable nesting habitat was not present in the portion of Sawler Lake located within the Study Corridor.

The Common Loon nest on Mill Lake is located within 20 m of the roadbed of the existing Highway 103. Given the close proximity of the nest to the existing road, it would appear that these Common Loons are tolerant of vehicle traffic. They may also be tolerant of activities associated with the construction of the new west bound lane; however, this activity will be episodic and will involve the visual presence of humans making it potentially more stressful and harder for the loons to habituate to. Activities such as blasting may be particularly stressful. It is proposed that several artificial nest platforms be placed in suitable locations on Mill Lake before construction activities commence. These nesting platforms are inexpensive and when properly constructed and positioned are readily used by Common Loons. This will provide alternative nesting sites for loons if they find conditions too stressful at the existing nest site. In addition, blasting will be conducted outside of the period when Common Loons are incubating eggs (early May to mid-July), to the extent practical.

Golden-crowned Kinglet and Ruby-crowned Kinglet

Golden-crowned Kinglets and Ruby-crowned Kinglets have just recently been assigned a status of “Sensitive” by NSDNR. The ACCDC assigns a rank of “S4” to both species indicating that although they are fairly common throughout their range in the province, they are of long-term concern.

Both species of kinglet are common in the Assessment Area with Golden-crowned Kinglet the most abundant species encountered during the field surveys. Golden-crowned Kinglets are widely distributed throughout the Assessment Area while Ruby-crowned Kinglets are most abundant at the southern end of the Assessment Area. Both species are found in a variety of forested habitats but occur most frequently in mature softwood and mixedwood forest. Mitigation to reduce adverse effects of construction activities on this species would consist of clearing the RoW outside of the breeding season.

Boreal Chickadee, Cape May Warbler, Bay-breasted Warbler

These species are associated mainly with mature coniferous forest habitats. All are considered to be “Sensitive” species by NSDNR. The highest concentrations of these species were encountered between chainages 18+000 and 19+000 m. Narrowing of the median between 15+200 and 20+500 m will reduce potential adverse effects on these species. Clearing outside of the breeding season would mitigate direct mortality of eggs and flightless young.

Pine Siskin, Yellow-bellied Flycatcher, Black-backed Woodpecker, and Scarlet Tanager

Pine Siskin, Yellow-bellied Flycatcher and Black-backed Woodpecker are associated with mature coniferous forest and have recently been ranked as “Sensitive” species by NSDNR. Scarlet Tanager is ranked as status “Undetermined” by NSDNR. They nest in mature hardwood or mixedwood forest. Yellow-bellied Flycatcher was recorded at two locations while Pine Siskin, Black-backed Woodpecker and Scarlet Tanager were recorded at only one location each. Most of these sites were located at the northern end of the Study Corridor. Clearing of the RoW outside of the breeding season is the only specific mitigation proposed for these species.

Barn Swallow

Barn Swallows typically nest in or on human-made structures such as buildings and culverts. This species was ranked as a “Sensitive” species in Nova Scotia by NSDNR in 2006.

Barn Swallows were regularly observed at Mill Lake (chainage 3+000 m) and Little Indian Lake (chainage 3+500 m) (Figure 5.5.1a). Nests were found under the bridges at both sites. Construction activities will not directly affect these nesting sites but could cause Barn Swallows to abandon these sites as a result of disturbance during construction of the new bridges and approach causeways. The adverse effects of disturbance on nesting Barn Swallows could be reduced by providing artificial nesting structures that could be used as alternative nest sites if Barn Swallows are reluctant to nest at their existing nest sites due to nearby construction activities. These nesting structures are inexpensive and effective. They can be made more attractive to Barn Swallows by attaching artificial Barn Swallow nests made out of plaster to the structure. The artificial nest structures should be placed as close to the original nests as possible but at least 50 m from the area where construction will take place.

If possible, the new bridge structures should be constructed using the same steel I beam deck supports as used on the existing bridges. This would provide additional nesting sites for this species. If reinforced concrete deck supports are used, shelves could be added to them to provide suitable nesting sites for Barn Swallows.

Tree Swallow

Tree Swallows were rankeded as a “Sensitive” species in Nova Scotia by NSDNR in 2010. Tree Swallows nest in unoccupied woodpecker holes and will also use nest boxes. They feed largely over lakes, rivers and wetlands containing open water. Their nests are often situated near these foraging sites. The field survey data suggests that Tree Swallows nest in forest habitat adjacent to Little Indian Lake, Mill Lake and Dorey Lake. The adverse effects of construction activities on Tree Swallows could be mitigated in two ways. Firstly, clearing will be conducted outside of the breeding season to prevent mortality of eggs and unfledged young. Secondly, Tree Swallow nest boxes will be placed in forest habitat adjacent to these three lakes to replace any nesting cavities lost to construction activities.

Turkey Vulture

Nova Scotia is at the northern limit of the range of the Turkey Vulture. This species is regularly encountered in southwestern Nova Scotia but is not commonly encountered in central Nova Scotia. It is rare in Nova Scotia but its abundance is increasing over time. Given the low numbers of Turkey Vultures present in the province, NSDNR has listed this species as Sensitive. Turkey Vultures typically nest on ledges on cliffs and may occasionally nest in abandoned buildings. A single Turkey Vulture was observed at the eastern end of the Assessment Area (chainage 1+000 m) in late May. No suitable nesting habitat is present within the Study Corridor so this species is not believed to be nesting there. No mitigation is proposed for this species.

Long-eared Owl

The Maritime Breeding Bird Atlas data suggests that Long-eared Owls may be present in the Assessment Area. Long-eared Owls are typically active only at night and roost in dense conifer stands. Suitable Long-eared Owl habitat is present at a number of locations within the Assessment Area where recent clear-cuts are surrounded by dense stands of mature conifers. There is a relatively high likelihood that Long-eared Owls nest in the Assessment Area. Mitigation to reduce the adverse effects of construction activities on Long-eared Owls would consist of clearing the RoW outside of the breeding season. Long-eared Owls nest earlier than most bird species so it would be necessary to end the period when clearing could occur sooner. Areas having high potential for nesting Long-eared Owls could be easily modeled so the reduced clearing period would only apply to a small subset of terrestrial habitats present in the Assessment Area. In these areas the period during which clearing could not occur would extend from March 1 to August 31.

Raptors

Six raptor species were encountered in the Study Corridor during the field surveys including Bald Eagle, Osprey, Northern Goshawk, Red-tailed Hawk, Broad-winged Hawk, and Merlin. None of these species is rankeded as “Sensitive” in Nova Scotia by NSDNR; however, they typically occur in low numbers and are often sensitive to anthropogenic disturbance, particularly around their nest sites. Two of the raptor species, Broad-winged Hawk and Osprey were confirmed as nesting in or near the Study Corridor. No evidence of breeding activity was observed for the remaining four species.

A single occupied Broad-winged Hawk nest was found at the eastern end of the Study Corridor near chainage 0+600 m. Broad-winged Hawks will reuse nests but typically alternate between two sites and will occupy a given nest every second year. This nest was outside of the surveyed area but was located within the RoW of a proposed property access road. It is recommended that the access road be re-routed to avoid the nest site. Broad-winged Hawks are relatively tolerant of human activities so a 100 m buffer around the nest should be adequate, particularly if the access road is not heavily used. If avoiding the nest is not possible, the clearing of the habitat around the nest must occur prior to the breeding season.

Two occupied Osprey nests were found during the field surveys. The first nest was found on a power pole located on the south side of Highway 103 outside of the Study Corridor (chainage 1+000 m). The second nest was located at the northern end of Mill Lake at the Nova Scotia Power hydroelectric facility. This nest was constructed on an Osprey nest platform and was located near the northern edge of the surveyed area (chainage 3+000 m). Neither of these nests will be affected by construction activities and this species is typically very tolerant of human activities so no specific mitigative measures are proposed for this species.

Mammals

No rare mammal species have been recorded in the vicinity of the Assessment Area. Construction within the RoW will result in the permanent loss of habitat for some wildlife species, and the creation of edge habitat along the RoW. Clearing of mature forest for highway construction resembles clear-cutting of forest in which the existing forest becomes unavailable or reduced in the immediate area. Although the Project does pass through mature forest, clearing will be kept to a minimum, and off road travel will be limited. The area cleared will be as narrow as practical to reduce the amount of lost habitat but wide enough to ensure good visibility of large animals crossing the road.

Change in wildlife habitat quality includes habitat fragmentation and sensory disturbance. There may also be mortality of small mammals. The 1 km wide Assessment Area is already moderately fragmented and 16 % (469 ha) of the Assessment Area consists of forest interior habitat. Twinning of the highway will not increase the number of habitat fragments but will reduce the size of 10 of the 18 patches of forest interior habitat. It is estimated that the amount of forest interior habitat lost as a result of highway construction will be 50.7 ha. Construction of access roads parallel to the highway are not expected to substantially increase habitat fragmentation since the access roads are typically located within the cleared RoW of the new lanes. Sensory disturbance of mammals is not expected to have a substantial effect on local mammal populations for several reasons. No rare or particularly sensitive mammal species have been recorded in the area. The Assessment Area is located in an area of relatively high human activity including the presence of the existing Highway 103, forest harvesting, an active borrow pit and a wide variety of human activities associated with residential, industrial and retail facilities. Species sensitive to human activities are unlikely to be present and the species that are present are habituated to the presence of humans. Construction activities are unlikely to significantly affect the abundance or distribution of mammals in the Assessment Area. Mitigative measures are limited to minimizing vegetation clearing as far as practical during RoW preparation to preserve habitat.

Herpetiles

Snapping Turtle is the only sensitive herpetile species encountered along the proposed highway RoW during the various field surveys. Wood Turtle, has been reported in the general vicinity of the Assessment Area. The field surveys did not reveal the presence of this species nor was suitable wood turtle habitat found in the Study Corridor.

Suitable habitat for Four-toed Salamander is present in the Assessment Area; however, this species was not encountered during herpetofauna surveys conducted at the appropriate time for this Project. Construction activity will result in the loss of some amphibian habitat in a number of the wetlands that are crossed by the proposed highway RoW. This habitat will be replaced as part of the wetland compensation program.

Summary

Based on consideration of the potential environmental effects of the activities required for the Construction phase of the Project, the proposed mitigation (*e.g.*, avoidance, EPP, and limiting area of disturbance), and the residual environmental effects significance ratings criteria, the environmental effects of construction on Wildlife and Wildlife Habitat are rated not significant because Species at Risk and Species of Conservation Concern will not be affected adversely by the Project and biodiversity in the theme region will not likely be adversely affected.

5.5.7.2 Operation and Maintenance

During operation and maintenance of the Project, winter safety activities, vegetation maintenance and the physical presence of the Project could result in a change in wildlife habitat quantity or quality, direct mortality of wildlife and/or loss of Species of Conservation Concern. Wildlife could be affected by disturbance caused by traffic and direct mortality associated with collisions with automobiles. Several studies have shown that disturbance associated with automobile traffic can have an adverse effect on bird abundance and breeding success. A study of terrestrial bird abundance, species composition and breeding success in forested habitats adjacent to a busy highway in New Brunswick (JWEL 1998) revealed a reduction in bird abundance of 18 to 25% in plots located 100 and 200 m away from the road relative to control plots 500 m from the road. Evidence of breeding activity was reduced by 34 to 39% relative to control plots. These reductions were not statistically significant.

A similar study conducted in the Netherlands revealed a reduction in the number of singing males from 3.3/ha in control plots to 2.1/ha in areas within 200 m of a highway (Reijnen and Foppen 1994). Reijnen and Foppen (1994) noted that the degree of disturbance to birds by highway traffic was best correlated with noise levels. These data indicate that disturbance associated with operation of the road will have a measurable adverse effect on local populations but is not expected to significantly adversely affect regional populations. However, since Highway 103 already exists and twinning will occur immediately adjacent to the existing highway there will be no net increase in the level of disturbance to wildlife in habitats adjacent to the highway. The twinning of the highway is not expected to significantly increase traffic volumes. The main disturbance effect associated with twinning of the highway will be that disturbance effects will be projected approximately 25 m further on the side of the highway where the new lanes are established. As such, no significant increase in the level of disturbance to wildlife is expected.

Road kill is generally not considered as a significant source of mortality for bird populations (Leedy and Adams 1982). This is supported by a study which demonstrated that the survival rates of male Willow Warblers (*Phylloscopus trochilus*) were equal in areas near and far from highways (Reijnen and Foppen 1994). Roadkill data collected for a 100 Series Highway, secondary highway and city streets in Nova Scotia over a two year period yielded an average rate of roadkill of 0.9 birds/km/yr for the 100 Series Highway, 1.2 birds/km/yr for the secondary highway and 0.7 birds/km/yr for city streets (M. Crowell unpublished data). The new highway will be a 24 km long 100 Series Highway, therefore, the estimated number of birds killed in collisions with automobiles would be 22 per year. This is probably an underestimate of the actual number of birds likely to be killed since small birds are easily missed during the surveys and their bodies are quickly destroyed by traffic or removed by scavengers. If it is assumed that only one in ten birds killed by traffic is recorded, the estimated number of birds killed per year would be approximately 220 birds. This number represents only a small proportion of the local bird population.

Mammals are more susceptible to collisions with automobiles than birds due to the facts that they are less able to avoid traffic and are generally active at night. The road kill study cited above also collected data on mammal road kills on various highway classes in Nova Scotia. The number of mammals killed by collisions with automobiles can be expected to average approximately 3/km/year based on road kill data collected for Highway 102 over a two year period (M. Crowell, unpublished data). As such, the total number of mammals killed along the proposed highway each year is estimated to be approximately 72 animals. The species which can be expected to account for most of the road kills are raccoon and porcupine. Because the Project consists of twinning an existing highway, it is unlikely that the Project will cause a significant increase in road kill.

Maintenance activities such as resurfacing and mowing of the RoW are not expected to have significant effects on local bird populations. Disturbance associated with repairs to the road surface are not expected to be any more intense than that encountered during the construction or operational phases of the project. If feasible, the RoW will not be mowed until August to avoid nest destruction.

Some bird species such as Cliff Swallows, Barn Swallows and Eastern Phoebes frequently nest on bridges. Maintenance activities such as sandblasting, painting or structural repairs to the sides or underside of the bridge during the breeding season could result in the destruction or abandonment of active nests, a violation of the *Migratory Birds Convention Act, 1994*. This could be prevented by inspecting bridges prior to maintenance work to determine if occupied nests of protected bird species are present. If active nests are present maintenance activities would be delayed until after young have fledged. Other bird species not protected under the *Migratory Birds Convention Act, 1994* also nest on bridge structures including Rock Dove, European Starling and House Sparrow. Maintenance work would not necessarily have to be delayed if these species were nesting on the structure.

The field data collected to date does not indicate that additional mitigation is required, since operation of the twinned highway will have essentially the same effects as operation of the existing highway.

Based on available data and assumptions and consideration of the potential environmental effects of the activities required for the operation and maintenance phase of the Project, the proposed mitigation (*e.g.*, avoidance, EPP, and limiting area of disturbance), and the residual environmental effects significance ratings criteria, the environmental effects of operation and maintenance on Wildlife and Wildlife Habitat are rated not significant.

5.5.7.3 Assessment of Cumulative Environmental Effects

The key potential cumulative environmental effect of the Project in combination with the environmental effects of other projects and activities is increased habitat loss and reduction of habitat quality as a result of habitat fragmentation, production of adverse edge effects and disturbance of wildlife.

Various activities have historically resulted in the loss and/or change in the quantity and quality of wildlife habitat in the Assessment Area. These include the construction and operation of Highway 103 and other roads, electrical transmission lines, hydroelectric generation facilities, borrow pits, and housing and commercial property development.

Forest harvesting is the most widespread and extensive adverse environmental effect found in the Assessment Area. Virtually all of the Assessment Area has been subjected to forest harvesting at some time. Although this form of disturbance is widespread, it is largely temporary since the forest habitat will regenerate. It is anticipated that forest harvesting will continue throughout much of the Assessment Area for the foreseeable future.

A number of borrow pits have been established in the Assessment Area. It appears that these were established to provide fill material during the construction of Highway 103. Only one of the borrow pits is still operating. Abandoned borrow pits revegetate and eventually develop into natural plant communities; however, this process is slow due to the fact that in most instances the biologically active topsoil has been removed. The borrow pits in the Assessment Area are relatively small and have not resulted in large losses of wildlife habitat. The one active borrow pit operates infrequently and is unlikely to be an important source of disturbance to wildlife in adjacent habitats. In the absence of future twinning of Highway 103, the number of borrow pits is not expected to increase substantially although continued housing and commercial development in the Upper Tantallon area can be expected to provide a demand for fill material from the remaining borrow pit. Twinning of Highway 103 can be expected to greatly increase the demand for fill material which may result in the establishment of new borrow pits.

Housing and commercial development is currently present only at the western end of the Assessment Area in the vicinity of Hubbards and Simms Settlement. Although development is not present within the eastern end of the Assessment Area at Upper Tantallon, housing and commercial development appears to be most active in this area and is likely to encroach on the Assessment Area in the near future. Housing and commercial developments can adversely affect wildlife in various ways. Subdivision development results in the establishment of large and interconnected road networks that can result in heavy habitat fragmentation. Although much native vegetation is left in place in the subdivisions near the Assessment Area, the constant presence of humans and pets such as cats and dogs can dissuade wildlife species that are sensitive to disturbance from using the habitats in and near the subdivisions. These developments are essentially permanent. Housing and commercial development can be expected to increase at the eastern and western ends of the Assessment Area in the near future resulting in adverse effects on wildlife. Improved highway conditions associated with twinning of Highway 103 may help to encourage more development. For the forseeable future, this development can be expected to be focused in the eastern and western ends of the Assessment Area.

Highway and electrical transmission line RoWs are essentially permanent disturbances. These features are maintained on an ongoing basis for many decades. The degree of disturbance and habitat fragmentation varies according to the type of RoW. Generally the degree of habitat fragmentation is high given the fact that they are long linear structures that generate large amounts of habitat edge relative to the size of the disturbed area. Electrical transmission lines cause less fragmentation and disturbance than highway RoWs due to the fact that they are maintained in a semi-natural state (albeit in an early stage of plant succession) and there is little ongoing human activity at these sites to dissuade wildlife from crossing them. Highway RoW cause more severe fragmentation and disturbance to wildlife since they are largely devoid of cover and often support a high degree of disturbing human activity in the form of vehicle traffic. Traffic and a lack of cover can dissuade wildlife from crossing roads and can also result in direct mortality of wildlife through collisions with vehicles. The presence of road kill also helps to draw generalist predators to roads. Busy paved highways are a much greater barrier to wildlife movement than unpaved woods roads that carry little traffic. Both roads and electrical transmission lines provide conduits for humans to enter relatively undisturbed habitats. The number of roads in the Assessment Area, particularly unpaved woods roads, can be expected to increase as forest harvesting continues and roads are required to allow the movement of equipment and forest products. The development of new roads will be partially offset through the degradation of older unused roads. There is some potential for electrical transmission lines in the area to be widened to allow greater power transmission. This process is not expected to be as extensive as road development. Existing electrical transmission lines will be periodically cleared using a combination of mechanical clearing and herbicide applications. These processes can be expected to disturb wildlife and will make the transmission line RoW less attractive as habitat for many wildlife species due to the loss of vegetation cover.

Although linear features such as highways can substantially increase habitat fragmentation and the production of edge effects, the proposed highway twinning project will have a lower effect on habitat fragmentation and the production of edge effects since it is a widening of an already existing highway in which the new lanes are nested inside an area already adversely affected by edge effects from the existing highway.

5.5.8 Determination of Significance

Table 5.57 evaluates the significance of potential residual environmental effects on Wildlife and Wildlife Habitat resulting from any interactions between Project activities and the VEC, after taking into account any proposed mitigation. Significance was determined through the assessment of adverse environmental effects using wildlife Species at Risk and of Conservation Concern as indicators of changes to the Wildlife and Wildlife Habitat VEC. The table also considers the level of confidence of the assessment team in this determination and the likelihood of potential environmental effects.

Table 5.57 Residual Environmental Effects Summary Matrix for Wildlife and Wildlife Habitat

Residual Environmental Effects Summary Matrix Valued Environmental Component: WILDLIFE AND WILDLIFE HABITAT				
Phase	Residual Environmental Effects Rating, Including Cumulative Environmental Effects*	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Construction	NS	2	2	2
Operation and Maintenance	NS	3	2	2
Project Overall	NS	2	2	2

Key

Residual Environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Level of Confidence
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence
N/A= Not Applicable

Scientific Certainty: based on scientific information and statistical analysis or professional judgment
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence
N/A= Not Applicable

*As determined in consideration of established residual environmental effects rating criteria.

In summary, adverse residual environmental effects on Wildlife and Wildlife Habitat during Project construction, operation and maintenance are predicted to be not significant.

5.5.9 Follow-up and Monitoring

Prior to the start of construction activities, it is recommended that Canada Warbler and Rusty Blackbird surveys be conducted in the area between chainages 17+600 and 19+000 m. The objectives of these surveys would be to assess the abundance of these species in this area and to determine how they make use of habitat in this area. These surveys would determine how important the habitat is to these species and which areas are most heavily used by them. This information would be used to better assess the effect of the Project on these species and help to fine tune mitigation measures to reduce adverse effects of the project on them. The information collected could also be used as pre-disturbance data for monitoring studies to assess the efficacy of mitigation.

Prior to the onset of construction activities, a Long-eared Owl breeding habitat modeling exercise will be undertaken to determine the locations of potential Long-eared Owl nesting sites within the Assessment Area. Long-eared Owls nest earlier than most bird species so it would be necessary to truncate the period when clearing could occur in order to prevent the destruction of active nests. Areas having high potential for nesting Long-eared Owls could be easily modeled so the reduced clearing period would only apply to a small subset of terrestrial habitats present in the Study Corridor. In these areas the period during which clearing could not occur would extend from March 1 to August 31.

5.6 Wetlands

5.6.1 Rationale for Selection as Valued Environmental Component

Wetlands were selected as a VEC because of the potential for interactions between Project activities and wetland environments, and because of the relationship between this VEC and wildlife and other biological and physical environments. Wetlands are an important feature of the landscape, performing many biological, hydrological, social/cultural, and economic functions. They provide habitat for many species of flora and fauna which depend on wetland conditions for their survival. Hydrological functions of wetlands include erosion and flood control, contaminant reduction, and groundwater recharge and discharge. Wetlands support various forms of recreational activity, as well as subsistence production, such as harvesting of plants and other wildlife, and commercial production, such as cranberry bogs, forestry, and peat extraction.

“Wetland” is defined in the Nova Scotia *Environment Act* (NS 1995) as

> *land commonly referred to as a marsh, swamp, fen or bog that either periodically or permanently has a water table at, near or above the land's surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation and biological activities adapted to wet conditions.*

"Wetland function" is defined by the Federal Policy on Wetland Conservation (Environment Canada 1991) as:

> *…the natural processes and derivation of benefits and values associated with wetland ecosystems, including economic production (e.g., peat, agricultural crops, wild rice, peatland forest production), fish and wildlife habitat, organic carbon storage, water supply and purification (groundwater recharge, flood control, maintenance of flow regimes, shoreline erosion buffering), and soil and water conservation, as well as tourism, heritage, recreational, educational, scientific, and aesthetic opportunities.*

In this section, the environmental effects of the Project activities on wetlands resulting from construction, and operation and maintenance are assessed.

5.6.2 Environmental Assessment Boundaries

5.6.2.1 Spatial

The spatial boundary for the assessment wetlands via field surveys (*i.e.*, Study Corridor) was approximately 120 m to the north and 85 m to the south of the existing highway centerline. However, information on the distribution of wetlands beyond this Study Corridor, to a distance of 500 m of either side of the existing highway centerline were also obtained and used for descriptive purposes (*i.e.*, Assessment Area). The potential environmental effects of the Project on wetlands, including cumulative environmental effects, are considered within the context of this Assessment Area.

5.6.2.2 Temporal

The temporal boundaries for the assessment of the potential environmental effects of the Project on wetlands include the duration of Project construction, and operation and maintenance of the Project in perpetuity.

5.6.2.3 Administrative and Technical

Wetlands are protected through provincial legislation and provincial and federal policy.

Wetland conservation is federally promoted by the Federal Policy on Wetland Conservation (Environment Canada 1991). The objective of this policy is to "promote the conservation of Canada"s wetlands to sustain their ecological and socio-economic function, now and in the future." Coordination of implementation of the policy is the responsibility of Environment Canada, specifically the CWS and the Environmental Conservation Branch (ECB). Although there is no specific federal legislation regarding wetlands, they may be protected federally under the *Species At Risk Act* (*SARA*), if they contain critical habitat for Species At Risk, the *Migratory Birds Convention Act*, *1994*, if they contain nests of migratory birds, and/or the *Fisheries Act*, if the wetland contributes to an existing or potential fish habitat. Details on the application of the

Migratory Birds Convention Act, *1994* and *SARA* for protection of wildlife and fish and fish habitat are provided in the Sections 5.5 and 5.3, respectively.

In Nova Scotia, wetlands are protected under the Activities Designation Regulations (Activities Designation Regulations, 2007) made pursuant to the provincial *Environment Act* (1995). Any project with the potential to alter a wetland (filling, draining, flooding or excavating), including direct and indirect impacts, requires a Water Approval from NSE prior to starting the work, as described in the Operational Bulletin Respecting the Alteration of Wetlands (NSEL 2006). If alterations exceed 2 hectares of any wetland, the project is also subject to registration under the Environmental Assessment Regulations (NS 2009). The Province of Nova Scotia has also committed to establishing a policy to prevent the net loss of wetlands under the *Environmental Goals and Sustainable Prosperity Act* (NS 2007).

Applications for Wetland Alteration Approval must be supported with details of the unavoidable nature of the proposed wetland alterations, the measures to minimize or compensate for wetland alteration, and the character and function of wetlands to be affected. These applications are evaluated in the context of the "mitigative sequence". The mitigative sequence for decision-making is the foundation for achieving wetland conservation in Nova Scotia. The sequence – avoidance, minimization, compensation – assists proponents in planning and designing project proposals that will be acceptable to Nova Scotia Environment. "Avoidance" is the priority, and requires consideration of project alternatives that would have less adverse effects on the wetland. "Minimization" requires that the project be designed and implemented using techniques, materials and site locations that reduce or remediate the project effects on the wetland. "Compensation" requires that the residual effects on the wetland functions are compensated for by the enhancement, restoration or creation of wetland habitat at an area ratio commensurate with the loss. Any losses of wetland habitat, either through direct infilling or indirectly through alteration of wetland hydrology, requires compensation to replace the wetland functions lost as a result of the wetland alterations.

5.6.3 Residual Environmental Effects Rating Criteria

A **significant residual adverse environmental effect** on wetland habitat is one that:

- results in the loss of a wetland type, and its associated functions in the Assessment Area (as determined using DNR Wetland Inventory Data);
- affects a high proportion of wetlands, locally (greater than 25% of wetland area within the Assessment Area); or
- results in permanent loss of wetland area and associated functions

An environmental effect that does not meet any of the above criteria is rated as not significant.

5.6.4 Baseline Conditions

Prior to field surveys, the distribution of known and prospective wetlands within 500 m of the existing highway centerline was determined from the Nova Scotia Wetland Inventory Database (NSDNR 2007b) and interpretation of 1:10,000 air photographs of the Assessment Area. Using this information as a guide, field surveys were conducted in the fall of 2009 to inventory and delineate all wetlands present within 120 m to the north and 85 m to the south of the existing highway centerline. Wetlands which were encountered within this Study Corridor but that continued outside of its boundaries were delineated using a combination of field delineation techniques and air photo interpretation. The technical approach used for wetland identification and delineation during the 2009 and 2010 surveys was based on principles prescribed in the US Army Corps of Engineers Wetlands Delineation Manual (Environmental Technical Services Co. 1995) using vegetation, soil, and hydrology as wetland indicators.

An evaluation of potential functions was completed for wetlands identified to have the potential to be directly or indirectly affected by the Project (*i.e.*, the "Assessed Wetlands"). Directed studies of the wildlife, hydrological and biogeochemical functions of each of these wetlands were completed during multiple site visits between May and November, 2010 and supplemented with data collected during additional surveys of flora and fauna within the Study Corridor.

The wildlife functional assessment encompassed surveys of species (including inventories of vascular plants, birds, mammals, reptiles and amphibians) which were observed to inhabit or utilize the wetlands, habitat descriptions and assessments, and evidence of anthropogenic stress to these biodiversity values. Much of the data collected during this evaluation was based on a series of wildlife-related questions outlined in a functional assessment methodology called NovaWAM which had been developed by wetland scientist Dr. Ralph Tiner (2009). At the time of writing, this approach is being considered by NSE for adoption as a standard functional assessment procedure for the province. Several modifications were made to the relevant sections of this approach by experienced Stantec ecologists in an attempt to more accurately tailor it to the range of conditions within the Study Corridor. Further information regarding wildlife within these wetlands was obtained from the rare plant surveys conducted in the fall of 2009 and spring of 2010, the breeding bird surveys performed in June 2010, and additional wildlife observations made during 2009 visits.

The wetland hydrological and biogeochemical function assessment involved the characterization of physical and structural wetland features which can be indicators of potential functions and services performed by a wetland. The approach is based largely on the methods of others (*e.g.*, Tiner 2003; Tiner 2009), with supplemental supporting information from literature review (*e.g.*, Devito *et al.* 1996). The approach distils the indicative features of wetland function down to representative categorical and nominal data that can be collected in a single page form, and then interpreted with supplemental desktop data. The analysis provides an overview of the likely potential functions a wetland is performing; however the evaluation of the importance of these functions is left to the judgment of the qualified assessor. The function assessment method was tailored to the specific wetland types and probable functions performed by wetlands found in the Study Corridor during preliminary site visits and characterizations.

The completed assessment forms and the supporting guidance document explaining the use of the forms is provided in Appendix H.

Wetlands within the Assessment Area were classified according to the criteria outlined in the Canadian Wetland Classification System (CWCS). The CWCS is a hierarchical system that incorporates that identifies of three general levels of wetland features – class, form, and type (Warner and Rubec 1997). Wetland classes are based on the properties of the wetland that reflect their origin and the nature of the wetland environment. This level may be used to group wetlands at their most general scale, and include bog, fen, swamp, marsh, and shallow water designations. Wetland forms and subforms are subdivisions of each wetland class and are based on their morphology, surface pattern, water type, and the morphological characteristics of the underlying soil. Many wetland forms apply to more than one wetland class whereas others are more specific. Wetland types are further subdivisions of their forms and subforms and are based on the physiognomic characteristics of their vegetation communities (Warner and Rubec 1997). All wetlands within the Assessment Area were grouped according to their class (Table 5.58), but information on form and type was only obtained for those which were targeted for detailed field surveys.

Table 5.58 Wetland Areas

Wetland Class[1]	Total Wetland Habitat Within Assessment Area*		Total Wetland Habitat Within Study Corridor**	
	Total Area (ha)	Proportion of Total Wetland Area by Class (%)	Total Area (ha)	Proportion of Total Wetland Area by Class (%)
Bog	37.59	0.18	6.46	0.14
Bog / Swamp	3.60	0.02	0.94	0.02
Marsh	1.25	0.01	0.94	0.02
Shallow Water	12.09	0.06	0.00	0.00
Shallow Water / Marsh	0.02	0.00	0.02	0.00
Swamp	130.15	0.63	27.29	0.60
Swamp / Fen	2.85	0.01	2.73	0.06
Swamp / Marsh	13.37	0.06	4.66	0.10
Swamp / Shallow Water	6.10	0.03	2.10	0.05
Swamp / Shallow Water / Fen	1.14	0.01	0.40	0.01
Total	208.17	1.00	45.54	1.00

[1]Wetland classification data based on field surveys, air photo interpretation, and NSDNR's wetland inventory

*The Assessment Area includes that which is within 500 m of the existing highway centerline

** The Study Corridor includes that which is within 120 m north and 85 m south of the existing highway centerline

A total of 323 wetlands have been identified within the Assessment Area. All recognized wetland classes are present within the Assessment Area, including swamp, bog, marsh, shallow water, and fen (Table 5.58). Wetland complexes (identified as wetlands which are comprised of two or more wetland classes) are common, with approximately 25 being identified, including shallow water / marsh, swamp / marsh, swamp / shallow water, swamp / fen, and swamp / shallow water / fen.

Swamps occupy the vast majority of wetlands within the Assessment Area and are distributed throughout its extent. Swamps are mineral wetlands or peat lands and characteristically have tall woody vegetation (Warner and Rubec 1997). Their water table is generally at or near the surface of the swamp and is commonly present in the form of either stagnant or flowing pools or channels. Swamps generally have some internal water movement originating from their margins or from other sources of mineral enriched waters. If peat is present, it consists mainly of well-decomposed wood, underlain at times by sedge peat.

Bogs are the second most prominent wetland class within the Assessment Area and are scattered throughout its extent. Bogs are peat wetlands which are raised or level with the surrounding terrain and are unaffected by runoff waters or groundwater from the surrounding mineral soils (Warner and Rubec 1997). Water levels are generally at or slightly below the surface of the bog. Because they receive their nutrient and water input atmospheric deposition, they are typically nutrient poor and have a low pH. They typically have a well developed peat layer comprised of peatmoss and the woody remains of shrubs.

Marshes are common within the Assessment Area where they most often occur as a component of larger wetland complexes. These are typically mineral wetlands and are periodically inundated by standing or slow flowing water whose levels generally fluctuate seasonally. During drier periods declining water levels may expose areas of matted vegetation or mud flats. The surface waters are typically rich in nutrients. Although their substrate is usually mineral material, well-decomposed peat may occasionally be present. Marshes typically display zones or surface patterns consisting of pools or channels interspersed with patches of emergent vegetation, bordering wet meadows and peripheral bands of shrubs or trees (Warner and Rubec 1997).

Shallow water wetlands usually occupy the transitional areas between wetlands that are saturated or seasonal wet and permanent, deep water bodies, such as are associated with lakes. They have standing or flowing water that is <2 m deep during mid-summer but their hydrological character is quite varied. That is, water levels with shallow water wetlands may be seasonally stable, permanently flooded, or intermittently exposed during droughts, low flows, or intertidal periods (Warner and Rubec 1997). Within the Assessment Area, the larger shallow water wetlands were characteristically associated with water bodies but smaller components were also observed to be independent of such features.

Fens are minerotrophic peat lands with fluctuating water levels (Warner and Rubec 1997). Surface water movement is common within fens and may be observed in channels or pools. Their vegetation is strongly influenced by water depth and chemistry and they may be dominated by graminoids, bryophytes, shrubs, and/or trees. Fens were identified within two wetland complexes of the Assessment Area and were associated with Little Indian River (Wetland 49) and Ingram River (Wetland 146). Fens are likely to be present elsewhere within the Assessment Area but it can be difficult to distinguish this wetland type from others using air photo interpretation.

The distribution and abundance of wetlands within the Study Corridor is similar to that of the Assessment Area, although some differences in the relative prominence of wetland classes do exist. In particular, Table 5.58 suggests that wetland complexes are relatively more prominent within the Study Corridor than the Assessment Area. However, this difference likely reflects variation in how wetlands were identified within the respective zones. That is, many of the wetlands within the Study Corridor were subject to field surveys and their classification reflects the detailed site information that can be gained from such visits. Conversely, the classifications of wetlands outside of the Study Corridor were based on information gained from NSDNR"s wetland inventory and/or obtained from additional air photography. As such, their current classification may reflect limitations that are commonly associated with these approaches (including identifying their vegetative composition, boundaries, and connectivity to other patches of wetland). Similarly, the presence of shallow water wetlands within the Assessment Area (of which they are identified to comprise approximately 5%) and their absence within the Study Corridor, except as components of complexes, likely reflects this limitation.

The character and functional attributes of those wetlands identified for potential direct or indirect impact by the Assessment Area (and for which detailed field surveys were performed) are discussed in the following sections.

5.6.4.1 Wetland Habitats and Wildlife-related Functions

Vegetation

The vegetation component of the assessment incorporates two principal components: diversity and integrity. Diversity relates to the ability of the wetland to support a variety of wildlife (flora and fauna) and is interpreted here by a range of indicators including the number of distinct plant communities, plant species richness, and the occurrence of rare plants. Integrity refers to the overall condition of the plant community and for the purposes of this functional assessment, is interpreted by indicators of anthropogenic stress, particularly exotic plants and evidence of disturbance to vegetation.

Vegetation Diversity

Habitats

The physiognomic vegetation types outlined by the CWCS (*e.g.*, “graminoid”) were used in conjunction with wetland class (*e.g.*, “marsh”) to identify habitat types (*e.g.*, “graminoid marsh”). Only those communities which comprised 10% or more of an individual wetland were included. Vegetation types that were observed included aquatic, graminoid, moss, non-vegetated, shrub, and treed physiognomic groupings. Specific treed types were recognized as coniferous treed, deciduous treed, and mixed treed, while distinct shrub types included low shrub, mixed shrub, and tall shrub designations. Additionally, a "cut-over" descriptor was applied to those treed swamps which had recently been clear-cut. When combined with their respective wetland class a total of 19 habitat types were recognized (Table 5.59). Wetland habitat descriptions (percent cover estimates for dominant plant species) are provided in Table 1 of Appendix H.

Table 5.59 Number of Occurrences of Habitat Unit Types within Assessed Wetlands

Class	Habitat Type	Number of Occurrences within Assessed Wetlands
Swamp	Mixed Treed Swamp	48
	Coniferous Treed Swamp	39
	Deciduous Treed Swamp	1
	Cut-over Mixed Treed Swamp	7
	Cut-over Coniferous Treed Swamp	3
	Cut-over Deciduous Treed Swamp	1
	Tall Shrub Swamp	40
	Mixed Shrub Swamp	5
	Low Shrub Swamp	7
	Graminoid Swamp	2
	Moss Swamp	4
Bog	Coniferous Treed Bog	2
	Mixed Shrub Bog	2
Marsh	Graminoid Marsh	12
	Moss Marsh	1
Shallow Water	Aquatic Shallow Water	3
	Moss Shallow Water	3
	Non-Vegetated Shallow Water	6
Fen	Graminoid Fen	2

Treed swamps are dominated by woody vegetation that is more than 5 m in height and were the most abundant vegetative community encountered within the Assessed Wetlands. Coniferous and mixed treed types were particularly abundant, as well as their cut-over counterparts. Single deciduous treed and cut-over deciduous treed swamps were also identified based on having a slightly greater relative abundance of hardwoods. Although the overstory cover of these swamps is comprised of differing proportions of coniferous and deciduous trees, the identities of their constituents are rather consistent. Black spruce (*Picea mariana*), balsam fir (Abies balsamea), and red spruce (*Picea rubens*) are generally the most abundant conifers whereas red maple (*Acer rubrum*) comprises the large majority of hardwood. Additionally, American larch (*Larix laricina*), eastern white pine (*Pinus strobus*), paper birch (*Betula papyrifera*), and heart-leaved paper birch (*Betula papyrifera var. cordifolia*) are important components of some of the treed swamps. Shrub cover is varied and primarily comprised of the aforementioned tree species in addition to mountain holly (*Nemopanthus mucronatus*), speckled alder (*Alnus incana*), sheep-laurel (*Kalmia angustifolia*), leatherleaf (*Chamaedaphne calyculata*), velvetleaf blueberry (*Vaccinium myrtilloides*), and possum-haw viburnum (*Viburnum nudum*). Dominant herbaceous species are typically three-seed sedge (*Carex trisperma*), cinnamon fern (*Osmunda cinnamomea*), dwarf dogwood (*Cornus canadensis*), and northern starflower (*Trientalis borealis*) whereas peatmoss (*Sphagnum spp.*) forms a prominent ground layer. The vegetative composition of the cut-over swamps typically reflects their more intact counterparts but their structure is markedly different. Typically lacking any overstory cover except for a few scattered remnant trees, they are dominated by a shrub layer comprised of regenerating tree species and other woody plants. Furthermore, they have a higher abundance of species which are characteristic of relatively open and disturbed conditions, particularly cottongrass bulrush (*Scirpus cyperinus*).

Shrub swamps are also common within the Study Corridor and include both tall shrub, mixed shrub, and low shrub designations. Tall shrub swamps are dominated by woody species that are greater than 1.5 m in height but may also have a diversity of other shrubs. Although this habitat type was often naturally present within the Assessment Area, it also occurred as a result of anthropogenic influences – particularly along roadside areas where drainage was somewhat impeded and/or which are subject to disturbances that inhibit the development of trees. Speckled alder is usually the most dominant species within these habitat types but a number of other shrubs are often common, including green alder (*Alnus viridis*), leatherleaf, possum-haw viburnum, sweet bayberry (*Myrica gale*), narrow-leaved meadow-sweet (*Spiraea alba*), and a variety of stunted trees. Dominant herbaceous species include blue-joint reedgrass (*Calamagrostis canadensis*), parasol white-top (*Doellingeria umbellata*), manna-grass (*Glyceria sp.*), sensitive fern (*Onoclea sensibilis*), and cinnamon fern. Low shrubs are often associated with the edges of water bodies and are dominated by woody vegetation that is less than 0.5 m in height. In the Study Corridor, this was most often leatherleaf and sweet bayberry, although a number of other species were also common. The herbaceous layer of these communities was quite varied, but some dominants included blue-joint reedgrass, tussock sedge (*Carex stricta*), bog aster (*Oclemena nemoralis*), and hoary sedge (*Carex canescens*). Mixed shrub swamps are comprised of a mixture of tall, low, and medium shrubs (0.5 to 1.5 m) and their vegetation composition is generally of an intermediate nature to the tall shrub and low shrub swamp communities previously described. A diffuse tree cover was present within shrub swamp communities, as was a prominent ground cover of peatmoss.

Two graminoid swamps were identified in the Study Corridor, where they were located within a power line corridor. This vegetative community is a result of repeated anthropogenic disturbance, particularly by cutting and herbicide treatment. These stressors have resulted in the suppression of woody plants, which would otherwise dominate these wetlands. Graminoids currently comprise the majority of the vegetation cover within these habitats, including brownish sedge (*Carex brunnescens*), three-seed sedge, and crinkled hairgrass (*Deschampsia flexuosa*), along with cinnamon fern and some blackberries (*Rubus spp.*). Prominent mosses include peatmoss and hair-cap moss (*Polytrichum sp.*).

The effect of anthropogenic influences, in the form of hydrological alterations, is also present in the occurrence of “moss swamps”. Several of these habitats were identified within the Study Corridor (within Wetlands 82, 84, 99, and 148) where they were found in association with treed swamps that abutted the edge of the existing highway and whose drainage was impeded. Although some minimal groundcover was provided by species such as cottongrass bulrush, hoary sedge (*Carex canescens*), and large cranberry (*Vaccinium macrocarpon*) these species were dominated by peatmoss. The vegetation and origin of this community type is very similar to those identified as "moss shallow water" but these have been separated based on more peat accumulation within the swamps and greater degrees of water saturation within the shallow water wetlands.

Two bog vegetation communities were identified within the Study Corridor during the wildlife functional assessment of the wetlands: coniferous treed and mixed shrub. Being dominated by stunted black spruce trees and ericaceous shrubs such as rhodora (*Rhododendron canadense*), common labrador tea (*Ledum groenlandicum*), leatherleaf, small cranberry (*Vaccinium oxycoccos*), and velvetleaf blueberry; the vegetation communities of these habitats were very similar. Their distinction is based on the relative cover of tree species, almost exclusively black spruce, being greater in the treed vegetation type. A limited herbaceous layer was present within the bogs and varied amongst the visited sites. Scattered graminoids typically provided the majority of herbaceous cover however, as was provided by tawny cotton-grass (*Eriophorum virginicum*), and sedges (including *Carex magellanica ssp. irrigua* and *C. canescens*). Although peatmoss dominated the ground cover, other non-vascular plants, particularly red-stemmed moss (*Pleurozium schreberi*) and reindeer lichen (*Cladina spp.*), were common within the drier portions of the bogs.

The freshwater marshes encountered during field surveys were typically dominated by graminoids. Species composition within this habitat was considerably varied but hoary sedge, soft rush (*Juncus effusus*), and cottongrass bulrush were common dominants. Other graminoids, such as variable tussock sedge (*Carex stricta*), slender sedge (*Carex lasiocarpa*), broad-leaf cattail (*Typha latifolia*), and blue-joint reedgrass were important components of specific wetlands. A variety of forbs were also found within these habitats, with species such as sensitive fern and marsh St. John's-wort (*Triadenum fraseri*) sometimes being quite abundant. A diffuse shrub cover was often present within the graminoid marshes, and although primarily provided by speckled alder, a variety of other species were also found to be dominant within particular wetlands. Many of the marshes exhibited a distinct zonation of their plant community assemblages, with variation reflecting proximity to water features (*e.g.*, stream channels, lake edges) and degree of saturation. One area of brackish marsh is present within the Study Corridor (Wetland 225) but is located outside of the RoW and was not targeted for detailed field assessment.

A single moss marsh (Wetland 109) was identified within an anthropogenic pit. Rather than being dominated by peatmoss, as were other "moss" vegetation types that were associated with swamps and shallow water wetlands classes, this habitat was characterized by an extensive coverage of hair-cap moss. Cottongrass bulrush provided the majority of vascular plant cover within the marsh while sheep-laurel and balsam willow (*Salix pyrifolia*) provided some fringing shrub cover. This area is periodically inundated by surface water run-off and exhibits fluctuation in its water depth. It reflects an early successional state that has resulted from anthropogenic activities and is expected to develop into a graminoid marsh with time.

Three types of shallow water vegetation communities were recognized in the Study Corridor: aquatic shallow water, moss shallow water, and non-vegetated shallow water. Amongst these, there is considerable variation in topographic positioning, local hydrology, and vegetative character. Aquatic shallow water habitats are dominated by aquatic macrophytes and were prominent within the water bodies of Dorey Lake, Little Indian Lake, and the Mill lake Backwater Pond. Dominant species within these areas consisted of a variety of submerged, floating, and emergent plants, including watershield (*Brasenia schreberi*), American water-lily (*Nymphaea odorata*), pickerel weed (*Pontederia cordata*), and bladderworts (*Utricularia spp*.). Additionally, a variety of emergent herbs, such as bear sedge (*Carex utriculata*), and shrubs (*e.g.*, sweet bayberry) were present along the edges of these habitats where they graded into other community types. Non-vegetated shallow water habitats were also found in relation to the water bodies of lakes. These habitats were characterized by having less than 5% of their surface area covered with vegetation - a reflection of their depth (up to 2 m), low light penetration, and rocky substrate. In addition, some small areas that were not associated with water bodies but which were periodically inundated and devoid of vegetative cover were also classified as non-vegetated shallow water habitats (*i.e.*, vernal pools). Moss shallow water habitats were characterized by persistent standing water that was dominated by aquatic peatmoss. As previously discussed, the character and origin of this community type is very similar to that of “moss swamps”. Although peatmoss dominates both communities, a distinction has been made based on the greater level of saturation and lack of peat accumulation with the shallow water communities.

Two areas of graminoid fen were identified within the Study Corridor where they formed a component of Wetlands 49 and 146, located along the banks of the Little Indian and Ingram rivers, respectively. These communities of graminoid fen are associated with the shores of these watercourses and/or associated lakes (*i.e.*, Little Indian Lake) and receive minerotrophic inputs from them. Graminoids such as bear sedge, slender sedge (*Carex lasiocarpa*), three-way sedge (*Dulichium arundinaceum*) and blue-joint reedgrass dominate this habitat but shrubs such as leatherleaf and large cranberry are also common and peat moss coverage is extensive.

The number of habitats encompassed by wetlands is an important functional attribute related to their ability to support a diversity of wildlife. The number of recognized plant communities within individual wetlands varied from one to five. Approximately half (53%) of the wetlands are comprised one plant community whereas 38% had two. In contrast, the percentage of wetlands with three, four, and five communities was approximately 5%, 2%, and 1%, respectively. Wetland 49, located at Little Indian Lake, had the greatest number of communities and included components of aquatic shallow water, low shrub swamp, tall shrub swamp, graminoid fen, and coniferous treed swamp. Wetland 296 was also associated with a major water body, Sawler Lake, and had a relatively high diversity of plant communities, including non-vegetated shallow water, low shrub swamp, mixed treed swamp, and aquatic shallow water.

Wetland 10 also had a relatively high number of plant communities (four), including coniferous treed swamp, mixed treed swamp, graminoid marsh, and tall shrub swamp. However, the diversity of habitats encompassed within this wetland strongly reflects the influence of anthropogenic stressors. Wetland 10 is located immediately off the highway edge at the eastern end of the Assessment Area and its graminoid marsh and tall shrub swamp components are considered to reflect an increased hydroperiod (as evidenced by a large amount of dead trees) which is likely due to anthropogenic activities. As such, greater diversity of plant communities can not necessarily be interpreted in terms of habitat quality. Furthermore, the occurrence of several communities within the Study Corridor, including cut-over treed swamp types, graminoid swamp, moss swamp, and moss shallow water are a reflection of anthropogenic stressors, particularly hydrological alterations to wetlands and the suppression of their woody vegetation. Of the wetlands that had three plant communities (Wetlands 82, 88, 146, 148, 215, and 325), cut-over treed swamp was recognized as a plant community within three of them and moss swamp was present within one.

Species Richness

A total of 302 species of vascular plants were recorded within wetlands during field surveys. Table 2 in Appendix H provides lists of plant species that were observed in association with specific wetlands and information on their population status within the province.

The number of plant species recorded within individual wetlands varied from six to 108, with an average of approximately 34. Plant species richness was generally related to the size and habitat diversity of wetland. For example, Wetlands 49 and 296, which had the greatest species richness, were large complexes associated with Little Indian and Sawler Lake, respectively. In contrast, wetlands with low numbers of plant species, such as Wetlands 93 and 109, tended to be small and comprised of only one or two recognized habitats.

Although it is somewhat arbitrary to identify what level of species richness might be considered to represent a "high" level of diversity, those wetlands which contained 20% (*i.e.*, greater than 60 plant species) or more of the total plant richness observed within the entire suit of wetlands were considered to have *High* diversity. Based on this criterion, eight wetlands, representing approximately 7% of those assessed, were considered to have *High* plant diversity.

Species At Risk or of Conservation Concern

No "At-Risk" plants were found within any of the wetlands but six were found to contain Species of Conservation Concern, including Wetland 88 (southern twayblade), Wetland 249 (southern twayblade), Wetland 296 (small swollen bladderwort and woods-rush), Wetland 302 (woods-rush), Wetland 314 (swamp rose and Nova Scotia false-foxglove) and Wetland 316 (early coralroot). Additionally, Wetland 285 provides habitat for rough horsetail, a species whose population is considered "Secure", but uncommon, in the province.

Southern twayblade is a small orchid that is typically associated with the shaded sphagnum moss of bogs or treed swamps (Zinck 1998). It is considered "May be at Risk" by NSDNR and is given a ranking of “S2” by the ACCDC. This species is only visible above ground for several weeks during early summer (mostly in June) and then it senesces. Within the current Assessment Area, this species was encountered amongst two coniferous treed swamps, Wetlands 88 and 249, both of which are found on the north side of the existing highway. The large majority of those encountered were within Wetland 249 (approximately 50 stems) whereas only a few were encountered within Wetland 88. Individuals within Wetland 249 were restricted to the micro-depressions of the swamp and were not found in association with hummocks or in areas that were more readily inundated (*i.e.*, it appeared to be restricted to a rather specific moisture regime). Southern twayblade was also observed within a portion of Wetland 249 which was outside of the Study Corridor (*i.e.*, beyond 120 m from the existing highway centerline). Although only six of the individuals were encountered in this area, a thorough population survey was not conducted and the amount of potentially suitable habitat appeared abundant. This species is considered to be vulnerable to local changes in hydrology, nutrient status, and land use in other parts of its range (Hoy 2003) and it is expected that this would also be true of Nova Scotian populations.

Woods-rush is found throughout wet boggy woods and in the openings of spruce swamps in the province (Zinck 1998). Although previously assigned a rank of “Undetermined” by NSDNR (indicating that there was uncertainty regarding its population status), it is now considered Sensitive by the province. This species was recorded in two wetlands of the Study Corridor – within the swamp bordering the southern end of Dorey Lake (Wetland 296) and on the edge of Wetland 302 on the southern side of the existing highway.

The population of swamp rose within Nova Scotia is considered “Secure” by NSDNR and is ranked “S3” by the ACCDC. This species is associated with wet ground, lake shores, and swamps within the province (Zinck 1998) and was observed within the tall shrub swamp component of Wetland 314, located at the southern end of Maple Lake.

Early coralroot is a small saprophytic (*i.e.*, feeds on dead organic matter) orchid that is scattered throughout the province and associated with moist and well-shaded coniferous woods (Zinck 1998). Its population is considered to be “Secure” by NSDNR and is ranked “S3” by the ACCDC, indicating that it is uncommon and of long-term concern. Over 20 stems of this species were observed within Wetland 316 where they were associated with a channel that flows through the wetland.

Small swollen bladderwort is an aquatic herb associated with ponds and sluggish waters (Zinck 1998). The provincial population of small swollen bladderwort is currently considered “Secure” by NSDNR and is ranked “S3” by the ACCDC. Field surveys identified this species within the water of Wetland 296, at Dorey Lake.

Nova Scotia false-foxglove is a small herb that is endemic to Nova Scotia. It is fairly common within the province where its population is considered “Secure” by NSDNR and is assigned a ranking of “S3” by the ACCDC. Typically associated with moist, especially sandy soil (Gleason and Cronquist 1991), it was found within Wetland 314 but was much more commonly associated with the shoulder of the existing highway and other roads within the Study Corridor.

For additional information on plant Species of Conservation Concern found within the Study Corridor refer to Section 5.4.4.

Vegetation Integrity

Exotic Plants

Exotic, or non-native, plants are relatively reliable indicators of ecological integrity because they are known to be promoted by a variety of anthropogenic stressors associated with management and fragmentation, have a known historical state, have the ability to cause undesirable changes to biodiversity and ecological processes, and are relevant to all floristic communities. As such, exotic plants were used to convey information on the vegetative quality of the Assessed Wetlands. Specifically, information on the presence of non-native dominant species, potential invasives, and the species richness of exotic plants was obtained for each of the surveyed wetlands.

Fifteen exotic plants were recorded within the surveyed wetlands, including brittle-stem hempnettle (*Galeopsis tetrahit*), climbing nightshade (*Solanum dulcamara*), colonial bentgrass (*Agrostis capillaris*), colt's foot (*Tussilago farfara*), common apple (*Malus pumila*), common dandelion (*Taraxacum officinale*), common mouse-ear chickweed (*Cerastium fontanum*), creeping butter-cup (*Ranunculus repens*), marsh hedge-nettle (*Stachys palustris*), meadow hawkweed (*Hieracium caespitosum*), orchard grass (*Dactylis glomerata*), red clover (*Trifolium pratense*), scribner bluegrass (*Poa trivialis*), sweet vernal grass (*Anthoxanthum odoratum*), and white clover (*Trifolium repens*). These were found distributed amongst 13 of the wetlands - 10, 49, 55, 127, 145, 193, 296, 303, 304, 314, 316, 317, and 327. Wetland 327 had the highest richness of exotics at seven species, followed by Wetland 314 with four, Wetland 316 with three, and Wetlands 127 and 317 with two each. A recent review of exotic plants within the Atlantic Maritime Ecozone (Hill and Blaney 2010) did not identify any of the aforementioned species as being current or potentially problematic invasives within the region.

Two of the exotic plants, creeping butter-cup and black nightshade, were observed to be dominant components within several of the swamps. Creeping butter-cup was identified as a dominant within the tall shrub swamps of Wetlands 316 and 327, where it obtained a percent cover of approximately 20% and 40%, respectively. Black nightshade was found to be a dominant species within Wetland 193 where it had a percent cover of approximately 25% within the tall shrub swamp habitat. These species were also the most frequently encountered, being present in six wetlands each. All other species were limited to a single wetland, except for meadow hawkweed, which was present in two.

Disturbance and Other Stressors

During functional assessment surveys, wetlands were qualitatively assessed for the effect of stressors on their vegetative communities. An overall measure of the intensity of disturbance was assigned for each wetland, and included “severe”, “minor”, and “relatively undisturbed” designations. The types of disturbances and other stressors which were evident were tallied for each wetland, including whether there was any notable influence due to harvesting, insect infestation, storm damage, sedimentation, eutrophication, impoundment or other altered hydrology. Additionally, notes on the response of stressed vegetation were taken, particularly concerning whether there were any dead woody plants.

Of the surveyed wetlands, approximately half were characterized as being subject to some “minor” disturbance and about a fifth were “severely” disturbed. Some evidence for all of the aforementioned stressors, with the exception of grazing and insect infestation, was observed. The most prominent stressors were tree harvesting and those associated with the existing highway. As previously discussed, much of the Assessment Area has recently been subject to forest harvesting activities and many of the treed swamps have been cut-over, at least in part (over a third of the surveyed wetlands exhibited some evidence of this). Many of the wetlands slated for impact by the current Project are located adjacent or are in close proximity to the existing highway and their current vegetation reflects an influence from this feature, particularly hydrological stressors associated with roadside ditching and impediments to drainage. However, evidence of other types of stressors were also associated with the existing highway, including salt intrusion, sedimentation, mowing, eutrophication, and infilling. The effect of herbicides on the suppression of woody vegetation was noteworthy for those wetlands located within a power line corridor which dissects the Assessment Area. In contrast to the prominence of anthropogenic stressors, evidence of storm damage was only present within several of the wetlands.

Reflecting the influence of anthropogenic factors on their vegetative communities, many of the wetlands (approximately a quarter of those surveyed) exhibited stressed vegetation. The presence of dead woody plants, which may result from stressors associated with changes in hydrology, was particularly prevalent within the Assessed Wetlands. Additionally, herbicide-induced plant deformities were observed in wetlands that were associated with the power line corridor that dissects the Assessment Area.

Vegetative Quality

The vegetation within each of the surveyed wetlands was assigned to one of three designations to represent its overall quality: high, medium, or low. Guidelines for each of these designations were identified using a combination of factors relating to the abundance of exotics, the prominence of human disturbance and other stressors, and the types of habitats surrounding the wetlands, as such (modified from Tiner 2009):

- *High Quality*: Plant community shows minimal evidence of human disturbance or other influences. Community composed of native species characteristic of the wetland type. Exotic species are absent or of minimal importance.
- *Moderate Quality*: Plant community shows obvious signs of human disturbance or other influences but is composed mostly of native species characteristic of the wetland type. Exotic species cumulatively comprise less than 20% cover of any stratum.
- *Low Quality*: Plant community strongly reflects human disturbance or other human influence; non-native species cumulatively comprise >20% cover of any stratum.

The majority of the surveyed wetlands were identified as having either *High* (42%) or *Moderate* (51%) vegetative quality. Wetlands whose vegetation was considered of *Low* quality (6%) were typically those previously discussed as being subject to "severe" amounts of disturbance and/or those for which exotic species were identified as dominant components of their vegetative composition.

Fauna

The ability of the wetlands to provide habitat for fauna was assessed by their structural attributes and through direct observations of wildlife usage. In particular, wetlands were assessed in relation to their value as bird, herpetile, mammal, and fish habitat. In addition, interspersion of vegetation and open water was used to provide general information on the ability of a wetland to provide habitat for a diversity of wildlife.

Vegetation interspersion is a measure of the abundance of edges between vegetation and/or open water, and is a valuable attribute for wildlife. Wetlands that contain vegetation interspersed with open water are more likely to support notably greater on-site diversity and/or abundance of fish and wildlife species. Those with very dense vegetation and no channels or open water areas are less likely to be important within this context (Tiner 2009). Additionally, for wetlands that are characterized by multiple vegetative communities, the increased structural diversity and amount of edge associated with greater interspersion is generally positively correlated with wildlife habitat quality (Tiner 2009).

The interspersion of open water and emergent, submergent, or floating-leaved vegetation within the Assessed Wetlands was characterized as *High*, *Medium*, *Low,* or *N/A* (minimal or no open water) and the ratio of vegetation to open water was estimated. Similarly, the degree of interspersion amongst vegetative communities was ranked as High, *Medium*, *Low*, or *N/A* (only one community present). This assessment evaluated vegetation interspersion using the identities of the aforementioned habitat types and therefore required that more than one of these be present within a wetland for it to have vegetation interspersion.

The majority of the Assessed Wetlands (approximately 80%) were not considered to have open water interspersed with vegetation but approximately 4% were categorized as having *High* vegetation-open water interspersion; 4% had *Medium* and 11% had *Low* vegetation-open water interspersion. Wetlands considered as having *High* or *Medium* vegetation were characteristically complexes formed by either marsh or shallow water wetland types, and swamp. Wetlands with *Low* designations were also most commonly complexes formed by the aforementioned associations but several non-complexes, particularly swamps, were also classified as such. The ratio of vegetation to open water was highly variable amongst wetlands but those considered to have *High* interspersion generally had similar amounts of each. Those wetlands for which the degree of interspersion between vegetation and open water was negligible were characteristically swamps and bogs, although some other wetland types were represented in this designation.

Approximately half of the Assessed Wetlands were comprised of more than one vegetation community. Of these, approximately 15% and 85% were considered to have *Medium* and *Low* vegetative interspersion, respectively. None of the Assessed Wetlands were considered to have *High* vegetation interspersion. All wetlands having *Medium* interspersion were either swamps or complexes formed by the swamps in association with other wetland types.

Table 3 in Appendix H provides functional information pertaining to vegetation for each of the Assessed Wetlands.

Birds

Overview

A total of 65 bird species were recorded in association with wetlands of the Study Corridor during their functional assessments. Table 4 in Appendix H provides lists of birds that were observed in association with specific wetlands and information on their population status within the province.

Wetlands were categorized during the functional assessment according to whether they were "salt marsh with tidal creeks and neighboring tidal flats", "freshwater marsh adjacent to open water", or "swamp with adjacent open water". The general wetland types encompassed by this classification are considered to be relevant for assessing potential habitat for waterfowl and other waterbirds. Eleven of the wetlands identified for impact by the Project were classified as either swamps or marshes that were adjacent to open water, and included Wetlands 39, 40, 49, 185, 202, 226, 277, 288, 294, 296, and 314. Although none of the wetlands identified for impact were salt marshes, Wetland 225 which is located at the western end of the area known as "The Puddle" did include a salt marsh component, reflecting the brackish nature of the water within this area.

Waterfowl were observed within five of the wetlands that were targeted for functional assessments (39, 49, 277, 288, and 294). Species of waterfowl that were observed at these sites include Common Loon (*Gavia immer*), Wood Duck (*Aix sponsa*), American Black Duck (*Anas rubripes*), and Canada Goose (*Branta canadensis*). Additional waterbirds that were recorded within wetlands included Great Blue Heron (*Ardea herodias*), Double-crested Cormorant (*Phalacrocorax auritus*), and Herring Gull (*Larus argentatus*) which were found in association with Wetland 49, 288, and/or 296. All of the Assessed Wetlands in which waterfowl or other waterbirds were observed were classified as either swamps or marshes that were adjacent to open water. Many of these wetlands were complexes associated with the larger water bodies of the Study Corridor and included shallow water components. In addition to the aforementioned waterbirds, a number of other species are also associated with the habitat conditions provided by the lake systems and their associated wetlands. For example, Osprey are known to nest in the area and were observed fishing within the shallow water component of Wetland 296, at Sawler Lake, and were also observed at Wetlands 39, 40, and 49.

Species At Risk or of Conservation Concern

The wetlands of the Study Corridor provide habitat for a number of birds which are considered to be At Risk or of Conservation Concern. Two species encountered within the wetlands of the Study Corridor, Canada Warbler and Rusty Blackbird, are listed under *SARA*. There are an additional 10 species which are considered “Sensitive” by NSDNR which were associated with wetlands; including Common loon, Golden-crowned Kinglet, Ruby-crowned Kinglet, Boreal Chickadee, Black-backed Woodpecker, Barn Swallow, Tree Swallow, Cape May Warbler, Bay-breasted Warbler, and Yellow-bellied Flycatcher. Furthermore, Scarlet Tanager, a species ranked as rare (“S2”) by the ACCDC and which has been assigned a status of “Undetermined” in the province by NSDNR was encountered within a wetland of the Study Corridor.

Canada Warblers are considered “Threatened” by COSEWIC and are listed under Schedule 1 of *SARA*. Additionally, they are considered “At Risk” by NSDNR and are ranked as “S3B” by the ACCDC indicating that breeding populations are uncommon throughout their range in the province and are of long-term concern. Canada Warblers use a variety of habitat for nesting, including both uplands and wetlands. The key features of breeding habitat for this species are forested areas with an open tree canopy, dense understory, and a structurally complex forest floor to provide sheltered nest sites. Canada Warblers will nest in both mature and immature forest stands provided the conditions described above are present. In Nova Scotia, treed swamps with dense understory shrub or tree cover are one of the habitats most frequently used by this species. Canada Warblers were encountered at three locations during the field surveys, two of which were Wetlands 279 and 283, situated approximately 500 m east of the outflow of Dorey Lake. These two records were made on separate occasions and were only 130 m apart, so it is likely that the same male was heard singing both times. Wetlands 279 and 283 both contain forested wetland characterized by an open tree canopy underlain by a dense tall shrub understory and provide potentially suitable nesting habitat for the Canada Warbler. The third record of this species was from Wetland 226 which is located along Stillwater Brook (chainage 13+500 m). This wetland is a coniferous treed swamp that has a relatively open tree canopy and a dense shrub understory composed mainly of advanced regeneration of balsam fir. At this site an agitated Canada Warbler was observed near the northern boundary of the Study Corridor. Given the breeding evidence collected during the field surveys, this species is considered to be a probable breeder in the Study Corridor.

Rusty Blackbirds are listed as a “Species of Concern” under Schedule 1 of *SARA* and are considered “May be at Risk” by NSDNR. Rusty Blackbirds were recorded at four locations during the field surveys – all of these being in the vicinity of Dorey Lake between chainages 17+600and 18+500 m (Figure 5.4.2d) in wetland habitat, including Wetlands 277, 279, 288, and 294. An adult with newly fledged young was observed at one of the sites; consequently, this species was confirmed as breeding in the Study Corridor. Rusty Blackbirds typically nest in wetlands containing a mixture of coniferous forest, open water and areas of shrub or graminoid cover, and construct their nests over or near water. These habitat types were present in the four wetlands where the Rusty Blackbirds were found although Wetland 279 was the only wetland that contained all three features of good breeding habitat. Wetland 279 was the location where fledged Rusty Blackbirds were observed. The area where the four Rusty Blackbird observations were made is characterized by high interspersion of relatively large wetlands that are structurally complex compared to most wetlands along the route. It is likely that the Rusty Blackbirds in the area incorporate more than one wetland as part of their home range and are therefore able to find all of the required habitat features in a relatively small area. Another feature of wetlands in this area is the relative abundance of stillwaters and pools compared to most other wetlands along the route.

Common Loons nest on islands in freshwater lakes and are considered by NSDNR as “May be at Risk”. Regional declines in the abundance of this species may be related to a variety of stressors including mercury contamination, ingestion of lead sinkers, swamping of nests by power boat traffic, acidification of lakes, and residential development around lakes. Common Loons were regularly observed at Mill Lake and Sawler Lake and an occupied nest was found within Wetland 38 at the northern end of Mill Lake. Although no evidence of breeding was observed within the portion of Sawler Lake that is within the Study Corridor, it is likely that Common Loons nest in the area.

Golden-crowned Kinglets are typically found in coniferous forests of the province where they are year-round residents. They have just recently been assigned a status of “Sensitive” by NSDNR and are given a rank of “S4” indicating that although they are fairly common throughout their range in the province, they are of long-term concern. There are concerns that extensive harvesting of softwood forest in recent decades and other factors such as possible reduction in softwood forest cover as a result of climate change could result in substantial long term reductions in the abundance of this species within the province. However, Golden-crowned Kinglets were the most abundant species encountered during the breeding bird surveys, accounting for 7.5% of all of the records. Golden-crowned Kinglets were found to be associated with 27 wetlands of the Study Corridor (the majority of which are treed swamps) including 118, 122, 129, 135, 141, 142, 146, 148, 149, 153, 167, 172, 178, 185, 186, 202, 207, 248, 252, 259, 261, 267, 277, 283, 285, 294, and 324.

Ruby-crowned Kinglets have also been recently ranked as “Sensitive” by NSDNR and are given a rank of “S4B” by the ACCDC indicating that they are fairly common throughout their range in the province, but are of long-term concern. For reasons unknown, the population of this species has shown a steady decline in Nova Scotia during the last several decades (CWS 2010). Ruby-crowned Kinglets were relatively abundant in the study area, comprising 2.1% of all of the birds recorded during the field surveys. In addition to upland forests, they were associated with treed swamps of the Study Corridor and were observed at 18 of the targeted wetlands, including numbers 5, 19, 25, 55, 91, 131, 135, 138, 141, 185, 215, 248, 249, 253, 259, 277, 279, and 283.

Boreal Chickadees are considered “Sensitive” by NSDNR and are given a rank of “S3” by the ACCDC indicating that they are uncommon within the province. This species is typically associated with mature coniferous forest habitats but may also reside in immature stands provided there are sufficient feeding opportunities and tree cavities for nesting and winter sheltering. They were encountered in association with the treed swamps of Wetlands 63,131, and 215.

Black-backed Woodpeckers are typically found in mature softwood stands and in burned areas where dead trees are plentiful. They are currently considered “Sensitive” by NSDNR and are given a rank of “S3S4” by the ACCDC indicating that they are uncommon to fairly common within the province. A single Black-backed Woodpecker was observed with Wetland 114 which is comprised of both tall shrub bog and coniferous treed swamp habitats.

Yellow-bellied Flycatchers have recently assigned a status of “Sensitive” by NSDNR and are ranked“S3S4B” by the ACCDC indicating that they are uncommon to fairly common throughout their range in the province and are of long-term concern. This species is associated with a variety of habitats, including swamps and damp coniferous woods. The Sensitive ranking assigned to this species by NSDNR is expected to reflect loss of lowland coniferous forest and possible long term loss of coniferous forest habitat as a result of climate change. Yellow-bellied Flycatchers were observed in association with two wetlands in the Study Corridor. One observation was in the tall shrub swamp habitat of Wetland 49 on the edge of Little Indian Lake whereas the other was recorded in the coniferous treed swamp of Wetland 131 near Porcupine Lake. The coniferous treed swamp at Wetland 131 would provide suitable nesting habitat for this species and a singing male was recorded at this location. However, the tall shrub swamp habitat at Wetland 49 would not provide good nesting habitat and the individual observed at this location did not exhibit any behavior that would indicate that it was nesting nearby - this bird may have been foraging in the wetland but nesting in an adjacent area. Furthermore, although this wetland was surveyed on three other occasions during the breeding season; this species was not noted during any of these visits.

Barn Swallows typically nest in or on man-made structures such as buildings and culverts and were regularly observed at Mill Lake and Little Indian Lake. Furthermore, the bridges associated with these water bodies were found to contain swallow nests. The presence of suitable nest sites and hatches of aquatic insects within the surrounding wetlands (including Wetlands 39, 41, 49, and 51) and lakes makes this general area good breeding habitat for Barn Swallows. Although this species has generally benefitted from human activities, its Nova Scotian population has been in decline since the mid-1980s. It was ranked as a “Sensitive” species in Nova Scotia by NSDNR in 2006 and is currently ranked as “S3B” by the ACCDC.

Tree swallows were ranked as a “Sensitive” species in Nova Scotia by NSDNR in 2010 and are currently ranked as “S4B” by the ACCDC. They feed largely over lakes, rivers, and wetlands containing open water and nest in unoccupied woodpecker holes and nest boxes, often in close proximity to their foraging sites. They were observed at three wetlands within the Study Corridor, all of which contained open water and were adjacent to a water body: Wetland 40 at Mill Lake, Wetland 49 at Little Indian Lake Mill Lake, and Wetland 294 (a swamp recently flooded by beaver activity). Tree swallows likely nest in forest habitat adjacent to these water bodies.

Cape May Warbler was added to the list of "Sensitive" species in the province by NSDNR in 2010. This species is typically associated with conifer forests and over harvesting of such stands is likely a factor in the decline of this species within Nova Scotia. Furthermore, the abundance of Cape May Warbler is often correlated with outbreaks of spruce budworm and the suppression of this species to prevent mortality of balsam fir and spruce may also be a factor contributing in its decline. Cape May Warbler was recorded in association with Wetland 296 and 303, both of which are in close proximity to Dorey and Sawler Lakes.

Bay-breasted warblers were ranked as a "Sensitive" species by NSDNR in 2010 and nest in mature conifer stands. The population of this species is often correlated with spruce budworm abundances and declines in bay-breasted warblers populations are related to the suppression of spruce budworm outbreaks in addition to habitat fragmentation, large-scale harvesting of mature conifer stands, deforestation in the wintering grounds, and, potentially, reductions in the abundance of coniferous forest in the future as a result of climate change. Bay-breasted warblers were encountered at the edges of Wetlands 10 and 92.

Scarlet Tanagers are considered "Sensitive" by NSDNR and are rarely encountered in Nova Scotia. When encountered, they are typically associated with mature hardwood forests. The single Scarlet Tanager that was observed during the field surveys was found in the mixed wood treed swamp habitat of Wetland 16 which was adjacent to a mature softwood stand and a mature mixed wood stand. The male Scarlet Tanager observed at this location was not recorded during any of the three other visits made to this site during the breeding season suggesting that it does not nest in or immediately adjacent to the wetland.

Table 3 in Appendix H provides functional information pertaining to birds and their habitat, including a summary of which ones were observed to provide habitat for Species at Risk or of Conservation Concern.

Herpetiles

Overview

Fourteen herpetile species were encountered within wetlands of the Study Corridor, including yellow spotted salamander (*Ambystoma maculatum*), redback salamander (*Plethodon cinereus*), pickerel frog (*Rana palustris*), mink frog (*Rana septentrionalis*), green frog (*Rana clamitans*), wood frog (*Rana sylvatica*), northern spring peeper (*Pseudacris crucifer*), American toad (*Bufo americanus*), common garter snake (*Thamnophis sirtalis*), redbelly snake (*Storeria occipitomaculata*), ringneck snake (*Diadophis punctatus*), smooth green snake (*Liochlorophis* *vernalis*), snapping turtle (*Chelydra serpentina*), and northern painted turtle (*Chrysemys picta*). Table 5 in Appendix H provides lists of herpetiles that were observed in association with specific wetlands and information on their population status within the province.

For amphibians to successfully breed, wetlands must remain inundated long enough for the larval stages to metamorphose into adults. However, amphibian species reproduce at different times and utilize different habitat conditions in doing so. Early breeders typically reproduce in shallow, seasonal wetlands whereas others do so in larger and more permanent wetlands. As such, the Assessed Wetlands were categorized as to whether they were considered to be inundated long enough in most years to provide appropriate herpetile breeding potential for vernal pool and/or permanent pool species. This assessment incorporated observations on the wetlands hydroperiod and direct breeding evidence such as the presence of calling frogs, egg masses, tadpoles, or newly metamorphosed frogs. The large majority of the wetlands identified for impact by the Project were considered to have sufficient inundation to allow for some herpetile breeding habitat. In particular, approximately 80% were identified as providing breeding habitat for species which utilize shallow, seasonal wetlands (*i.e.*, “vernal pool”) such as spring peeper, wood frog, or redback salamander. Approximately 18% of the wetlands were considered to provide appropriate habitat conditions for herpetiles that are dependent on permanent pools, including green frog and mink frog. Wetlands identified to have potential to support breeding amphibians which are dependent on permanent pools included all of the major wetland types but the majorities were marshes, swamps, shallow water wetlands, and complexes formed by these wetland types.

The ability of wetlands to provide optimal breeding habitat for amphibians is also dependent on a lack of predatory fish. Such wetlands are those that winterkill, dry periodically, are periodically anoxic, and are not connected to waters bearing predatory fish. As such, wetlands within the Study Corridor were evaluated as to whether they were connected with a lake or river so that predatory fish are always present or the wetland is used for rearing of game fish (*High* potential for predatory fish), whether they were occasionally connected to other waters so that predatory fish may be present in some years (*Moderate* potential), or whether they were isolated so that predatory fish are never present (*Low* potential). Of the Assessed Wetlands, approximately 84% were found to have *Low* potential for predatory fish whereas 12% and 4% were identified as having *Moderate* and *High* potential, respectively.

The ability of wetlands to provide overwintering habitat for certain herpetiles species (*e.g.*, green, bull, and mink frogs, as well as turtles) is dependent on their depth and whether they are sufficiently oxygenated. As such, water depth was used as an indicator for whether the wetland is expected to provide appropriate overwintering habitat. Designations were allocated based on whether the wetland was normally more than 1.5 meters deep (high potential to provide overwintering habitat), normally around I meter deep (moderate potential), normally less than I meter deep and often freezes to the bottom (low potential), or whether it never or rarely contains standing water or is nearly always dry in winter (no potential). Of the Assessed Wetlands, 8% and 5% were classified as having *High* and *Moderate* overwintering potential respectively, whereas 65% were considered to have *Low* potential, and 22 % were considered to have none.

Wetlands considered to have *High* herpetile overwintering were generally also considered to have a greater probability of supporting predatory fish, as a result of their proximity to water bodies. However, the potential for overwintering herpetiles within a wetland may vary considerably in some cases, such as for those which are associated with lake edges and which have multiple wetland forms (due to gradients in water depth and other important breeding factors).

Turtles were observed in four wetlands of the Study Corridor, including Wetlands 39, 49, 145, and 296, all of which were complexes formed by swamps in association with shallow water or marshes. Suitable resting areas for turtles, in the form of floating logs or emerged rocks, were also observed within Wetlands 40, 208, and 277 suggesting that there is potential for turtles to occupy additional habitats than those in which they were observed. Of these, Wetlands 40 and 208 are swamps whereas Wetland 277 is a complex formed by swamp and shallow water.

Species At Risk or of Conservation Concern

None of the herpetiles encountered during field surveys are considered to be Species at Risk or of Conservation Concern, as defined in Section 5.5.3 of this report. However, snapping turtle is assessed as a “Species of Special Concern” by COSEWIC. This concern is related to the life history traits of the snapping turtle which make it sensitive to even small increases in mortality. Snapping turtles are slow to mature, have high rates of egg and nestling mortality, are long lived, and in pristine habitats have low adult mortality rates. Populations are maintained as a result of the great longevity of this species which allows adults to reproduce many times during their life to compensate for low levels of recruitment. Any factor which increases the mortality rate of adults in a given population even to a small degree can have an adverse effect on the ability of the population to persist. In Nova Scotia the population is considered to be “Secure” and there is a hunting season for Snapping Turtles. During the field surveys, snapping turtles were observed in association with Wetland 48, at Little Indian Lake during 2009 and 2010 field visits. Additionally, a landowner reported this species as present in Sawler Lake, and it may therefore be associated with wetlands in this area.

Table 3 in Appendix H provides functional information pertaining to herpetiles and their habitat for each of the Assessed Wetlands.

Mammals

Overview

Evidence of 17 mammal species were recorded within wetlands of the Assessment Area, including cinereus shrew (*Sorex cinereus*), water shrew (*Sorex palustris*), meadow vole (*Microtus pennsylvanicus*), southern red-backed vole (*Myodes gapperi*), muskrat (*Ondatra zibethicus*), American red squirrel (*Tamiasciurus hudsonicus*), eastern chipmunk (*Tamias striatus*), snowshoe hare (*Lepus americanus*), American beaver (*Castor canadensis*), North American porcupine (*Erethizon dorsatum*), eastern coyote (*Canis latrans*), red fox (*Vulpes vulpes*), northern raccoon (*Procyon lotor),* mink (*Neovison vison*), northern river otter (*Lutra canadensis*), short-tailed weasel (*Mustella erminea*), and white-tailed deer (*Odocoileus* *virginianus*). Of these species, the American beaver, mink, muskrat, northern river otter, and water shrew are generally associated, or dependent upon, wetland habitats. Evidence of these wetland-related mammals was observed within approximately 10% of the Assessed Wetlands. Table 6 in Appendix H provides data on mammals that were observed in association with specific wetlands and information on their population status within the province.

In addition to direct observations of mammals or their sign, the potential value of wetlands for providing habitat for wetland-related wildlife was assessed based on the presence or absence of key habitat features. In particular, wetlands were evaluated as to whether they were considered likely to provide habitat for mink, northern river otter, muskrat, and the American beaver.

Minks are associated with a diversity of wetland or aquatic habitats, including stream banks, lakeshores, swamps, and tidal flats where they feed on a variety of prey, most notably small mammals, fish, and herpetiles (Banfield 1974). Due to the diversity of wetland habitats in which they occur and their varied diet, minks could potentially utilize many of the wetlands within the Assessment Area. Due to the importance of fish as a prey item for mink, wetlands identified as having *High* or *Moderate* value for fish habitat (see below in Section 5.6.4.1) are considered here to have the greatest potential to support this species. Based on this criterion, approximately 28% of the Assessed wetlands were considered to have potential mink habitat although direct evidence of this species was only observed at one wetland (Wetland 39).

Northern river otters spend the majority of their time on the shores of deep, clear water in lakes, rivers, large marshes, and bays where they are primarily dependent on fish for food (Banfield 1974). Wetlands considered to have potential otter habitat were those identified as having *High* value for fish habitat (see Section 5.6.4.1) and which were immediately adjacent to deep, open water, as may be provided by rivers or lakes. Based on these criteria, approximately 4% of the wetlands were identified as having potential value as otter habitat. During field surveys, an adult northern river otter was observed swimming in Dorey Lake and is therefore considered to be associated with Wetland 296.

Muskrats are associated with a variety of wetland and aquatic habitats, including lakes, rivers, ponds, sloughs, and marshes. Within such habitats, they require open water that is deep enough to not freeze during the winter but which is shallow enough to support aquatic vegetation, generally between one to two meters (Banfield 1974). Within the Assessed Wetlands, potential muskrat habitat was identified as those areas that contained or were immediately adjacent to open water with the aforementioned depth criteria. Approximately 8% of the Assessed Wetlands were considered to have potential habitat for this species and direct evidence of muskrat was observed within five of the wetlands (Wetlands 39, 49, 223, 226, and 296).

Beavers inhabit slow-flowing streams, lakes, rivers, and marshes (Banfield 1974). Because evidence of beaver activity is relatively persistent, the habitat assessment for this species was based on signs of its current or remnant usage, including the presence of dams or trees cut or gnawed by beavers. Of the Assessed Wetlands, approximately 9% had some evidence of beaver usage although direct observations of this species were restricted to two wetlands (Wetlands 185 and 294).

Based on the above evaluations, approximately 28% of the Assessed Wetlands are considered to have relatively *High* potential to support mammals that are generally associated or dependent upon wetland habitats. Table 3 in Appendix H provides information on wetland-related wildlife habitat for each of the Assessed Wetlands.

Species At Risk or of Conservation Concern

None of the mammals encountered during field surveys are considered to be Species at Risk or of Conservation Concern, as defined in Section 5.5.3 of this report.

Fish

Overview

The value of wetlands for providing fish habitat is generally related to their connectivity with deepwater habitats. As such, wetlands are generally considered to have *High* value for fish if they provide spawning/nursery habitat or refuge for native fish species in adjacent estuaries, lakes, rivers or streams (Tiner 2009). Additionally, wetlands may intermittently support populations of certain fish species as a result of colonization during flood events and some isolated, but permanently flooded, wetlands can support native populations of species such as minnows. Additionally, those that do not directly support fish may still be important for maintaining their habitat by improving the quality of downstream water, for example, by providing shade to maintain water temperature in adjacent water bodies or watercourses. Wetlands that are isolated and are not permanently flooded do not generally support fish populations.

The value of wetlands for providing fish habitat was evaluated by assessing the degree to which they were contiguous with a permanent water body or watercourse which was either known or expected to be capable of supporting native fish species. Specifically, wetlands were evaluated based on their position to water bodies and watercourses within the Assessment Area, results of the fish-outs (see Section 5.3.4), and observations of fish during site visits. Those wetlands that are lentic, lotic, or estuarine or otherwise contiguous with a permanent water body or watercourse that was determined to support native fish species were considered to have *High* value. Those that were contiguous with a permanent watercourse considered to have potential to support fish, but for which no fish were found during fish-out efforts, are regarded here as having *Moderate* value. Wetlands which were connected to a watercourse which was not considered to have potential for supporting fish (and for which no fishing effort was thereby performed) were considered to have *Low* fish habitat value. Wetlands which are isolated from all water bodies or watercourses were considered to have *Negligible* value with regards to fish habitat. Of the Assessed Wetlands, approximately 20% were considered to have high fish habitat value, 8% moderate, 7% low, and 65% were not considered capable of supporting fish.

Fish were directly observed within 11 of the wetlands during their functional assessments, including Wetlands 39, 40, 49, 277, 294, 296, 314, 316, 324 and 327. Species which were identified during these surveys include banded killifish (*Fundulus diaphanus*), brook trout (*Salvelinus fontinalus*), white sucker (*Catostomus commersoni*), and sticklebacks (unknown species). Other species which were observed during fish-outs of the water bodies and watercourses and which could be associated with wetlands of the Assessment Area include American eel (*Anguilla rostrata*), Atlantic salmon (*Salmo salar*), blacknose dace (*Rhinichthys atratulus*), common shiner (*Notropis cornutus*), fourspine stickleback (*Apeltes quadracus*), golden shiner (*Notemigonus crysoleucas*), mummichog (*Fundulus heteroclitus*), ninespine stickleback (*Pungitius pungitius*), threespine stickleback (*Gasterosteus aculeatus*), and yellow perch (*Perca flavescens*). Table 3 in Appendix H provides information on fish and fish habitat within the Assessed Wetlands. Further information on fish habitat within the Assessment Area is provided in Section 5.3.

Species At Risk or of Conservation Concern

The watercourses and water bodies of the Assessment Area provide habitat for two salmonid species which are considered to be of Conservation Concern, Atlantic salmon (*Salmo salar*) and brook trout (*Salvelinus fontinalis*). Salmonids are generally considered a sensitive family of fish, indicative of good water quality in relation to pH, dissolved oxygen, and metals (or other contaminant) levels. The Atlantic salmon is considered "May be at Risk" by NSDNR and is given a ranking of "S2" by the ACCDC indicating that local populations are rare and may be vulnerable to extirpation. Brook trout are considered to be "Sensitive" by NSDNR but are given a ranking of "S4" by the ACCDC indicating that although they are generally widespread and common within the province, they are of long term concern.

Although not considered a Species of Conservation Concern, as defined in Section 5.5.3 of this report, American eel (*Anguilla rostrata*) is assessed as a Species of Special Concern by COSEWIC. The American eel is catadromous (lives in fresh water, spawns in salt water) and as such can be found in lakes, streams, rivers and estuaries, depending on the lifecycle stage of the individuals. NSDNR considers the species to be "Secure" whereas the ACCDC assigns a provincial rank of "S5" to this species indicating that it is widespread and abundant. The designation by COSEWIC is due to recruitment issues because the species is panmictic, meaning that all spawners originate from a single breeding unit. Therefore, the Canadian recruitment can be affected by a decline in global population.

Wetlands which encompass or are immediately adjacent to water bodies or watercourses, within which the aforementioned Species of Conservation Concern are associated, may be considered to provide habitat for these species. For further discussion regarding the distribution and abundance of fish species within the Assessment Area, refer to Section 5.3.

Summary of Wildlife Functions

The value of the Assessed Wetlands for providing important habitat for wildlife was summarized with the use of selected functional attributes relating to vegetation, birds, herpetiles, mammals, and fish. Details on the criteria used to summarize key wetland functions associated with each of these wildlife groups, in addition to Species at Risk or of Conservation Concern is as follows:

Vegetation

Select attributes related to both the integrity and diversity of vegetation were used to assess the value of the wetlands for providing habitat for plants. Wetlands which were given a vegetative quality ranking of *High* (based on previously discussed guidelines pertaining to the effects of anthropogenic disturbances and the presence of exotics within Section 5.6.4.1) were considered to have relatively high vegetation integrity, and were summarized as such. Plant species richness was selected as a measure of vegetative diversity within wetlands. In particular, those wetlands which contained more than 20% (*i.e.*, > 60 species) of the cumulative wetland plant list were regarded as having relatively *High* diversity and were used for summary purposes pertaining to the function of vegetation diversity.

Birds

The ability of wetlands to provide habitat for waterfowl and/or other waterbirds was selected as a key functional attribute. Those which had been previously identified as providing potential habitat for waterfowl (based on their wetland class and adjacency to open water, as discussed in Section 5.6.4.1) and those within which waterfowl or other waterbirds were observed, are considered to be relatively important for providing this function.

Herpetiles

Wetlands which provide herpetile habitat were identified using a combination of factors. Specifically, those considered to provide potential herpetile breeding habitat for either vernal and permanent pool related species (based on observations of the wetlands hydroperiod and direct breeding evidence such as the presence of calling frogs, egg masses, tadpoles, or newly metamorphosed frogs), those identified as having potential turtle habitat (presence of floating logs), *Moderate-high* overwintering potential (based on water depths) as discussed in Section 5.6.4.1), or any wetlands which herpetiles were observed within, were regarded for the purposes of this evaluation as providing herpetile habitat.

Mammals

Wetlands which were considered to provide potential habitat for the selected wetland-related mammals (mink, northern river otter, muskrat, and American beaver, as discussed in Section 5.6.4.1) and/or within which evidence of wetland-related wildlife were observed (*i.e.*, live individuals, scat, tracks, or other sign) were considered to provide mammal habitat.

Fish

Wetlands considered to be relatively important for fish habitat include those identified as having *Moderate – High* value for fish habitat (based on their position relative to water bodies and watercourses within the Assessment Area, results of the fish-outs, and observations of fish during site visits) in Section 5.6.4.1.

Species at Risk or of Conservation Concern

Because the ability of wetlands to provide habitat for Species at Risk or of Conservation Concern is an important functional attribute, this information was also summarized. Fish species were not included in this summary.

Information concerning the numbers and areas of wetlands considered to be important in providing key wildlife functions are summarized in Table 5.60. Additionally, the status of individual wetlands, with regards to their value as habitat for plants, waterbirds, herpetiles, wetland-related mammals, fish, and Species at Risk or of Conservation Concern is provided in Table 7 of Appendix H.

During field surveys a total of 115 wetlands were subject to detailed functional assessments, accounting for over 28 ha of wetland habitat (Table 5.60). Based on the previously described methodology for wildlife-related wetland functions:

- 48 wetlands, comprising an area of 14.86 ha, are considered to have high vegetation integrity;
- 8 wetlands, comprising an area of 7.15 ha, are considered to have high vegetation richness;
- 13 wetlands, comprising an area of 8.70 ha, provide habitat for waterfowl and/or other waterbirds;
- 103 wetlands, comprising an area of 26.97 ha, are considered to provide herpetile habitat;
- 32 wetlands, comprising an area of 11.63 ha, are considered to provide habitat for wetland – related mammals;
- 32 wetlands, comprising an area of 11.63 ha, are considered to provide fish habitat; and
- 51 wetlands, comprising an area of 19.76 ha, provide habitat for Species at Risk or of Conservation Concern (specifically plants and birds).

Table 5.60 Number and Area (ha) of the Assessed Wetlands which Provide the Selected Wildlife Functions

Wetland Class	High Vegetation Integrity		High Vegetation Diversity		Waterfowl/ Waterbird Habitat		Herpetile Habitat		Mammal Habitat		Fish Habitat		Habitat for Species at Risk or of Conservation Concern		Total Assessed	
	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area
Bog	2	1.36	0	0.00	1	0.54	2	1.36	1	0.54	1	0.54	2	1.36	2	1.36
Bog / Swamp	0	0.00	1	0.89	0	0.00	1	0.89	0	0.00	0	0.00	1	0.89	1	0.89
Marsh	0	0.00	0	0.00	0	0.00	1	0.02	0	0.00	0	0.00	0	0.00	2	0.03
Shallow Water / Marsh	0	0.00	0	0.00	0	0.00	2	0.02	0	0.00	0	0.00	0	0.00	2	0.02
Swamp	40	8.61	2	0.53	5	1.51	78	16.12	22	4.42	22	4.42	40	10.86	89	17.29
Swamp / Fen	1	0.40	0	0.00	1	0.40	1	0.40	1	0.40	1	0.40	0	0.00	1	0.40
Swamp / Marsh	1	0.03	1	1.06	1	0.21	8	1.75	1	0.17	1	0.17	3	1.46	8	1.75
Swamp / Shallow Water	3	2.36	3	2.56	4	3.94	9	4.30	6	3.99	6	3.99	4	3.09	9	4.30
Swamp / Shallow Water / Fen	1	2.10	1	2.10	1	2.10	1	2.10	1	2.10	1	2.10	1	2.10	1	2.10
Total	**48**	**14.86**	**8**	**7.15**	**13**	**8.70**	**103**	**26.97**	**32**	**11.63**	**32**	**11.63**	**51**	**19.76**	**115**	**28.16**

5.6.4.2 Wetland Hydrogeomorphology and Non-Wildlife Functions

Nominal and categorical hydrogeomorphic data were collected in each wetland with the potential to be affected by the Project during field studies between May and June, 2010, and supplemented by an additional field study in November 2010. This data was used to complete an evaluation of the potential functions performed by each wetland by applying criteria, such as wetland type, landscape position or character of sustaining water sources (refer to Tables 8 and 9 in Appendix H). These criteria are largely based on the work of others (Tiner 2003, 2009). Full evaluation procedures, completed data collection forms and tabulated raw data are provided in Appendix H.

The non-wildlife functions evaluated include hydrological functions, biogeochemical functions and social benefits. The functions evaluated were tailored to the probable functions performed by the classes, forms and types of wetlands identified during previous wetland delineation and mapping exercises. For example, coastal surge protection was not evaluated as a possible function to be performed by wetlands in the Study Corridor due to the distance to the ocean"s coast.

Hydrology

The hydrological functions evaluated for the wetlands in the Study Corridor include baseflow maintenance, stormwater management, shoreline erosion control, water storage, and groundwater recharge. A complete presentation of the hydrological functions performed by individual wetlands in the Study Corridor is provided in Appendix H.

Baseflow Maintenance

Wetlands that provide baseflow maintenance are valued for maintaining flow to downgradient water bodies in dry conditions, thus supporting wildlife habitat and water resources for human use. The potential for a wetland to perform this function was assigned to wetlands that were the source of a stream, were observed to have greater channel outflow than inflow, were very large and had an abundance of saturated organic soil, or wetlands that were observed to be spring-fed.

Table 5.61 provides a summary of the wetland habitat to be affected by the Project that was attributed with the potential to provide baseflow maintenance, by wetland class and form. This function was attributed to 64 of the 115 Assessed Wetlands, with 19.96 ha of contributing wetland area. The large proportion of wetlands providing this function is reflective of the large number of wetlands that are hydrologically maintained by springs or groundwater.

Shoreline Erosion Control

Vegetated riparian wetlands in the Study Corridor have the potential to slow the flow of surface water, stabilize soil and disperse energy in a way that reduces the erosive forces of surface water. By nature of wetland vegetation, all vegetated riparian wetland forms have the potential to provide this function. Of the 115 Assessed WetlandsAssessed Wetlands, 28 have been attributed with performing this function, comprising 8.24 ha of contributing wetland area. These wetlands are primarily shoreline or riparian swamps, or complexes of swamp with shallow water wetland, marsh or shoreline fen components.

Stormwater Management

Wetlands that collect and store surface water during storms and high-water events alleviate flooding and may prevent environmental and property damage associated with high-energy flows. With some exceptions, the potential for a wetland to perform this function was generally assigned to wetlands with indicators of a fluctuating water table (indicators of high and regular water marks), surface water-fed wetlands with basin or floodplain forms, and wetlands fed fully or partially by artificial surface water conveyance features (*e.g.*, drainage ditches).

This function was attributed to 78 of the 115 Assessed Wetlands, contributing a total of 16.23 ha of stormwater management services (Table 5.61). The swamps, which typically form in a fluctuating hydrological regime, comprise the majority of Assessed Wetlands (77% of wetlands, comprising 58% of assessed wetland area). Complexes of swamp and marsh were found to be the dominant wetland class providing this function.

Water Storage

The function of water storage (as opposed to stormwater management) is related to the general value of water retained on the surface for wildlife, raising local groundwater tables, local climate moderation, aesthetics, supporting chemical processes and aquatic habitat, agricultural and fire fighting uses. Wetlands with substantial amount of open water retained at the surface during the growing season were identified by direct observation.

Water storage was determined to be provided by 56 of the Assessed Wetlands, contributing 11.55 ha of this function on an aerial basis (Table 5.61). The majority of swamp and marsh wetlands, and their complexes, were observed to have standing water or saturated surfaces for long durations of the growing season. Bogs, fens, and their complexes with other wetland types, were not attributed this function among the Assessed Wetlands.

Groundwater Recharge

Depending on landscape position, substrate distribution and morphology, wetlands may have the potential to capture surface flow and precipitation and discharge all or a portion to the groundwater table. This function cannot be determined directly without long term monitoring programs. In the Study Corridor, those wetlands located in elevated portions of a watershed, or wetlands that have greater inflow than outflow, have a high likelihood of performing this function. Wetlands that are hydrologically maintained by springs or watercourses have been excluded from this functional group as they are likely at a position of groundwater discharge in the watershed.

The groundwater recharge function was attributed to 11 of the 115 Assessed Wetlands, comprising 1.10 ha of wetland area (Table 5.61). The wetlands performing this function were exclusively swamps, marshes and swamp marsh complexes. Many of the wetlands in the Study Corridor were identified as spring fed, in bedrock controlled topography, indicating a general area of groundwater discharge. The wetlands associated with this function were found at a distance from mapped surface water bodies and local topographical highs, which supports this finding (Table 8 in Appendix H and Figures 5.4.2a-e).

Biogeochemical Function

The biogeochemical functions evaluated for the wetlands in the Study Corridor include water quality improvement, atmospheric carbon storage, and food chain support. A complete presentation of the biogeochemical functions performed by individual wetlands in the Study Corridor is provided in Appendix H.

Carbon Sequestration and Storage

Wetlands may contribute to the mitigation of global climate change if the fixation of atmospheric carbon (carbon dioxide) through photosynthesis exceeds the release of carbon to the atmosphere through the decomposition of organic material (carbon dioxide, methane), on a long term basis (greater than one year). Individual wetlands vary widely in their annual net carbon balances and year to year variability may result from climate and weather patterns. Wetlands with peat formation and woody vegetation are typically attributed this function, as peat and wood represent long-term storage of sequestered carbon. Wetlands with fluctuating water tables (alternating aerobic and anaerobic conditions) or greater flows and gradients, generally do not promote accumulation of organic matter (Whiting and Chanton 2001).

A summary of the wetland types that were attributed the potential to provide global climate change abatement through carbon sequestration and storage is presented in Table 5.61. This function was attributed to 95 of the 115 of the Assessed Wetlands comprising 24.38 ha or 87% on an aerial basis. The majority of wetlands assessed are peat-forming wooded wetlands, which represent long-term storage of atmospheric carbon.

Water Quality Improvement

Wetlands may support the improvement of water quality through physical processes and chemical and metabolic transformations. Several different wetland hydrogeomorphologies may be attributed this function. Efficient nutrient transformation can occur in wetlands with fluctuating water tables (*i.e.*, alternating aerobic and anaerobic conditions, high primary productivity, and high soil-water interactions). Sediment removal is also efficient in wetlands with fluctuating water tables, indicating that there is retention and slowing of stormflows, particularly those with flow-impeding emergent vegetation or microtopography (hummocks or cross-flow ridges).

Groundwater or spring sourced wetlands provide high soil-water interaction, which may be particularly valuable in agricultural watersheds (Hill 1991).

Riparian wetlands are important sinks for pollutants carried in upland runoff and from upstream areas such as agricultural soils (Gilliam 1996; Carpenter *et al.* 1998). They are noted for processing large fluxes of energy and materials from upstream sources, and they typically show high primary productivity (Mitsch and Gosselink 2000).

Because precipitation-fed systems (bogs and certain marshes) are largely isolated from other surface water resources, they typically contribute little to watershed surface water quality (Mitsch and Gosselink 2000).

The function of nutrient transformation and sediment accretion was attributed to 69 of the Assessed Wetlands, comprising 12.82 ha of wetland area (Table 5.61). The wetland classes associated with this function among the Assessed Wetlands are marshes, swamps and their complexes.

Food Chain Support

Through unique metabolic processes and their hydrological connection with the watershed, wetlands can be an important source of nutrients and food to downgradient aquatic habitats. Although the performance of this function is site specific, potential to perform this function can be attributed to all wetlands that are discharging to downgradient environments. A summary of the wetland types that were attributed this potential to is presented in Table 5.61. In total, 73 of the 115 wetlands (21.59 ha or 77% on an aerial basis) are attributed with performing this function, representing all wetland classes.

Social Values

Wetlands can provide a variety of social benefits. These include educational and scientific, as well as recreational opportunities, such as hunting, hiking, and artistic and spiritual inspiration. A summary of the wetland types that were attributed the potential to is presented in Table 5.61. Of the wetlands proposed for alteration, 22 wetlands were noted as having evidence of human use. In particular, timber harvesting, campsites, and ATV trails were observed in, or near select wetlands. These wetlands have a close proximity to Highway 103, therefore are likely be accessed and used relatively more frequently than remote wetlands. None of the human uses observed were considered unique or irreplaceable; several are considered harmful.

Table 5.61 Number and Area (ha) of the Assessed Wetlands which Provide Hydrogeomorphological and Other Non-wildlife Functions

Wetland Class	Baseflow Maintenance		Erosion Control		Stormwater Management		Groundwater Recharge		Water Storage		Carbon Sequestration Potential		Water Quality Improvement		Food Chain Support		Social Function		Total Assessed	
	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area
Bog	1	0.54	0	0.00	0	0.00	0	0.00	0	0.00	2	1.36	0	0.00	1	0.54	0	0.00	2	5.6.5 1.36
Bog / Swamp	1	0.89	0	0.00	0	0.00	0	0.00	0	0.00	1	0.89	0	0.00	5.6.6 1	5.6.7 0.89	5.6.8 1	5.6.9 0.89	5.6.10 1	5.6.11 0.89
Marsh	0	0.00	0	0.00	2	0.03	1	0.02	1	0.02	0	0.00	2	0.03	5.6.12 1	5.6.13 0.02	5.6.14 0	5.6.15 0.00	5.6.16 2	5.6.17 0.03
Shallow Water / Marsh	1	0.01	1	0.01	1	0.01	0	0.00	1	0.01	0	0.00	2	0.02	5.6.18 1	5.6.19 0.01	5.6.20 0	5.6.21 0.00	5.6.22 2	5.6.23 0.02
Swamp	53	13.24	18	2.70	63	12.62	9	0.87	44	9.45	80	16.26	52	8.83	5.6.24 60	5.6.25 13.80	5.6.26 20	5.6.27 6.35	5.6.28 89	5.6.29 17.29
Swamp / Fen	1	0.40	1	0.40	1	0.40	0	0.00	1	0.40	1	0.40	1	0.40	5.6.30 1	5.6.31 0.40	5.6.32 0	5.6.33 0.00	5.6.34 1	5.6.35 0.40
Swamp / Marsh	2	1.23	1	0.17	4	0.47	1	0.21	4	1.44	7	1.72	5	0.64	5.6.36 3	5.6.37 1.43	5.6.38 1	5.6.39 0.17	5.6.40 8	5.6.41 1.75
Swamp / Shallow Water	4	1.55	6	2.86	7	2.69	0	0.00	5	0.23	3	1.65	7	2.89	5.6.42 4	5.6.43 2.39	5.6.44 0	5.6.45 0.00	5.6.46 9	5.6.47 4.30
Swamp / Shallow Water / Fen	1	2.10	1	2.10	0	0.00	0	0.00	0	0.00	1	2.10	0	0.00	5.6.48 1	5.6.49 2.10	5.6.50 0	5.6.51 0.00	5.6.52 1	5.6.53 2.10
Total	**64**	**19.96**	**28**	**8.24**	**78**	**16.23**	**11**	**1.10**	**56**	**11.55**	**95**	**24.38**	**5.6.54 69**	**5.6.55 12.82**	**5.6.56 73**	**5.6.57 21.59**	**5.6.58 22**	**5.6.59 7.41**	**5.6.60 115**	**5.6.61 28.16**

5.6.62 Potential Interactions, Issues and Concerns

This section evaluates the potential for Project-related activities to affect Wetlands. Table 5.62 provides a summary of the potential environmental effects resulting from the Project-VEC interactions, which are discussed below. Table 10 in Appendix H presents the wetland areas that will be affected by the Project.

Table 5.62 Project Activity – Environmental Effects Interaction Matrix for Wetlands

Potential Interactions Between Project Activities, Including Other Projects and Environmental Effects Valued Environmental Component: WETLANDS			
Project Activities and Physical Works†	Potential Environmental Effects		
	Change in Wetland Quantity	Change in Wetland Quality	Loss of Wetland Function
Construction			
Site Preparation	✓	✓	✓
Roadbed Construction	✓	✓	✓
Watercourse Crossing Structure Construction	✓	✓	✓
Surfacing and Finishing			
Operation and Maintenance			
Project Presence			
Infrastructure Maintenance		✓	✓
Winter Maintenance		✓	✓
Vegetation Management		✓	✓
Other Projects and Activities			
Existing and Planned Linear Features	✓	✓	✓
Residential and Commercial Land Use	✓	✓	✓
Recreational Land Use		✓	✓
Resource Land Use	✓	✓	✓

† See Table 4.1 and Section 2.3 for list and details of specific activities and works.

5.6.62.1 Construction

The most substantive change in wetland habitat quantity and quality will result from site preparation activities. Clearing and grubbing during site preparation will directly remove wetland vegetation and soils whereas the construction of roadbeds will require that wetland habitats be infilled. Additionally, a number of indirect effects can result from site preparation activities. In particular, the erosion of uplands as a result of vegetation removal and deposition of sediments in wetland habitat (unplanned event) may alter wetland habitat beyond the Project footprint. Similarly, construction activities have the potential to disturb wetland habitat through off-road and off RoW activity. This may occur when vehicles are accessing the work site along tertiary roads, by the gradual widening of the thoroughfare, as well as through non-motorized activity in undisturbed areas adjacent to the RoW.

Blasting can have physical and chemical environmental effects on wetland habitat and associate wildlife. It is very likely that blasting will be required for the twinning of Highway 103 as the granite bedrock tends to be near the surface and consolidated (see Section 5.2.4). Blasting has potential to alter wetland hydrology by causing fractures in the underlying bedrock, thereby promoting the drainage of wetlands. Blasting may also have an adverse affect on wetland-associated wildlife – for example, by discouraging birds from establishing their nests during their breeding season.

The Project will require the installation of watercourse crossing infrastructure, such as culverts and bridges. Installation of such features can alter wetland habitat through drainage, flooding or extensive erosion. Improperly installed crossings (unplanned event) could also result in harmful alteration, disruption or destruction of fish and fish habitat and a potential loss of wetland function in wetlands supporting commercially or recreationally fished species. The environmental effects of watercourse crossing construction on fish and fish habitat are assessed in the Aquatic Environment VEC, Section 5.3.

Hydroseeding applications have the potential to alter the quality of wetland habitat. If applied in hydrological source areas for wetlands, hydroseeding applications have the potential to increase nutrient levels in wetlands, which could affect their biological process (*e.g.*, nutrient uptake by plants, decomposition rates, *etc.*). Although hydroseeding efforts will use an approved seed mix, these are typically comprised of non-native species and therefore have potential to influence the composition of wetland communities. Construction activities also increase the susceptible of wetland habitats to non-native and invasive plants through increased disturbances, proximity to anthropogenic infrastructure, and by promoting their dispersal.

Construction activities are expected to result in the direct alteration of 108 wetlands and the loss of almost 18 ha of wetland habitat (Table 5.63). The amount of wetland habitat directly impacted by Project activities represents approximately 8.4% of that identified within the Assessment Area. The large majority of the wetlands identified for direct impacts are swamps, or complexes formed by this wetland class and others.

Table 5.63 Direct Impact of Project on Wetlands by Wetland Class

Wetland Class[1]	Number of Wetlands Affected	Total Affected Area (ha)	Total Wetland Area in Assessment Area (ha)	Proportion of total Wetland Area affected by the Project (%)
Bog	2	0.61	37.59	1.62
Bog / Swamp	1	0.63	3.60	17.37
Marsh	2	0.05	1.25	3.66
Shallow Water	0	0.00	12.09	0.00
Shallow Water / Marsh	2	0.02	0.02	98.87
Swamp	81	11.12	130.15	8.54

Table 5.63 Direct Impact of Project on Wetlands by Wetland Class

Wetland Class[1]	Number of Wetlands Affected	Total Affected Area (ha)	Total Wetland Area in Assessment Area (ha)	Proportion of total Wetland Area affected by the Project (%)
Swamp / Fen	1	0.94	2.85	33.11
Swamp / Marsh	8	2.66	13.37	19.89
Swamp / Shallow Water	10	1.18	6.10	19.31
Swamp / Shallow Water / Fen	1	0.24	1.14	21.03
Total	108	17.45	208.17	8.38

[1]Wetland classification data based on field surveys, air photo interpretation, and NSDNR's wetland inventory

Direct impacts of the Project on wildlife-related functions (Table 5.64) include the complete or partial loss of:

- 45 wetlands, comprising an area of 8.54 ha, which are considered to have high vegetation integrity;
- 8 wetlands, comprising an area of 4.05 ha, which are considered to have high vegetation richness;
- 13 wetlands, comprising an area of 4.99 ha, which are considered to provide habitat for waterfowl and/or other waterbirds;
- 93 wetlands, comprising an area of 15.79 ha, which are considered to provide habitat for herpetiles;
- 29 wetlands, comprising an area of 7.18 ha, which are considered to provide habitat for wetland – related mammals;
- 29 wetlands, comprising an area of 7.18 ha, which are considered to provide fish habitat and;
- 48 wetlands, comprising an area of 10.15 ha, which provide habitat for Species at Risk or of Conservation Concern (specifically plants and birds).

Impacts of the Project on hydrogeomorphological and related functions (Table 5.65) include the complete or partial loss of:

- 57 wetlands, comprising an area of 11.53 ha, which have the potential to provide baseflow maintenance to downgradient aquatic habitats;
- 22 wetlands, comprising an area of 5.30 ha, which have the potential to provide shoreline erosion control services;

- 70 wetlands, comprising an area of 10.51 ha, which have the potential to provide stormwater management services;
- 7 wetlands, comprising an area of 0.84 ha, which have the potential to provide groundwater recharge services;
- 48 wetlands, comprising an area of 6.67 ha, which were attributed with providing water storage services;
- 88 wetlands, comprising an area of 14.40 ha, which have the potential to sequester and store atmospheric carbon;
- 60 wetlands, comprising an area of 9.27 ha, which have the potential to provide water quality improvement services;
- 63 wetlands, comprising an area of 12.78 ha, which have the potential to export nutrients and organic carbon to support downgradient aquatic habitat; and
- 21 wetlands, comprising an area of 3.37 ha, which have evidence of human use.

Table 5.64 Impacts of the Project on Selected Wildlife Functions (Number and Area (ha) of the Assessed Wetlands Directly Impacted)

Wetland Class	High Vegetation Integrity		High Vegetation Diversity		Waterfowl / Waterbird habitat		Herpetile Habitat		Mammal Habitat		Fish Habitat		Habitat for Species at Risk or of Conservation Concern	
	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area
Bog	2	0.61	0	0.00	1	0.43	2	0.61	1	0.43	1	0.43	2	0.61
Bog / Swamp	0	0.00	1	0.63	0	0.00	1	0.63	0	0.00	0	0.00	1	0.63
Marsh	0	0.00	0	0.00	0	0.00	1	0.02	0	0.00	0	0.00	0	0.00
Shallow Water / Marsh	0	0.00	0	0.00	0	0.00	2	0.02	0	0.00	0	0.00	0	0.00
Swamp	37	5.22	2	0.28	5	0.86	68	9.72	19	3.03	19	3.03	37	5.74
Swamp / Fen	1	0.24	0	0.00	1	0.24	1	0.24	1	0.24	1	0.24	0	0.00
Swamp / Marsh	1	0.03	1	0.25	1	0.21	8	0.94	1	0.17	1	0.17	3	0.65
Swamp / Shallow Water	3	1.27	3	1.71	4	2.08	9	2.44	6	2.13	6	2.13	4	1.33
Swamp / Shallow Water / Fen	1	1.18	1	1.18	1	1.18	1	1.18	1	1.18	1	1.18	1	1.18
Total	**45**	**8.54**	**8**	**4.05**	**13**	**4.99**	**93**	**15.79**	**29**	**7.18**	**29**	**7.18**	**48**	**10.15**

Table 5.65 Impacts of the Project on Hydrogeomorphological and Other Non-wildlife Functions (Number and Area (ha) of the Assessed Wetlands Slated for Direct Impacts)

Wetland Class	Baseflow Maintenance		Erosion control		Stormwater management		Groundwater Recharge		Water Storage		Carbon Sequestration Potential		Water Quality Improvement		Food Chain Support		Social Benefits	
	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area	#	Area
Bog	1	0.43	0	0.00	0	0.00	0	0.00	0	0.00	2	0.61	0	0.00	1	0.43	0	0.00
Bog / Swamp	1	0.63	0	0.00	0	0.00	0	0.00	0	0.00	1	0.63	0	0.00	1	0.63	1	0.63
Marsh	0	0.00	0	0.00	1	0.02	0	0.00	0	0.00	0	0.00	1	0.02	0	0.00	0	0.00
Shallow Water / Marsh	1	0.01	1	0.01	1	0.01	0	0.00	1	0.01	0	0.00	2	0.02	1	0.01	0	0.00
Swamp	46	8.07	12	1.70	56	8.17	6	0.63	37	5.54	73	10.18	44	6.31	51	8.37	19	2.57
Swamp / Fen	1	0.24	1	0.24	1	0.24	0	0.00	1	0.24	1	0.24	1	0.24	1	0.24	0	0.00
Swamp / Marsh	2	0.42	1	0.17	4	0.47	1	0.21	4	0.63	7	0.91	5	0.64	3	0.63	1	0.17
Swamp / Shallow Water	4	0.56	6	2.00	7	1.60	0	0.00	5	0.24	3	5.6.63 0.64	5.6.64 7	5.6.65 2.03	5.6.66 4	5.6.67 1.30	5.6.68 0	5.6.69 0.00
Swamp / Shallow Water / Fen	1	1.18	1	1.18	0	0.00	0	0.00	0	0.00	1	1.18	0	0.00	1	1.18	0	0.00
Total	**57**	**11.53**	**22**	**5.30**	**70**	**10.51**	**7**	**0.84**	**48**	**6.67**	**88**	**14.40**	**60**	**9.27**	**63**	**12.78**	**21**	**3.37**

5.6.69.1 Operation and Maintenance

Several activities related to the operation and maintenance of the Project could affect wetland habitat. In particular, maintenance of the Project infrastructure, winter maintenance activities, and vegetation management initiatives all have potential to adversely affect wetlands.

As part of infrastructure maintenance, the roadside shoulder will be periodically graded and ditched to improve water flow, reduce erosion and/or to deter excessive vegetative growth. These maintenance activities have potential to adversely impact the quality of wetland habitat through the direct disturbance of their vegetation and soils, as well as affects to their hydrology. Furthermore, indirect impacts can result from the release of sediment into wetlands.

During winter, salt is used by NSTIR on road surfaces to aid in melting snow and to provide clear road conditions. Road salt can enter into the environment (surface water, groundwater, and soil) through storage and application of these salts. The highest concentrations are usually associated with winter and spring thaws. Road salt application has the potential to result in damage to wetland habitat and/or loss of wetland function and quality. Salt storage and snow disposal areas will not be located in proximity to salt vulnerable areas along the RoW, including wetlands, as stated in the NSTIR Salt Management Strategy for this Project (Appendix C).

Vegetation management will consist primarily of mechanical control of vegetation. Regular mowing will occur on the shoulder of the road and occasional mowing of the median will occur on an as-needed basis to control the growth of trees and tall shrubs. Vegetation control on road shoulders and interchanges will be conducted by both manual and mechanical clearing during operation (see Section 2.3.2.4). These activities will result in the direct disturbance of wetland habitat.

The use of herbicides for vegetation management will generally be avoided but may be considered where undesirable species persist. For example, they may be required in areas where physical vegetation management techniques are unsuccessful at controlling noxious weeds. The use of herbicides in source water areas for wetlands has the potential to affect the survival and composition of the botanical community and wetland fauna. Herbicide use, if required, will be in accordance with the NSTIR‟s IRVM Manual.

5.6.70 Other Projects and Activities

Existing and Planned Linear Features

Linear features, including power line corridors, railways, and various types of roads, cause direct disturbance and loss (through infilling) of wetland habitats and also indirectly influence wetland character and function. For example, the existing highway has influenced adjacent wetlands (particularly along its north side) in a number of ways by acting as a hydrological barrier. By altering the hydrology of such areas, the existing highway has, in turn, influenced a number of wetland features related to its function, such as its size, hydroperiod, types of vegetative communities present, and the range of wildlife species which are supported.

Ongoing operation and maintenance activities of linear features also have important affects on vegetation. For example, herbicide applications along power line corridors are an obvious stressor to wetland plants, and increased levels of roadside sedimentation and/or salinity as a result of winter safety applications can cause changes to wetland habitats. Wetland quality and function may be affected by runoff through operation of the Project.

Residential and Commercial Land Use

Clearing activities associated with residential and commercial land use can affect the quantity and quality of wetland habitat through sedimentation, erosion, hydrological alterations, infilling and other disturbances. As such, existing residential and commercial land use in the Assessment Area has likely resulted in a direct reduction of total wetland area and affected wetland quality and function. Additionally, residential and commercial developments have potential to influence wetlands through the discharge of deleterious substances or invasive species. New residential and commercial developments are subject to an approval process in Nova Scotia (NSE 2006a) which emphasizes the avoidance and minimization of wetland impacts, and compensation for alterations. Despite the approval process and compensation obligations, future residential and commercial impacts on wetland habitat are likely to occur.

Resource Land Use

Forestry and quarrying activities are important forms of resource land use within the Assessment Area and have potential to impact both the quantity and quality of wetlands. Forestry activities have been extensive throughout the Assessment Area and many of the treed swamps have been cleared, at least in part, of their woody vegetation. Additionally, these activities have resulted in some soil disturbance and alterations to wetland hydrology (*e.g.*, skidder trails may cause soil compaction and in doing so can re-direct surface flow). Several areas on the north side of the existing highway have been subject to quarrying activities. During their operation, pits and quarries may result in the direct loss of wetland habitat and may also have indirect effects - for example, through sedimentation events if appropriate erosion and runoff control measures have not been implemented.

Recreational Land Use

Recreational land use can effect wetland quality and function through the use of all terrain vehicles (ATV; motorized and non-motorized) in wetland areas. The highway presence can increase ATVs accessibility to wetlands. These activities can cause damage to wetland through rutting, which causes direct damage to wetland vegetation and soils, and indirect damage by changing hydrological patterns and increasing sedimentation, and introduction of new species from other locations the ATVs traverse. Although tracks were observed in the Assessment Area, no well defined ATV tracks were observed in the Assessed Wetlands.

5.6.71 Environmental Effects Assessment

This section provides an evaluation of key potential Project-VEC interactions as summarized in the environmental effects assessment matrix (Table 5.66).

Table 5.66 Environmental Effects Assessment Matrix for Wetlands

Environmental Effects Assessment Matrix Valued Environmental Component: WETLANDS							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/ Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Construction							
Site Preparation	• Change in wetland quality (A) • Change in wetland quantity (A) • Loss of wetland function (A)	• Avoidance (narrow medians) • Follow EPP • Erosion control measures • Minimize work in and near wetland • Wetland compensation plan • Cleaning of construction machinery prior to leaving wetlands	2	1	2/6	I	2
Roadbed Construction	• Change in wetland quality (A) • Change in wetland quantity (A) • Loss of wetland function (A)	• Avoidance (narrow medians) • Follow EPP • Minimize work in and near wetland • Erosion control measures	1	1	2/1	R	2
Watercourse Crossing Structure Construction	• Change in wetland quality (A) • Change in wetland quantity (A) • Loss of wetland function (A)	• Follow Watercourse and Wetland Alterations approval conditions • Follow EPP • Erosion control measures • Minimize area of disturbance	1	2	1/6	I	2
Operation and Maintenance							
Infrastructure Maintenance	• Change in Wetland Quality (A) • Loss of Wetland Function (A)	• Follow EPP	1	1	2/1	R	2
Winter Maintenance	• Change in Wetland Quality (A) • Loss of Wetland Function (A)	• Follow NSTIR Salt Management Plan • Follow EPP	1	1	5/6	R	2

Table 5.66 Environmental Effects Assessment Matrix for Wetlands

Environmental Effects Assessment Matrix Valued Environmental Component: WETLANDS							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** (A = Adverse; P = Positive)	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/ Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Vegetation Management	• Loss of Wetland Function (A) • Change in Wetland Quality (A)	• Follow EPP • No herbicide use in wetlands	1	1	1/1	R	2

Key

Magnitude:
1 = Low: *e.g.,* specific group, habitat, or ecosystem localized one generation or less, within natural variation
2 = Medium: *e.g.,* portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability
3 = High: *e.g.,* affecting a whole stock, population, habitat or ecosystem, outside the range of natural variation

Geographic Extent:
1 = <1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101 - 1,000 km^2
5 = 1,001 - 10,000 km^2
6 = >10,000 km^2

Duration:
1 = <1 month
2 = 1 - 12 months
3 = 13 - 36 months
4 = 37 - 72 months
5 = >72 months

Frequency:
1 = <11 events/year
2 = 11 - 50 events/year
3 = 51 - 100 events/year
4 = 101 – 200 events/year
5 = >200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not Applicable
(A) = adverse
(P) = positive

5.6.71.1 Construction

The mitigative sequence has been adopted as the approach to wetlands in the Study Corridor to ensure no net loss of wetland habitat as a result of the Project. The mitigative sequence is a step-wise approach that provides a foundation for the decision making process. It achieves wetland conservation through the application of a hierarchical process of alternatives as follows: 1) avoidance of impacts; 2) minimization of unavoidable impacts; and 3) compensation for residual impacts that cannot be minimized. Within the context of the mitigative sequence, approvals will be sought for unavoidable wetland alterations.

Due to the limitations of other technical and environmental constraints, avoidance of impacts to wetlands of the Assessment Area is very difficult. Issues regarding the economical feasibility of the Project, technical aspects of highway construction, and environmental concerns related to the direct loss and fragmentation of natural habitat all indicate that the Project is best if in close proximity (*i.e.*, adjacent) to the existing Highway 103. Such constraints limit the spatial flexibility of the Project and therefore its ability to avoid direct impacts to wetlands within the area. Furthermore, the abundance of wetlands throughout the extent of the Assessment Area also constrains the ability of the Project to avoid alteration of wetland habitat. As such, the Project is expected to directly impact 108 wetlands, for a cumulative total of almost 18 ha of wetland habitat, during construction activities. These quantities account for over 8% of the wetland habitat described in the Assessment Area. However, because field surveys were limited to about 20% of the Assessment Area (the Study Corridor was a 200 m wide swath whereas the Assessment area is 1000 m wide) this proportion of impacted wetland is likely over-estimated. That is, the use of air photo interpretation for identifying wetland boundaries outside of the Study Corridor would not be sufficient to capture many small wetlands, particularly those that are dominated by woody vegetation.

Avoidance will be used as a means of wetland conservation along the southern side of the RoW. Wetlands within or adjacent to the RoW which are located to the south of the existing highway and which do not have planned access roads through them will be documented in the EPP and avoided by construction-related activities, including 30 m non-disturbance buffers. Additionally, although impacts to wetlands located outside of the RoW have potential to be affected by off-RoW vehicle traffic, these areas will also be documented in the EPP and mechanized activity will not be permitted within 30 m of their boundaries.

The use of narrow medians along portions of the Project will help minimize impacts to wetland habitat with high ecological value. Narrow medians have been proposed for two areas along the route, including an area over 3 km long around Little Indian and Mill Lake (chainage approximately 2+165 to 5+500 m) and at the western end the Project (chainage approximately 15+200 m to Exit 6). The narrow median approach within these areas will reduce impacts to at least 19 wetlands found on the northern side of the RoW, including Wetlands 39, 40, 49, 244, 249, 253, 259, 261, 267, 268, 277, 283, 290, 294, 296, 303, 306, 324, and 325. Many of these wetlands may be considered to be amongst the most ecologically significant of those within the Study Corridor. For example, Wetlands 49 and 296 are complexes located on the shores of Little Indian and Dorey Lakes, respectively, and provide important wildlife and hydrologically-related functions in association with these water bodies. For example, they provide high quality fish and waterfowl habitat and are important shoreline erosion control, baseflow maintenance, and may export nutrients and organic carbon to support aquatic processes. Furthermore, several of these wetlands were found to provide habitat for Species At Risk or of Conservation Concern, including the Canada Warbler (Wetland 283) and Rusty Blackbird (Wetlands 277 and 294), southern twayblade (Wetland 249), as well as small swollen bladderwort and woods-rush (Wetland 296). The use of narrow medians within these areas will therefore minimize adverse effects of the Project on the ability of these wetlands to continue to provide these important functions. Other initiatives to minimize unavoidable impacts to wetlands by construction activities are discussed in the following sections on site preparation, roadbed construction, and the construction of watercourse crossing structures.

Wetland habitat will not be disturbed without a Wetland Alteration Approval from NSE. In accordance with the Activities Designation Regulations (Activities Designation Regulations, 2007) which specifies the requisite information to support an application for Wetland Alteration Approvals, site specific plans for minimization of wetland alteration will be developed.

It is understood that Wetland Alteration Approvals may be contingent on the fulfillment of compensation obligations to ensure “no net loss” of wetland habitat as a result of the Project. Compensation requires that the residual impacts on the wetland functions are compensated by the enhancement, restoration, or creation of a wetland ecosystem at an area ratio commensurate with the loss.

To offset unavoidable wetland alteration, a wetland compensation plan is being developed in consultation with NSDNR and NSE prior to wetland disturbance (refer to Section 5.6.9). The compensation proposal will be agreeable to NSDNR and NSE, and will emphasize in-watershed function replacement. The objective of the compensation plan will be to ensure no net loss of wetland area or wetland function for up to 18 ha of altered wetland that requires compensation.

Site Preparation

As discussed previously, impacts to wetland habitat as a result of erosion and sedimentation may occur during all Project phases. However, these affects have potential to be most serious during site preparation activities, which include the clearing, grubbing, and infilling of upland and wetland habitat. As such, although erosion and sedimentation control measures apply to all phases where Project-induced erosion or sedimentation is possible, they are summarized here. Erosion control systems will be in place to manage runoff from the construction areas, as discussed in Section 2.3.1.1. NSTIR emphasizes the prevention of erosion rather than the capture of sediment prior to its release in watercourses and wetlands by minimizing the time, slope and area of exposed soil. Erosion control measures are identified in Section 3.2 of the Generic EPP, and also include erosion control fencing, check dams, use of mulch (possibly from shrubs and trees removed during clearing) and, if necessary, sedimentation control ponds. Contingency Plans will be developed and emergency resources will be available on site to react to unforeseen events. Sediment and erosion control will be carried out according to all applicable standards, regulations, the EPP, and site specific terms and conditions of government approvals, authorizations and letters of advice.

Roadbed Construction

Erosion and sedimentation control measures will remain following site (*i.e.*, roadbed) preparation. Site specific mitigation for roadbed construction will be developed through the Wetland Alteration Approval process and detailed in the terms and conditions of the Wetland Alteration Approval. Furthermore, Project-related off road activity will be limited during roadbed construction, Employee environmental awareness training

Additionally, as discussed in the Wildlife and Wildlife Habitat VEC (Section 5.5), a number of mitigative actions will be undertaken to minimize the effect of roadbed construction activities on wetland-related wildlife. Silt fencing will be erected along the roadbed toe of slope at Little Indian and Sawler Lakes to keep nesting snapping turtles out of the construction sites and an artificial loon nesting platform in Mill Lake will be erected to provide an alternative nest site during construction. Where feasible, blasting around the Mill Lake and Dorey Lake areas will be conducted outside of the bird breeding season (May 1 to August 31) to reduce impacts to bird Species at Risk and of Conservation Concern within these areas (*e.g.*, Canada warbler, rusty blackbird).

In wetlands where peat depths exceed 1 m the road bed will be installed progressively in 3 m increments of peat removal and direct replacement with structural fill to minimize the potential for over-excavation or overfilling, due to slumping on exposed edges of peat. Peat depths of greater than 1 m were documented in Wetlands 5, 10, 16, 49, 88, 94, 114, 129, 226, 249, 259, 283, 285, 219, and 146.

Watercourse Crossing Structure Construction

Many of the wetlands within the Assessment Area encompass watercourses or are immediately adjacent to them. As such, they are potentially susceptible to adverse effects resulting from the construction of watercourse crossing structures, including drainage, flooding, or sedimentation from erosion events. In addition to the erosion and sedimentation control practices outlined in Section 3.2 of the Generic EPP, the following mitigative measures regarding the installation of watercourse crossing infrastructure, such as culverts and bridges, will be followed and detailed through the Wetland Alteration Approval process:

- Preparation of site-specific erosion and sedimentation control procedures for each wetland crossing;
- Field flagging of wetland boundaries for avoidance;
- Contractor environmental awareness training, focusing on avoidance and minimization of wetland impacts ;
- Control of runoff from construction to reduce potential turbidity and sedimentation; and
- Use of clean, pH neutral, non-leaching, coarse fill materials within wetland areas.
- In addition to the anticipated conditions of Wetland Alteration Approvals which are required for Projects that may affect wetland habitat, the following mitigative measures will be considered for wetlands:
- Design culverts to accommodate water level equalization to allow peak and low flows;
- Retain existing circulatory patterns;
- Maintain existing orientation and minimum discharge elevation and cross-sections of streams in areas where narrow medians require extension of existing culverts, to ensure continued access to wetlands by aquatic life (*e.g.*, Wetland 277).
- Minimize channelling;
- Consider permeability and compression to allow for the passage of substrate water wherever feasible;
- Minimize the draining of surface water;

- Reduce median widths and increase slope of embankments to 2:1 where feasible;
- Restrict construction activities to designated roadways and access points of the Project; and
- Limit the extent of clearing to the outside toe of slope.

Additionally, as discussed in the Wildlife and Wildlife Habitat VEC (Section 5.5), a number of mitigative actions will be undertaken to minimize the effect of watercourse crossing structure construction on wetland-related wildlife. In particular, artificial nesting sites will be provided for barn swallows during construction and new bridges will utilize steel I beam trusses to provide additional barn swallow nesting habitat. In addition, areas will be cleared outside of the bird breeding season to minimize impacts to wetland-associated wildlife.

During construction, NSTIR will ensure that the installations are conducted according to the Contract documents, that the terms and conditions of Wetland Alteration Approval are met so as not to alter wetland habitat beyond the Project footprint.

Summary

Based on the wetland evaluations, consideration of the potential environmental effects of the activities required for site preparation of the Project, the proposed mitigation (*e.g.,* avoidance, minimization, and compensation), and the residual environmental effects significance ratings criteria, the environmental effects on Wetlands by construction activities are not likely to be significant.

5.6.71.2 Operation and Maintenance

In general, the operation and maintenance of the Project will not differ greatly from that of the existing Highway 103 with the exception that the increase in road area will necessitate an increase in salt loading. However, the effects of operation and maintenance on wetland habitat are not expected to differ from existing conditions.

Infrastructure Maintenance

As part of infrastructure maintenance, ditching may be required to improve water flow, reduce erosion and/or to deter excessive vegetative growth. Small scale hydrological modifications, such as ditch maintenance, could adversely affect the functioning of adjacent wetlands. For example, certain rare plants associated with wetlands of the Assessment Area (*e.g.*, southern twayblade) are considered to be sensitive to changes in their habitat, such as may be brought about by disturbances, sedimentation, or changes in hydrology. Any additional unplanned maintenance required post-construction will be assessed for the potential to enhance or reduce drainage from wetlands or to discharge sediment to wetlands, and appropriate mitigation will be implemented. Site specific mitigation for individual wetland impacts developed during the Wetland Alteration Approval process and outlined in the EPP will be used as a minimum.

Recreational Vehicles

Mitigation measures will be employed to limit unwanted ATV and snowmobile traffic in wetlands. The specific measures to be employed will be determined based on the specific geographic conditions that exist, and after discussions with landowners, stakeholders and regulatory agencies, as appropriate. Measures typically employed for access management include installation of natural barriers using the natural topography to advantage where practicable (*e.g.*, placement of rock barriers, planting of tree and shrub barriers), fencing and posting of signs prohibiting wetland. Development of a Public Awareness Program, intended to educate potential users of the RoW, will include a discussion of trespass and the potential consequences of unauthorized and/or unlawful entry onto properties along the RoW.

Winter Maintenance

Salt loading will be minimized by following the NSTIR Salt Management Plan, which specifies application rates and techniques. Mitigation measures include following the EPP (Section 3.18), applying drainage controls, employee environmental awareness training prior to commencement of maintenance activities (*e.g.,* salt and sand application during winter), and increased vigilance and inspection of permanent erosion and sediment control structures, particularly in areas identified as being sensitive.

Additionally, techniques that reduce the amount of road salt used will be employed. These include the use of road weather information systems to monitor road surface conditions, pre-wetting of salt, and the use of anti-icing systems such as brine solutions to minimize the amount of salt required. These techniques would minimize salt-induced stressors to wetland habitats as well as other important environmental components. Wetlands known to provide habitat for plant Species of Conservation Concern are to be considered salt sensitive areas for which pre-wetting and anti-icing agents will be employed.

Vegetation Management

Vegetation control on road shoulders and interchanges will be conducted by both manual and mechanical clearing during operation (see Section 2.3.2.4). The use of herbicides for vegetation control may be required in areas where physical vegetation management techniques are unsuccessful at controlling noxious weeds. Physical vegetation control activities within 30 m of a wetland and the use of herbicides in drainage areas for wetlands have the potential to affect the survival and composition of the botanical community and wetland fauna. As such, no vehicles will be permitted to operate from within the boundaries of wetlands for the purpose of controlling the growth of their trees and tall shrubs (*i.e.*, they will be operated from outside the edge of wetlands or hand tools will be used).

To minimize potential impacts to southern twayblade, relevant sections of Wetland 249 will be surveyed for this species prior to any vegetation management initiatives. Such surveys will be used to identify the location and abundance of southern twayblade within the area designated for vegetation maintenance and will help identify whether additional precautionary initiatives can be taken to avoid disturbance to those plants. In addition, the locations of plant Species at Risk or of Conservation Concern within wetlands of the RoW will be noted in the EPP and only mechanical vegetation control will be permitted in these areas.

Additional mitigative measures involving the flagging of setbacks and limits on the use of herbicides will be implemented to prevent disturbance to the remaining portions of partially affected wetlands and to avoid disturbance to nearby ones. Details of the site specific mitigation will be outlined in construction specifications and developed during the Wetland Alteration Approvals process.

Summary

Based on available data and assumptions and consideration of the potential environmental effects of the activities required for the operation and maintenance phase of the Project, the proposed mitigation (*e.g.,* Generic EPP and other wetland-specific mitigation developed during Wetland Alteration Approvals process), and the residual environmental effects significance ratings criteria, the environmental effects of operation and maintenance on wetlands are not expected to be significant.

5.6.71.3 Assessment of Cumulative Environmental Effects

Potential cumulative environmental effects on wetlands are primarily related to wetland alteration or loss as a result of Project construction activities in combination with those of other developments or human activities within the watersheds of the Assessment Area, including all past, current, and future initiatives.

The Project is identified to directly impact approximately 18 ha of wetland habitat, accounting for over 8% of that within the Assessment Area but complementary data on the effects of other activities are not currently available. However, historical activities which are known or likely to have caused a loss and/or change in the quantity and quality of wetlands in the Assessment Area include the construction and operation of Highway 103 and other roads, a railway, electrical transmission lines, hydroelectric generation facilities, borrow pits, forestry operations, and housing and commercial property development. Although these activities have had notable impacts on the Assessment Area, the landscape in which the Project is located is relatively intact. For example, approximately 84% of the Assessment Area is dominated by naturally-regenerating vegetation (*i.e.*, that which is not comprised of anthropogenic infrastructure) and as much as 75% has not recently been affected by human disturbances (*i.e.*, areas not comprised of anthropogenic infrastructure or subject to recent clear cutting practices). Although data on the historical loss of wetlands within the province is currently lacking, there is a general consensus that areas which have been most impacted are those which have been heavily utilized for agricultural purposes. However, data on the distribution and abundance of land use types within the Assessment Area (see Section 6.1) do not indicate that agricultural activities have been an important component of past land use within the area. Additionally, whereas historical impacts to salt marshes within the province have been an important driving factor in wetland conservation, no salt marshes have been identified for impact by the current Project.

Existing and Planned Linear Features

The most apparent potential source of cumulative effects are those associated with the Project and other linear developments, particularly the existing Highway 103. Hydrological impediments caused by the roadbed, improperly designed culverts, and road runoff from the existing highway are already influencing many of the wetlands identified for direct impact by the Project, especially for those on the northern side of the existing highway. However, because the twinning component of the Project is slated to be immediately adjacent to the existing infrastructure, cumulative effects due to interaction between these sources will be minimal. That is, wetland areas currently influenced by the presence of the existing highway are slated to be directly impacted (*i.e.*, infilled) of the twinning component of the current Project. However, wetlands located between the future twinning alignment and associated access (and other) roads will be subject to cumulative effects related to the presence, operation, and maintenance of these features. Indirect impacts to remaining portions of wetlands will be minimized by proper salt management (Salt Management Strategy, Appendix C), erosion and sediment control during construction (EPP, Section 3.2), vegetation management (NSTIR Integrated Vegetation Management Plan), and proper watercourse crossing structure design (NSTIR 1997 and revisions).

Wetlands in close proximity to the infrastructure of the Project and other developments will be influenced by cumulative effects related to habitat fragmentation. Fragmentation can adversely affect both wetland vegetation and wildlife by increasing the prominence of edge-influenced habitat, promoting the spread and establishment of synanthropic species (*i.e.*, those associated with human activity), and creating barriers to dispersal for other taxa. However, some of the cumulative effects (*i.e.*, edge influences) resulting from the Proposed will be minimized by the adjacent nature of the proposed twinning, as previously discussed. For more detailed discussion on the cumulative effects of the Project on wetland vegetation and wildlife as they relate to fragmentation and the promotion of multiple edge effects, refer to Sections 5.4.7.3 and 5.5.7.3.

Residential and Commercial Land Use

The Project may promote residential and/or commercial development in the Assessment Area as a result of improved highway conditions and access to adjacent properties. Although such development could occur along the entire length of the Project, the most pronounced increases are likely to be observed at the eastern and western ends of the Assessment Area. New residential and commercial land uses may result in further loss of wetland quantity and/or reductions in quality due to the direct loss of wetland and through habitat fragmentation, edge influences, and the contamination of terrestrial and aquatic habitats. However, future alterations to wetland habitat within the Assessment Area will be subject to the avoidance-minimization-compensation framework of wetland conservation adopted by the province, and will necessitate approval from NSE, including site specific plans for minimization of impacts.

Resource Land Use

Due to the prominence of resource land use within the Assessment Area, there is potential for these activities and those of the Project to result in some cumulative effects on wetland habitat. In particular, forestry activities have had a pronounced effect on the character of many wetlands within the Assessment Area through the removal of their woody vegetation. Although impacts of forestry activities on wetland habitat are potentially temporary, semi-permanent loss of some attributes can result depending on the intensity and periodicity of management initiatives. Wetlands which will be in close proximity to the proposed highway infrastructure and which are also influenced by forestry activities will potentially be subject to the cumulative stress imposed by them. However, a number of previously-discussed mitigative measures will be employed to minimize impacts of roadway maintenance and operation on adjacent wetlands and any potential impacts are likely to be restricted to the area immediately adjacent infrastructure.

Recreational Land Use

Recreational usage within the Assessment Area could increase as a result of the Project, particularly if it contributes to greater residential development or access to adjacent properties. Increased recreational activities may result in loss of wetland quality and function, particularly through the use of ATVs in wetland areas. Proposed monitoring of wetlands will identify whether ATVs are active in the area, and appropriate mitigation will be employed, as described in Section 1.1.7.2.

5.6.72 Determination of Significance

Table 5.67 evaluates the significance of potential residual environmental effects resulting from interactions between Project activities and wetlands, after taking into account any proposed mitigation and compensation associated with the Project. Mitigation includes avoidance of wetlands where possible, minimization of impacts through the use of narrow medians, limits to disturbance activities, adherence to the EPP, awareness training for contractors, site specific mitigation determined during the Wetland Alteration Approvals Process, and offset of wetland alterations through compensation (wetland enhancement, restoration, and/or creation). The evaluation considers the level of confidence of the study team in this determination and the likelihood of potential environmental effects. The residual environmental effects, including cumulative environmental effects, are rated not significant for construction and operation and maintenance because:

- The Project will not result in the loss of a wetland type, and its associated functions in the Assessment Area
  - All wetland classes identified in the Assessment Area will be represented post-construction (Table 5.63 Direct Impact of Project on Wetlands by Class)
- The Project will not affect a high proportion of wetlands (greater than 25%), locally

    - In total, 8.38% of wetlands identified in the Assessment Area will be affected by the Project
- The Project will not result in a permanent loss of wetland area and associated functions
    - Wetland area, and associated functions, affected by the Project will be compensated for by restoration, enhancement or creation of wetland area in another location.

Table 5.67 Residual Environmental Effects Summary Matrix for Wetlands

Residual Environmental Effects Summary Matrix Valued Environmental Component: WETLANDS				
Phase	Residual Environmental Effects Rating, Including Cumulative Environmental Effects*	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Construction	NS	3	N/A	N/A
Operation and Maintenance	NS	3	N/A	N/A
Project Overall	NS	3	N/A	N/A

Key

Residual Environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Level of Confidence
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence
N/A= Not Applicable

Scientific Certainty: based on scientific information and statistical analysis or professional judgment
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence
N/A= Not Applicable

*As determined in consideration of established residual environmental effects rating criteria.

5.6.73 Follow-up and Monitoring

Wetland Alteration Approvals are required from NSE before wetlands can be altered. As such, site works that may affect wetlands will not proceed until the requisite approvals are acquired. Approvals will be sought for wetlands that cannot be avoided and for wetlands that may be indirectly affected by the development despite the employment of appropriate mitigation measures (Table 5.67). The appropriate application forms (Water Approval) will be accompanied by the requisite information for each site, as outlined in the Activities Designation Regulations (2007). Additionally, site specific plans for minimization of wetland alteration will be developed in accordance with this bulletin (or relevant policy guidance at the time of application).

A wetland compensation plan will be developed in consultation with NSDNR and NSE prior to wetland disturbance. Compensation requires that the residual impacts on the wetland functions are compensated by the enhancement, restoration, or creation of wetland habitat at an area ratio commensurate with the loss. As such, the objective of the compensation plan will be to ensure no net loss of wetland area or wetland function for up to 18 ha of altered wetland. In-watershed function replacement will be emphasized in the development of the wetland compensation plan.

Monitoring will be conducted to confirm the extent of wetland alteration, the effectiveness of mitigative measures, and the successful completion of compensatory wetland restoration and creation. Efforts will be directed at existing wetlands along the Highway 103 (a subset of sites representative of the wetland types within the Assessment Area) as well as those enhanced, restored, or created as a result of compensatory obligations. Monitoring will be used to assess the status of ecological and hydrological parameters and will be used to guide adaptive management initiatives. A period of five years is recommended for the initial monitoring phase after which the data will be used to assess whether ongoing efforts are required to meet the objectives of the mitigative and compensation initiatives. With regards to the compensatory project, a functional assessment of the involved wetlands will be conducted to determine if they have developed the attributes deemed necessary to compensate for those lost due to the Project. Site specific monitoring plans will be developed through consultations with NSDNR and NSE.

6.0 SOCIOECONOMIC ENVIRONMENTAL EFFECTS ASESSMENT

6.1 Land Use

6.1.1 Rationale for Selection as Valued Environmental Component

Section 2(1) of *CEAA* considers socio-economic effects in terms of any change or resulting effect that the project may cause in the environment (including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species) on health and socio-economic conditions. In consideration of this interpretation of socio-economic effects, while also meeting the requirements of the Terms of Reference for this environmental assessment, this analysis focuses on effects the twinning Project may have on land use as a result of changes to the biophysical environment.

Land Use was selected as a VEC in consideration of potential Project-related interactions with current and anticipated land uses in the vicinity of the Project. The potential environmental effects of the Project are assessed for the immediate vicinity of the proposed Project (*i.e.*, the RoW) and the surrounding areas, including Hubbards and St. Margaret"s Bay.

The discussion of land use will also consider current use of lands and resources by Aboriginal persons which is defined as the known use of lands, and resources within those lands, which are within the Project RoW or on adjacent lands where those uses and resources are potentially affected by the Project. This "use" refers to contemporary hunting, fishing, and gathering activities for subsistence purposes as well as the use of lands and resources for social and ceremonial activities.

6.1.2 Environmental Assessment Boundaries

6.1.2.1 Spatial

The assessment boundaries for potential environmental effects of the Project on Land Use include the RoW (Highway 103) and adjacent lands, and surrounding communities such as St. Margaret"s Bay, Hubbards, Simms Settlement, Ingramport and Upper Tantallon, where Project-related activities could potentially interact with current and anticipated land uses.

6.1.2.2 Temporal

The temporal boundaries for the assessment of the potential environmental effects of the Project on Land Use include construction and operation and maintenance of the Project in perpetuity. Certain aspects of land use and community life (*i.e.*, recreational activities and economic activity related to tourism) are seasonal and will be affected to a greater or lesser extent according to the timing of the Project interaction.

6.1.2.3 Administrative and Technical

Land-use planning and development on the area is coordinated through Halifax Regional Municipality (HRM) and Lunenburg County. Within HRM the area is subject to regulations and bylaws set out in the Municipal Planning Strategy for Planning Districts 1 & 3 (St. Margaret"s Bay) and Land Use By-Laws, which took effect in May, 1995. According to the Future Land Use Maps from the Regional Municipal Planning Strategy, HRM zoning determination in the Project area is zoned Rural Commuter (HRM 1995, as amended).

Within Lunenburg County the area is subject to regulation and bylaws set out in the Municipality District of Chester Municipal Planning Strategy and Land Use By-laws taking effect in May, 1997. Among other things, these documents outline the overarching growth and development strategy for the area, presents the environmental constraints for potential development at various locations, and determines the permitted land uses of the area via zoning determinations.

Information used in support of the assessment of Land Use was obtained from available maps and property identification data, site visits, available provincial government and municipal documentation, and consultation with local municipal planners. Direct knowledge of the Project area was obtained during a windshield survey conducted on May 19, 2010.

6.1.3 Residual Environmental Effects Rating Criteria

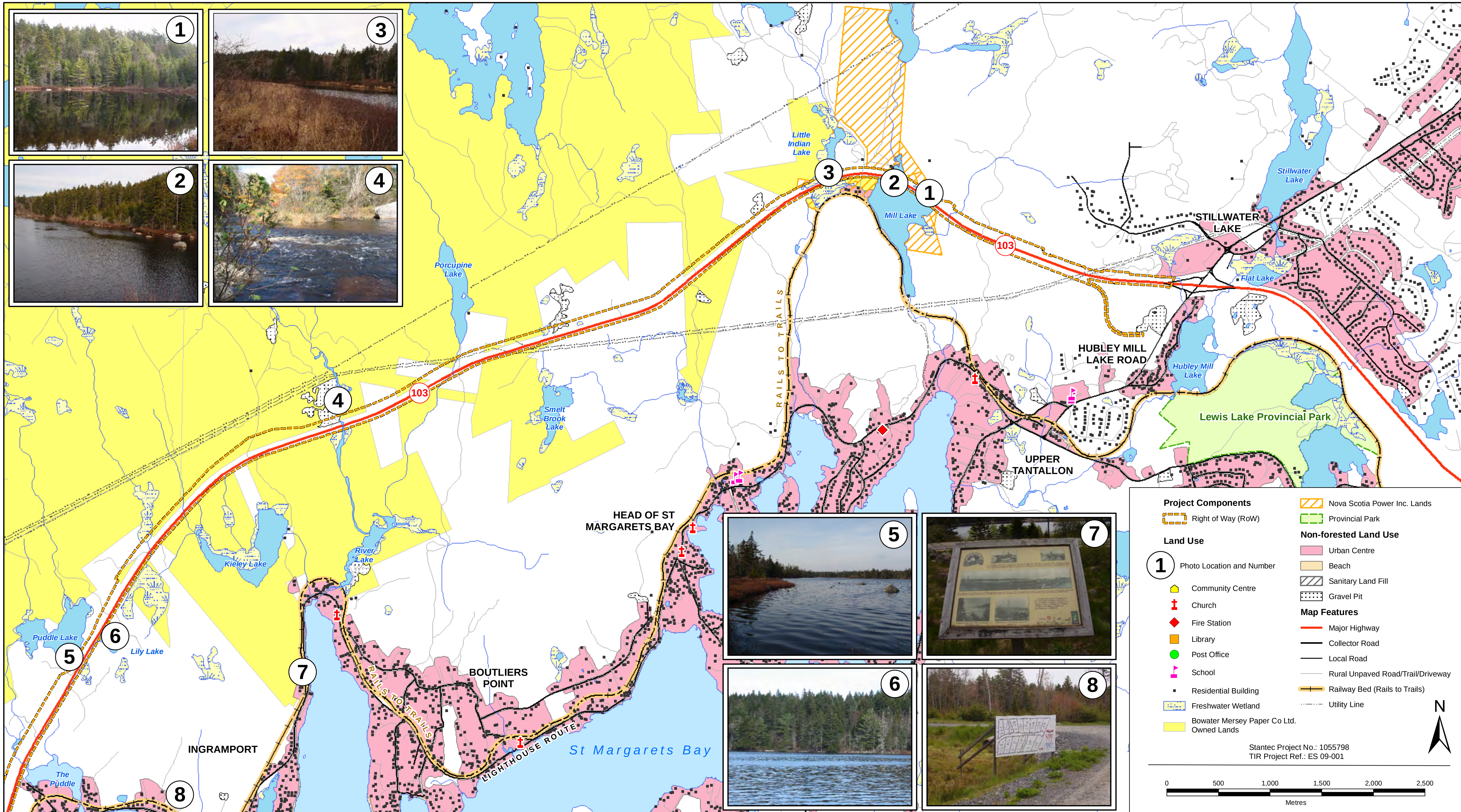
A **significant residual adverse environmental effect** on Land Use is one where Project activities will result in environmental effects on the land such that the existing activities cannot continue at current levels for extended periods of time (*i.e.,* beyond the Construction phase) and cannot be compensated.

A **significant adverse residual environmental effect** on Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons is defined as an unmitigated detrimental long-term Project-induced change in the current use of land and resources for traditional purposes by Aboriginal people or First Nation communities.

6.1.4 Baseline Conditions

6.1.4.1 General Overview of Land Use

Land use along the proposed highway corridor consists of industrial and natural resources uses (refer to Figures 6.1.1a-b). There are approximately 156 property owners within the Project Area and it is likely that the proposed Project will interact to some degree with these properties; however, NSTIR owns the RoW within which construction and operation activities will occur



DATE: September 2010

PREPARED BY: M. Huskins-Shupe

NOVA SCOTIA Transportation and Infrastructure Renewal

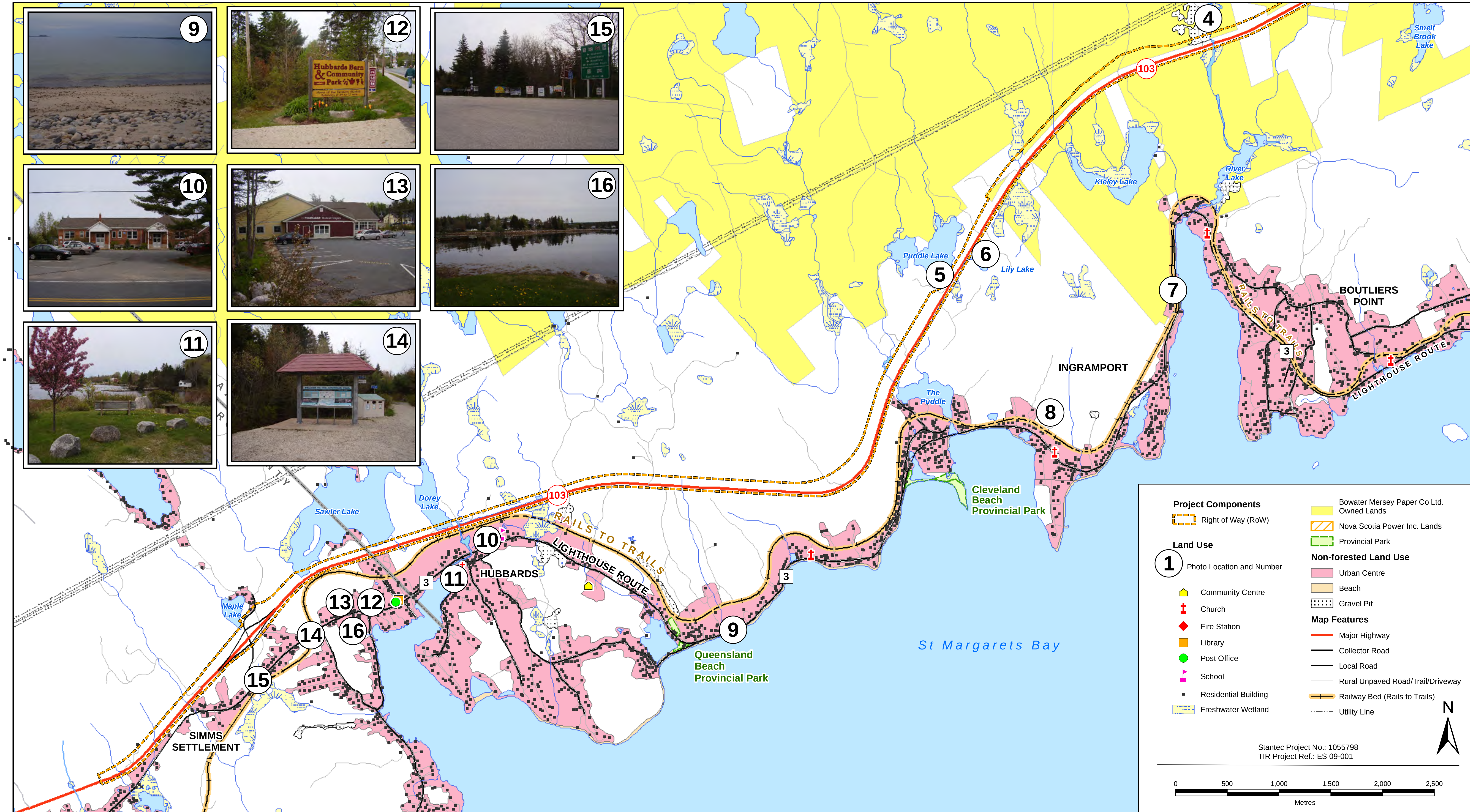
Data Reference:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographic Database (NSTDB), 1997
Project Data: Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
Land Use and Limited Use Lands Data: Nova Scotia Department of Natural Resources (NSDNR)
Wetlands: NSDNR, Wetland Mapping Inventory, 2007

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Land Use
Map 1

FIGURE NO.: 6.1.1a

Stantec



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Land Use and Limited Use Lands Data: Nova Scotia Department of Natural Resources (NSDNR)
Wetlands: NSDNR, Wetland Mapping Inventory, 2007

Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening

Land Use
Map 2

FIGURE NO.: 6.1.1b

Stantec

Land use on the south side of the proposed corridor consists of a combination of commercial, residential, institutional and resource uses. Several communities are found within or adjacent to this area including: Upper Tantallon, Head of St. Margaret‟s Bay, Boutilier‟s Point, Ingramport, Hubbards and Simms Settlement. Numerous residential properties are located adjacent to the proposed highway corridor and along the nearby shoreline.

Land use to the north of the proposed corridor consists mainly of industrial and natural resources. Bowater Mersey Paper Company Ltd owns the majority of the land to the north of the corridor with NSPIowning a smaller property to the northeast of the Project area associated with a hydroelectric plant on Mill Lake. There is, however, some residential land use along Sawler Lake and Maple north of the proposed corridor.

There are no municipal water or sewer systems in the study area; inhabitants depend on privately-owned onsite services. As noted in the MPS for Planning Districts 1 & 3, the installation of municipal water and sewer systems in Districts 1 and 3 would be prohibitively expensive and is not a viable or realistic option, in spite of growing concerns of population growth, malfunctioning onsite sewage systems, and issues with the quantity and quality of potable water (HRM 1995, as amended). The Planning Districts 1 & 3 MPS also indicated the residents give water resource a high priority: policies on setbacks from watercourses and enforcement of environment construction practice specifications that minimize impacts to quality and quantity of surface water.

6.1.4.2 Residential Land Use

The description of residential land use considers existing and anticipated land use.

There are a number of residential properties located adjacent to the proposed highway twinning; however, a majority of the properties are located off Highway 3 to the south of the proposed highway twinning, in the communities of Simms Settlement, Hubbards, Ingramport, Boutilier‟s Point, Head of St Margaret‟s Bay and Upper Tantallon. Residential land use varies from traditional coastline development along St. Margaret‟s Bay to suburban residential development on the eastern side of the Project area in Upper Tantallon. On the western side of the Project area the communities Simms Settlement and Hubbards are located in close proximity to Highway 103 bordering the proposed corridor. There is a mobile home park in Simms Settlement adjacent to the proposed highway RoW.

To the north of the proposed highway twinning, along Sawler Lake and Maple Lake, there are also several residential properties. As with many of the homes within the Project area, summer cottages have now become year-round residences. There is one structure within the RoW, approximately 160 m from the proposed centerline of the twinned lanes. The nearest structure however, is outside the RoW and is approximately 80 m from the proposed centreline.

Although there are numerous properties adjacent to the proposed highway twinning, NSTIR owns the properties along the proposed highway corridor, therefore, expropriation is not required for the RoW. Additional land may need to be acquired for the construction of property access roads.

Currently there are several residential developments in the design and/or construction phase along Highway 103 and St Margaret"s Bay. There have been some private road approvals and street completion for the St. Margaret"s Bay Village, E.W. Enterprises, and St. Margaret"s Bay Heights developments (R. MacNeil, HRM, pers. comm. 2010). Flemming Heights Phase Two, a residential development located in Black Point, has had lot approvals and street completion. Miller"s Landing, located in one of the inlets along St. Margaret"s Bay, will comprise 12 condominiums with semi-attached units (Destiny Developments, 2009). Miller"s Landing was proposed as a 27- unit condominium with several amenities including a marina development in 2004. Due to concern from the local community and Council, the development agreement proposal was amended to a 12-unit condominium development without amenities and was subsequently passed by Council in 2006.

In the District of Chester there are several developments occurring due to in part by the twinning of Highway 103. There have been few lots sold in three large rural subdivisions which are at various stages of approvals on the Aspotogan Peninsula. A 300-lot golf course subdivision is under development in Mill Cove, with a total of 500 lots when built out. Prior to the announcement of the proposed twinning of Highway 103, 40 approved lots in the whole Municipality of the District of Chester would have been considered a big year (G. MacDonald, Municipality District of Chester, pers. comm. 2010). In 2008, amendments were made to the Municipality District of Chester Municipal Planning Strategy (MPS), Land-use Bylaws (LUB) and Subdivision Bylaws (SDB) to better control cluster developments and subdivisions in response to HRM regional planning and the proposed highway twinning (G. MacDonald, Municipality District of Chester, pers. comm. 2010). Recent MPS amendments include setbacks from watercourses and the ocean where development permits are issued.

6.1.4.3 Commercial and Industrial use

Along the proposed corridor, there are few commercial and industrial services. Interhabs, a modular home company, has a manufacturing facility located in Hubbards, just south of Highway 103. This plant employs approximately 30 people (Interhabs, 2006-2007).

Along Highway 3 there are numerous commercial service offerings, including gas stations, grocery stores, restaurants, hardware stores and pharmacies. The majority of these services are located within the Hubbards Shopping Centre on the western side of the Project area and the St. Margaret"s Bay Shopping Village on the eastern side of the Project area. Several bed and breakfast, cottages and inns are located along the waterfront of St. Margaret"s Bay.

6.1.4.4 Institutional Use

There are several institutional uses located along Highway 3 within the Assessment Area. These include churches, schools, childcare centres and libraries. There are approximately eight active churches, three schools, one library and one childhood development centre. The J.D. Shatford Memorial Public Library serves portion of the Hammonds Plains and St. Margaret"s Bay area. Shatford Memorial School is the closet sensitive receptor to the proposed highway RoW and is located approximately 220 m south of the proposed centerline.

6.1.4.5 Resource Land Use

The majority of resource land within HRM Planning District is owned by Bowater Mersey Paper Co Ltd. This area, which is situated to the north of the existing Highway 103, encompasses over 20,234 ha. Bowater Mersey maintains a logging camp on these holdings at Sawler Lake and harvested wood is trucked to the company's pulp and paper mill located in Liverpool. The level of logging activity that take places on these lands in any given year is dependent upon a number of factors, including market demand for the final product and the supply of logs from other sources (HRM 1995, as amended). Several access roads to this property are located within the proposed corridor. Apart from lands owned by Bowater Mersey, there are also smaller parcels owned by individuals for resource use, many of which are also used for recreation (*e.g.*, hunting and fishing).

In addition to forestry resources, the study area has plenty of aggregate deposits, as evidenced by numerous gravel pits along the existing Highway 103. The majority of the gravel pits in the area are currently inactive with only one active pit located north of the proposed RoW east of Porcupine Lake.

Nova Scotia Power Inc. has a hydroelectric plant on Mill Lake located near Exit 5. This facility was initially constructed in the early 1920s by Halifax Power Company Limited but is now owned and operated by Nova Scotia Power Inc (Nova Scotia Power, 1997). The Mill Lake Powerhouse includes two generating stations: the Sandy Lake Generating Station (3.2 MW) and the Mill Lake Generating Station (2.6 MW).

There is no agricultural land use within the study area.

6.1.4.6 Tourism and Recreational Land Use

There are several notable recreational areas in close proximity to the existing highway. An abandoned Canadian National Railway RoW is used as a “Rails to Trails” trail for walking, hiking, biking, snowshoeing and cross country skiing (Nova Scotia Health Promotion and Protection, n.d.). The 32 km trail extending from Station Road in Hubbards to Hubley follows along Highway 3 entering into the proposed corridor RoW in three separate locations. Aspotogan Trail is continuous from Rails to Trails extending 11 km from Hubbards in the east to East River in the west. The year-round trail is used by hikers, cyclists, ATVs and snowmobilers.

Bowater Mersey has opened up a portion of their holdings to public use and permits informal recreation such as hiking, cross-country skiing, and snowmobiling on some of the logging roads that cross their property. One particularly well-known hiking trail is the Old Annapolis Road Trail which runs from Highway 103 toward the Annapolis Valley (HRM 1995, as amended). The access road to this trail is located approximately 300 m east of the bridge over Indian Lake.

Adjacent to the proposed highway corridor, the parallel Highway 3 is also a part of the Lighthouse Route. The Lighthouse Route is one of eleven touring routes in Nova Scotia stretching from Highway 103 and Route 3 junction stretching along the South Shore to Cape Forchu, Yarmouth. The South Shore is an outstanding area for tourism, recreation and fitness. Several beaches including, Queensland beach and Hubbards beach, walking trails and hiking trails attract locals and tourists to area. The community of Hubbards has been a tourism destination since mid-1800s (Nova Scotia Tourism and Culture, 2010). The area has several cottages, inns and campgrounds along St Margaret‟s Bay waterfront.

There are three provincial parks within the study area: Cleveland Beach Provincial Park, Queensland Beach and Lewis Lake Provincial Park. Cleveland Beach and Queensland Beach are located off Highway 3 along St. Margaret‟s Bay and Lewis Lake is located on the eastern side of the proposed study area. Although these Provincial Parks are within the study area, the parks are not within the proposed highway corridor.

Several watercourses within the study area have been determined to be navigable through the completion of a navigability inquiry conducted by NSTIR for the Project. Specifically, this inquiry resulted in the identification of the following eight watercourse systems as being navigable: Ingram River (WC-15), Little Indian Lake (WC-7), Mill Lake (WC-6), Puddle Lake (WC-38), Sawler Lake (WC-32), Dorey Lake (WC-31 and the adjoining WC-29, Hubbards River), The Puddle (WC-40, and the adjoining WC-24, Stillwater Brook) and an unnamed brook (anticipated to be WC-11, Porcupine Brook). Since these waterbodies are considered navigable, they have the potential to support recreational boat use. The construction of watercourse crossing structures at the crossing locations of these lakes and brooks has the potential to cause direct effects on navigation within those waterbodies. Therefore, authorization under the *NWPA* is likely to be required. Environmental effects of the Project on navigation are taken into consideration as part of the EA only when the effects are indirect. The potential Project effects on navigation within the identified waterbodies are anticipated to be direct; therefore, the effects of the Project on navigation are not addressed in thisEA.

Table 6.1 identifies and describes local recreational uses within the Project area including parks, trails and associations.

Table 6.1 Local Recreational Uses within the Assessment Area

Local Recreational Uses	Description
Aspotogan Trail Hubbards in the east to East River in the west	Comprised of 11 km of the disused South Shore railway. May be used by hikers, cyclists, ATV‟s and snowmobilers.
Old Annapolis Road Hiking Trail	Maintained hiking trail on Bowater Mersey property between Exits 5 and 6 on Highway 103 that lies partially on an old roadway that used to run to the Annapolis Valley.(Outdoor Nova Scotia http://www.outdoorns.com/features/wilderness.htm)
Bay Look Out Park Boutilier‟s Point	3 ha waterfront park
Bayswater Beach between Blandford and Aspotogan	The beach provides sand and surf along the main stretch and at the western most tip there is a quiet area, with few rocks and a fresh water pond.
Bishops Park The Head of Hubbards Cove	Waterside park with gazebo, picnic tables, walking trails, gardens, interpretive panels. Overlooking Hubbards Cove. Fishing
Cleveland Beach Provincial Park Queensland	4.4 ha beach consisting of a picnic area, large sandy beach and fresh water lagoon.
Four Winds Charters	Provides a scenic tour of the shoreline near Peggy‟s Cove and a tour of coves between Peggy‟s Cove and the Aspotogan Peninsula, St. Margaret‟s Bay. (Four Winds Chater http://www.fourwindscharters.com/location_smb.php)
Hubbard‟s Beach Hubbards	A privately controlled and maintained beach.
Hubbards Recreation Centre	Local community hall
Lewis Lake (Jerry Lawrence) Provincial Park	Jerry Lawrence (Lewis Lake) is a scenic park with wheelchair accessible walkways and lookoffs, bird watching, fishing and picnic area.
Queensland Provincial Beach Park Queensland	A 500 m long park including 300 m of beachfront.
Shore Club Dance Hall (shoreclub.ca), Hubbards, NS	Known as Nova Scotia‟s last Great Dance Hall. Famous for lobster suppers.
St. Margaret‟s Bay Rails to Trails St. Margaret‟s Bay to Hubbard‟s	A 32 km linear trail used for walking, hiking, biking, cross country, Nordic walking, bird watching, nature appreciation and snowshoeing.

6.1.4.7 Current Use of Lands for Traditional Purpose Aboriginal Persons

A description of baseline conditions for current use of lands and resources for traditional purposes includes consideration of land and resource use sites, plants of significance to First Nations communities.

Current First Nations land and resource use activities are divided into five categories:

- Kill/hunting (*e.g.*, game/fish);
- Burial/birth;
- Ceremonial (*e.g.*, ceremonial plants);
- Gathering food/medicinal; and
- Occupation/habitation (*e.g.*, group campsite).

The Assessment Area is known to have been occupied by First Nation settlers. Numerous pre-contact sites have been recorded near the study area (Indian River System and Northeast River System) and several areas along major watercourses within the study area are deemed to be high potential for pre-contact First Nation archaeological sites (R. Ogilvie, pers. comm. 2007).

The MEKS conducted for the Project (refer to Appendix D) identifies kill/hunting (deer, rabbit, partridge, mackerel, salmon, trout, lobster) and gathering (berries, decoration plant) activities occurring in the study area, along with a potential burial site, and a group campsite (note the MEKS study area is defined to include a 5 km radius around the Project). Specific locations of the kill/hunting and gathering activities are not known, however the potential burial site and group campsite are well outside the area likely to be affected by the Project.

6.1.4.8 Community Character

Community character, for the purposes of this assessment, is defined as the distinguishing physical and social quality of a region, city, town, village, or hamlet. Such a character is shaped by the natural, cultural, societal, and economic forces over many years. In the case of the communities located along Highway 3 part of the area focuses around the scenic views of St Margaret‟s Bay and capitalizing on the cultural and natural landscapes.

The Project is located in the HRM and the District of Chester, and encompasses a 22 km section of Highway 103 from west of Exit 5 at Upper Tantallon to approximately 2 km west of Exit 6 at Hubbards. There are seven communities along the south side of the proposed corridor including; Hubley Mill Lake Road, Upper Tantallon, Head of St. Margaret‟s Bay, Boutlliers Point, Ingramport, Hubbards and Simms Settlement.

The first settlers to arrive to the South Shore were fisherman who arrived over 200 years ago (HRM 1995, as amended). The abundant cod stocks attracted people to the area influencing the Plan Area and settlement pattern. Today the relative significance of the fishing industry has decline; however St. Margaret‟s Bay still provides a source of employment for those in commercial fishing (HRM 1995, as amended).

St. Margaret‟s Bay and Hubbards communities are approximately 25-30 minutes from the provincial capital, Halifax. According to the 2006 census data, the population of the South Shore was 58,362. From 2001 to 2006 the population of the South Shore has decreased 1.6% (Statistics Canada 2006). However, in the ten-year period from 1996 to 2006 the area around Highway 103 at Exit 5 including Upper Tantallon, has seen a 54% increase in population and is designated as a growth centre in the Regional Plan. The population growth coupled with public investment in community facilities, educational institutions, and public highways has created commercial development pressures in this community (HRM 1995, as amended). The HRM has a total land area of 5,490.18 square km including several rural and urban communities. With a population of 372,679 approximately 289,518 of the population located in the urban areas and 83,340 located in rural areas, such as the proposed Project area (Statistics Canada 2006). The

South Shore – St. Margaret‟s Bay area has a total population of 82,855 (Statistics Canada 2006).

Chester; located within the Lunenburg County; has a population of 10,741 (Statistics Canada 2006). The eastern border of Chester is within 80 km of the urban Halifax centre, approximately a 40 minute drive (Municipality District of Chester Municipal Planning Strategy 1997). The major areas of employment in Chester are manufacturing, construction and retail trades (Statistics Canada 2006). However; approximately 46% of the working population works outside of the district; this demonstrates the lack of local job opportunities and the attractiveness of the district as a residential area (Municipality District of Chester 1997). Table 6.2 provides statistics on the population of the District of Chester, the dwelling count and employment.

Table 6.2 Population Counts in the District of Chester

Census Year	Population	Private Dwellings	Persons per Dwelling	Median age of the Population	Total Employed (not necessarily in District)
1996	10,602	4,215	2.28	39.4 (average)	4,655
2001	10,781	5,848	1.84	42.8	4,680
2006	10,741	6,161	1.74	46.5	5,310

Table 6.3 provides statistics on the population and dwelling counts of the Halifax Regional Municipality and Lunenburg County compared to Nova Scotia.

Table 6.3 Population and Dwelling Counts

Population and dwelling counts	Lunenburg County	Halifax Regional Municipality	Nova Scotia
Population in 2006	47,150	372,679	913,462
Population in 2001	47,591	359,111	908,007
2001-2006 population change (%)	-0.9	3.8	0.6
Total private dwellings	24,786	166,675	425,681
Private dwellings occupied by usual residents	20,082	155,060	376,829
Population density per square kilometer	16.2	67.9	17.3
Land area (square km)	2,907.93	5,490.18	52,917.46

6.1.5 Potential Interaction, Issues and Concerns

This section evaluates the potential for Project-related activities to affect Land Use. Table 6.4 provides a summary of the potential environmental effects resulting from the Project-VEC interactions, which are discussed below.

Table 6.4 Project Activity – Environmental Effects Interaction Matrix for Land Use

Potential Interactions Between Project Activities, Including Other Projects and Environmental Effects Valued Environmental Component: LAND USE	
Project Activities and Physical Works†	**Potential Environmental Effects**
	Change in Land Use
Construction	
Site Preparation	✓
Roadbed Preparation	✓
Watercourse Crossing Structure	✓
Surfacing and Finishing	✓
Operation and Maintenance	
Project Presence	✓
Infrastructure Maintenance	✓
Other Projects and Activities	
Existing and Planned Linear Features	✓
Residential and Commercial Land Use	✓
Resource Land Use	✓
Recreational Land Use	✓
Industrial Land Use	

† See Table 4.1 and Section 2.3 for list and details of specific activities and works.

6.1.5.1 Construction

The potential environmental effects on residential Land Use adjacent to the Project RoW include a potential loss of enjoyment of residential property, as a result of noise, dust, and air emissions during all phases of Construction and a change to, or loss of, access to property. Effects related to noise, dust and air emissions are addressed in Section 5.1. Access roads near Sawler Lake and Maple Lake on the north side of the proposed Project will provide access to residential properties during construction activities.

The Project has potential to interact with adjacent forestry activities due to the interaction with existing property access roads. This could affect not only resource use, but also recreational uses (*e.g.*, hiking, angling) which depend on existing woods roads for access to these resource lands.

The twinning Project could also potentially affect the NSPI Mill Lake Powerhouse if flow velocities are affected by the addition of new bridges on Indian River and Northeast River.

Current use of lands by Mi'kmaw individuals or communities for traditional purposes such as kill/hunting or gathering activities could potentially be affected by the Project. However, as indicated in the MEKS, the permanent loss of plant species of significance does not pose a threat to Mi'kmaq use as these species also exist in surrounding areas not influenced by the

Project. The group campsite and potential burial site is outside the area of influence from the Project, therefore no interaction is predicted. These potential effects are not considered further in this analysis.

6.1.5.2 Operation and Maintenance

With the exception of properties around Sawler Lake and Maple Lake at the western end of the alignment, the majority of residential properties in the study area are located adjacent to the existing Highway 103 lanes and would not be expected to experience a substantial increase in noise emissions during operation of the twinned highway (refer to Section 5.1).

6.1.6 Other Projects and Activities

Existing and Planned Linear Features

Existing linear features, including the existing Highway 103, the railway bed, power transmission corridors and numerous woods roads through the study area have influenced land use in the area including resource extraction, residential development, and recreational land use. Concurrent with this Project, but as a separate undertaking, NSTIR is also planning the construction of one or more interchanges and connector roads in the study area. The planning for the interchange(s) is currently underway therefore there are specific details available at this time.

Residential and Commercial Development

Development has occurred and continues to occur in the study area around Highway 3. Development activities are managed through the MPS and Land Use Bylaws for Planning Districts 1&3 and the MPS Land Use Bylaws document for the Municipality of the District of Chester. Future developments have been proposed in both Districts 1&3 and the District of Chester. The District of Chester has seen the number of lot approvals increase greatly since the twinning of Highway 103 was proposed; including the development of a 300 lot golf subdivision in Mill Cove. Amendments to the MPS and LUB and the development of an ICSP have addressed issues regarding future development in the area allowing the community character to remain while development occurs.

Resource Use

Forestry and quarrying activities in the study area have occurred historically in the study area and continue to occur. These activities characterize the current and expected future land use north of the proposed RoW.

6.1.7 Environmental Effects Assessment

This section provides an evaluation of key potential Project-VEC interactions as summarized in the environmental effects assessment matrix (Table 6.5).

Table 6.5 Environmental Effects Assessment Matrix for Land Use

Environmental Effects Assessment Matrix Valued Environmental Component: LAND USE							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration /Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Construction							
Site Preparation Roadbed Preparation Watercourse Crossing Structure Construction Surfacing and Finishing	• Change in land use (A)	• Temporary detours provided if necessary • Follow Generic EPP that includes guidelines for reducing noise and air emissions • Minimize dust through the application of water • Fair market value compensation • Maintain access to lands where possible • Reasonable accommodation to allow forestry operations access to adjacent lands during construction	1	1	2/6	R	2
Operation and Maintenance							
Project Presence	• Change in land use (A)	• No mitigation recommended	1	1	5/6	R	2
Infrastructure Maintenance	• Change in land use (A)	• Follow Generic EPP that includes guidelines for reducing noise and air emissions	1	1	1/2	R	2

Table 6.5 Environmental Effects Assessment Matrix for Land Use

Environmental Effects Assessment Matrix Valued Environmental Component: LAND USE							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** **(A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration /Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**

Key

Magnitude:

1 = Low: *e.g.*, specific group, residence or neighbourhood affected such that adjacent land use activities will not be disrupted such that current activities cannot continue even after short periods of time.

2 = Medium: *e.g.*, part of a community affected such that adjacent land use activities will be disrupted such that current activities cannot continue for extended period of time longer than two years.

3 = High: *e.g.*, community affected such that adjacent land use activities will be disrupted such that current activities cannot continue for extended periods of time longer than two years and are not compensated for.

Geographic Extent:
1 = <1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101 - 1,000 km^2
5 = 1,001 - 10,000 km^2
6 = >10,000 km^2

Duration:
1 = <1 month
2 = 1 - 12 months
3 = 13 - 36 months
4 = 37 - 72 months
5 = >72 months

Frequency:
1 = <11 events/year
2 = 11 - 50 events/year
3 = 51 - 100 events/year
4 = 101 – 200 events/year
5 = >200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse environmental effects.

N/A = Not Applicable

(A) = adverse

(P) = positive

6.1.7.1 Construction

Construction activities may affect the Land Use VEC within the Assessment Area. Although some of these environmental effects will continue in perpetuity (*e.g.,* property access), these environmental effects are mitigated in the construction phase of the Project, and are therefore considered only in the construction phase of the assessment.

Environmental effects of the Project on adjacent residential and recreational land uses from dust will be minimized during construction through the application of water. The EPP will include guidelines to reduce air and noise emissions during construction as discussed in Section 5.1. As noted in Section 5.1, there is not likely to be a significant adverse environmental effect on sound quality as a result of Project-related noise.

The environmental effects on forestry land use are related to the removal of and/or access to the lands during construction. This could result in the loss of production for the landowner and loss of lands in general. Mitigation for productive land loss is through compensation for lands acquired, used, or otherwise affected by the Project. NSTIR has been working with affected landowners (particularly Bowater Mersey) to ensure access is maintained at an acceptable condition. Reasonable accommodations will be made to allow operations access to adjacent lands during construction to minimize effects on resource extraction. Access to an active gravel pit along the north side of the proposed Project will be maintained through access roads. Although the emphasis will be on maintaining access for resource extraction, effects on informal recreational use will be mitigated through the development of access to resource lands and existing woods roads.

A hydrological impact study on potential effects of the proposed twinning of Highway 103 on the water level elevations of Mill Lake and Indian Lake concluded that the Project would have negligible effects on water levels (RV Anderson 2010b). Therefore, assuming access to the Mill Lake Powerhouse is maintained, the Project is not predicted to adversely affect the NSPI facility on Mill Lake.

Effects on recreational use in the study area are expected to be limited to access limitations around the woods roads north of the existing Highway 103 lanes. These effects are predicted to be minor and temporary and will be mitigated as access is mitigated for resource extraction.

The Project will not result in environmental effects that will restrict or degrade present Land Use in the Assessment Area to a point where activities cannot continue at current levels or be mitigated or compensated. Therefore, based on consideration of the environmental effects of the individual activities required to construct the Project, the proposed mitigation, and the residual environmental effects rating criteria, the residual environmental effects of construction on Land Use are rated as not significant.

6.1.7.2 Operation and Maintenance

The Project may result in loss of enjoyment of residential and recreational Land Use near the proposed Project. However, based on the predicted noise levels (as described in Section 5.1) and the presence of the existing highway, the environmental effects of noise from highway presence are predicted to be not significant.

NSTIR will negotiate acceptable access routes with affected landowners to ensure access to resource lands are maintained during operation of the Project. These access routes will also be accessible for recreational land use as required.

The Project will not result in environmental effects that will restrict or degrade present Land Use in the Assessment Area to a point where activities cannot continue at current levels or be mitigated of compensated. Therefore, based on the consideration of environmental effects of the operation and maintenance of the Project, the proposed mitigation, and the residual environmental effects rating criteria, the residual environmental effects of operation and maintenance activities on Land Use are anticipated to be not significant.

6.1.7.3 Assessment of Cumulative Environmental Effects

Land uses in the Assessment Area are a mix of industrial, commercial, residential and resource (forestry, pits/quarries) use. Historic and existing land uses have been captured in the description of existing conditions and assessment of Project-related effects. These land uses have been and continue to be, influenced by municipal planning strategies and bylaws. In 2009 The District of Chester developed an Integrated Community Sustainability Plan (ICSP) to set a new direction for the municipality using the four pillars of sustainability; society, culture, economy and environment. The ICSP identifies the proposed highway twinning as having an important impact on the District and possibly influencing development patterns therefore the ICSP, in conjunction with the MSP and LUB, addresses new developments in the area.

Potable water resources in the study area have been affected by these past and existing developments and can potentially be further adversely affected should development continue to proceed without appropriate controls. HRM has recognized this as an issue within Planning Districts 1 & 3 and is committed to working with NSE to protect water supplies during development activities. Sections 5.2 and 5.3 of this document describe NSTIR"s commitments to mitigating potential effects on surface and groundwater resources as a result of the Project.

Cumulative effects on Land Use associated with the Project interacting with existing and planned future land use in the Assessment Area are not predicted to be significant.

Potential construction and operation of an interchange(s) and connector road(s) along Highway 103 in the Assessment Area is more likely to affect existing and future land use than the twinning Project itself. The details of this development are not known at this time, but preliminary responses from the community regarding an interchange appears to indicate that the business community may be apprehensive about this new development. While the twinning Project is generally welcomed as an improvement to transportation and safety in the area (thereby potentially generating positive effects on tourism), a new interchange is regarded by some as an impediment to local tourism as tourists would gain a more direct route to their destination and may be less likely to travel longer distances along the Lighthouse Route. If the construction of an interchange(s) and connector road(s) proceeds beyond the preliminary planning stage, NSTIR will undertake an environmental assessment to assess and mitigate potential effects of that project on the biophysical and socio-economic environment. Significant adverse effects on Land Use as a result of the twinning Project interacting cumulatively with the interchange/connector project are not predicted to occur.

Given the individual controls on these other projects and activities, as well as overarching municipal plans and strategies, cumulative environmental effects of the Project (in combination with other projects and activities) on Land Use are not considered to be significant.

6.1.8 Determination of Significance

Table 6.6 evaluates the significance of potential residual environmental effects on Land Use resulting from any interactions between Project activities and the VEC, after taking into account any proposed mitigation. The table also considers the level of confidence of the Study Team in this determination.

Table 6.6 Residual Environmental Effects Summary Matrix for Land Use

Residual Environmental Effects Summary Matrix Valued Environmental Component: LAND USE				
Phase	Residual Environmental Effects Rating, Including Cumulative Environmental Effects*	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Construction	NS	3	N/A	N/A
Operation and Maintenance	NS	3	N/A	N/A
Project Overall	NS	3	N/A	N/A

Key

Residual Environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Level of Confidence
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence
N/A= Not Applicable

Scientific Certainty: based on scientific information and statistical analysis or professional judgment
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence
N/A= Not Applicable

*As determined in consideration of established residual environmental effects rating criteria.

The residual environmental effects of the Project are evaluated in consideration of planned mitigation, compensation, and the residual environmental effects rating criteria, and are rated not significant for construction, operation and maintenance and therefore the Project overall.

6.1.9 Follow-up and Monitoring

No follow-up or monitoring is recommended for the Land Use VEC (refer to Section 5.1.9 for potential follow-up and monitoring related to air quality and noise effects).

6.2 Archaeological and Heritage Resources

6.2.1 Rationale for Selection as Valued Environmental Component

Archaeological and Heritage Resources is a VEC in recognition of the potential interest of First Nations, the general public, and provincial and federal regulatory agencies in ensuring the effective management of these resources. For the purposes of this assessment, archaeological and heritage resources are defined as any physical remnants found on top of and/or below the surface of the ground that inform us of past human use of and interaction with the physical environment. These resources may be from the earliest time of human occupation in the study area up to the relatively recent past and include both built and depositional resources.

Heritage resources are generally considered to include historic period sites such as cemeteries, heritage buildings and sites, monuments, and areas of significance to First Nations or other groups. Also considered in this VEC are paleontological (fossil) resources.

6.2.2 Environmental Assessment Boundaries

6.2.2.1 Spatial

The spatial boundaries (*i.e.*, Assessment Area) for the assessment of the potential environmental effects of the Project on Archaeological and Heritage Resources include the locations of all Project-related activities associated with construction, and operation and maintenance, which could involve any ground disturbance. Archaeological and heritage resources may be affected by any surficial or subsurface Project-related disturbance of the area within which these resources are located. The assessment of potential Project-related environmental effects on archaeological and heritage resources is focused principally on those activities that entail ground disturbance.

6.2.2.2 Temporal

Temporal boundaries for archaeological and heritage resources consider that these resources are relatively permanent features of the environment. Construction activities carried out at any time of year can therefore affect the integrity if any archaeological or heritage site encountered. Ground disturbance associated with construction will be relatively short term. However, any potential adverse environmental effect on archaeological and heritage resources will be permanent as no archaeological site can be returned to the ground in its original state once it has been disturbed or destroyed. Temporal boundaries also consider that archaeological and heritage sites may be affected in the long term by an increase in accessibility. The temporal boundaries for the assessment of the potential environmental effects of the Project on Archaeological and Heritage Resources include the construction, and operation and maintenance of the Project in perpetuity.

6.2.2.3 Administrative and Technical

All archaeological, historical, paleontological, and ecological sites located within the Assessment Area fall under the jurisdiction of the *Special Places Protection Act*, which is administered by Heritage Division of the Nova Scotia Museum.

Information used for the assessment of archaeological and heritage resources was derived from published sources, some of which were old and potentially limited in accuracy. Also, the potential presences of subsurface remains are by nature often difficult to locate during most types of low intrusive surveys. Another technical constraint was the inability to conduct subsurface sampling in a particular area of high archaeological potential due to lack of landowner permission.

6.2.3 Residual Environmental Effects Rating Criteria

A **significant adverse residual environmental effect** on Archaeological and Heritage Resources is defined as one which will disturb or destroy archaeological or heritage resources considered by affected First Nations, communities, or provincial heritage regulators to be of major importance due to factors such as rarity, condition, spiritual importance, or research importance, and that cannot be mitigated.

6.2.4 Baseline Conditions

The description of existing conditions for Archaeological and Heritage Resources is based on background research and a field survey in November, 2009, which included limited sub-surface testing of high to moderate potential areas along the RoW. Background research considered resources located at the Nova Scotia Museum, the Public Archives of Nova Scotia, as well as the Internet. The objective of this research was to identify any high potential areas that may have been located within the Assessment Area.

6.2.4.1 Known Archaeological and Heritage Resources

There are no known archaeological and heritage resources (including paleontological resources) in the Assessment Area.

6.2.4.2 Potential Archaeological and Heritage Resources

First Nations

Recorded Archaeological Sites

The study area travels three sections of the Borden Grid System, which is the system used in the designation of archaeological sites in Canada. The longest RoW section travels through BeCx, from Tantallon to Porcupine Lake. In all, there are 68 sites recorded in this grid section; the vast majority are First Nations and are concentrated around Big Indian, Rafter, Sandy, and Wright Lakes and Coon Pond. The nearest site to the RoW is over one kilometre to the north. These sites were discovered during different decades when archaeologists were able to access the shoreline when the Nova Scotia Power dams were opened and the water levels in the lakes were lowered. This intensive archaeological study may skew the data, however, as the relative paucity of recorded sites in nearby areas may say more about the lack of study than the lack of sites.

The RoW travels through a very small section of BdCx, which has nine recorded sites, but there are no recorded archaeological sites within the RoW.

The second longest stretch of RoW travels through the Borden grid BdDa. There are only four recorded archaeological sites within this grid, all of which are well south of the RoW. As mentioned above, the relative lack of sites may not necessarily reflect the potential of an area that has been understudied.

The potential for a site to contain First Nations archaeological resources is generally determined by proximity to exploitable resources (food sources, for example) and/or a major watercourse that was either a transportation route or allowed access to one. Given these criteria, the area of Little Indian and Mill Lakes would be considered high potential, especially given the presence of recorded sites to the north. There would also have been abundant food resources within the rivers, along their banks, and in the interior. The rivers would have allowed easy access to the coast in the summer and the interior in the winter, the yearly migration route of the Mi‟kmaq. The Ingram River, which drains from Snake Lake to River Lake, and that appears to be navigable, was also considered to have high potential. Finally, the area at the south end of Dorey Lake, where it drains into Shankels Pond and, eventually, Hubbards Cove, was also considered to have high potential. The A.F. Church map (1865) for the area presents various discrepancies with respect to present waterbodies. For example, on the A.F. Church (1865) map, Big Indian Lake was shown to be much narrower than it is now, and Rafter and Sandy Lakes do not exist at all on the map. There was just Indian River that drained from Big Indian Lake to St. Margarets Bay. Similarly, the 1865 map does not show Coon Pond or Mill Lake; only the Northeast River drained Wrights Lake to the Bay.

The 1908 Geological Survey of Canada (GSC) map shows the beginning of the harnessing of water power in the Big Indian/Wrights Lake watershed, where many dams are now shown and notes refer to “Site for water power” in a couple of places. Coon Pond is shown on the map as well as Mill Lake and Little Indian Lake. Apart from that, there was nothing else of note on the GSC map.

It is quite obvious that the damming of these lakes by Nova Scotia Power in the first quarter of the twentieth century not only dramatically changed the watercourses in the area, but also flooded a great number of First Nation‟s archaeological sites. This, of course, has quite an impact on archaeological potential.

Historic Period

The vast majority of the Assessment Area saw very little to no development during the eighteenth to the early twentieth centuries, particularly given it‟s remoteness from the coast, where the early settlement occurred. The A.F. Church map, while not the most accurate, does provide some interesting insights into settlement and changes in the landscape within the Assessment Area. The A.F. Church map illustrates how the settlement began on the coast and how the first roads reflected this as they traveled through every cove and point to get to the settlers. As a matter of fact, Church shows no structures at all through the Assessment Area and the closest structures are some remote saw mills. There are also no structures shown within the Assessment Area on the 1908 GSC map.

Based on the background research, the historic archaeological potential for the RoW would be considered low.

6.2.4.3 Field Survey Results

Using a combination of windshield and pedestrian surveys, two Stantec archaeologists surveyed the total length of the Assessment Area in October 2009 and four Stantec archaeologists conducted limited shovel testing in November, 2009 (see Figure 6.2.1). The surveys and shovel tests in high potential areas (as identified by desktop modeling) are summarized below.

Watercourse #6

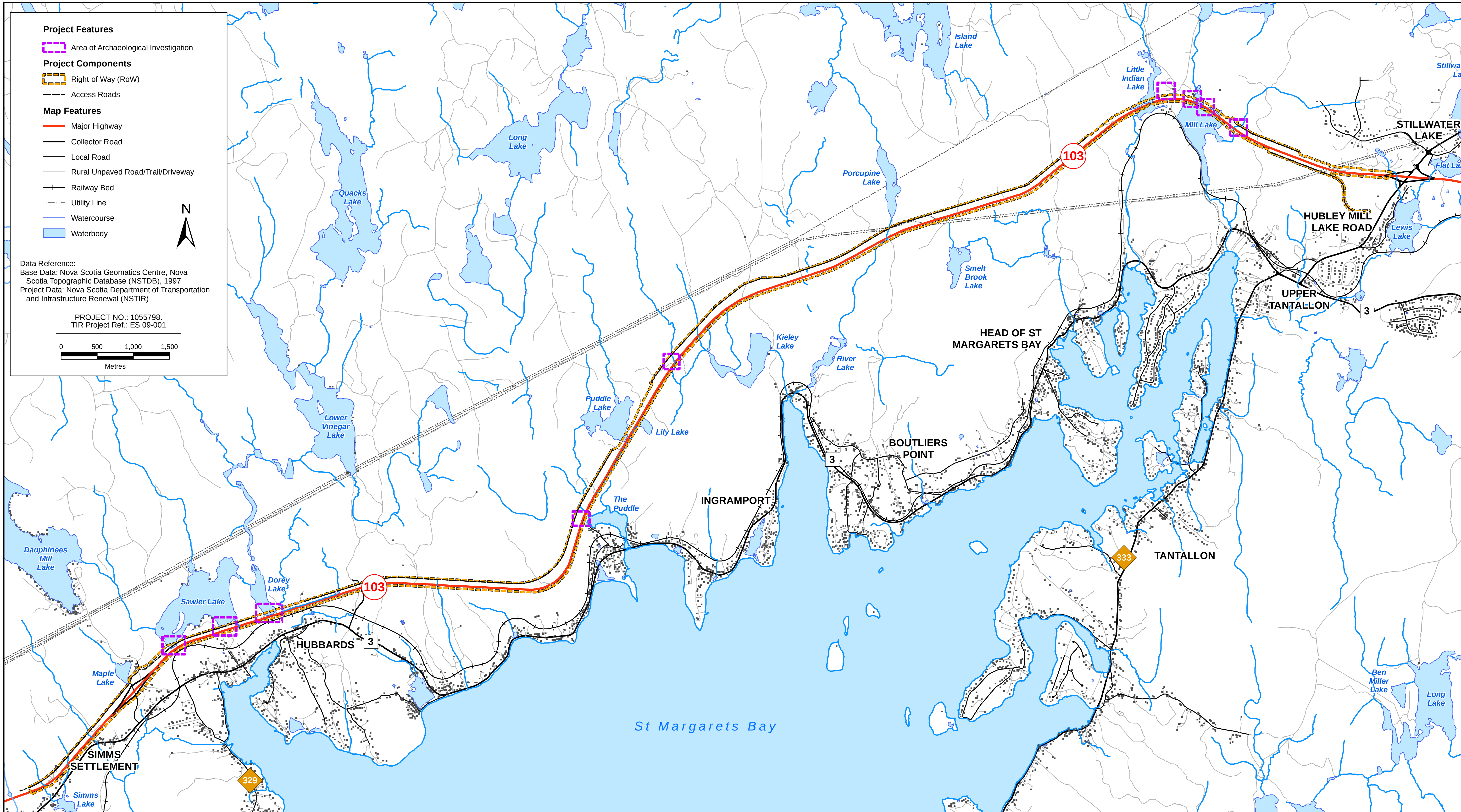
This is a very small watercourse located about 250m southeast of Mill Pond. The watercourse is fast flowing and about 1 to 3m wide and 30 to 40cm deep. The banks are lined with medium to large granite erratics and it would never have been navigable. The forest is a young mixed wood one. There is an old logging road along the west bank and a large knoll just west of that. The east side is a steep slope up to undulating rocky ground. There is also some disturbed rocks and soils at the south edge of the RoW, which is probably the result of the Highway 103 construction. This is a minor watercourse and should be considered low potential.

Mill Lake Pond

This is a small section of Mill Lake that has been truncated by the present Highway 103 lanes. It is now a small pond with a low, very rocky shore with high ridges to the north and east. The east side is flat but rocky and the forest is a young, mixed one. This area is considered to be low potential, especially knowing that it did not exist prior to at least 1908.

Mill Lake

The A.F. Church map shows that this lake did not exist in 1865 and it does not make an appearance on a map until 1908. The section of lake within the RoW is a small, truncated section on the north side of the highway. The east side of the lake is a steep incline to some rocky cliffs and the west side is very low and very rocky. The forest is a scrubby mixed one. Much of the southeast corner is wetland and is very rocky with large erratics. This is also the location of the Nova Scotia Power Station and there are many disturbances relating to this building such as the access road and a berm that was built along the south edge of the lake. There might be some potential in this area, which was a stream prior to the damming of the lakes, but any archaeological resources are most likely under water. The archaeological potential at the present water level should be considered to be low.



DATE: September 2010	Highway 103 Twinning Project, Upper Tantallon to Hubbards CEAA Screening	FIGURE NO.: 6.2.1
PREPARED BY: C. Shupe		
NOVA SCOTIA Transportation and Infrastructure Renewal	**Areas of Archaeological Investigation**	Stantec

Little Indian Lake

This lake appears to be at the same relative level as it was in the 1908 GSC map, although its south end has been truncated by Highway 103 and a small canal has been built between it and Mill Lake. The building of the canal is foretold on the GSC map: "Water can be diverted from Lit. Indian into Mill L.". Of course, prior to 1908 these were known as the Indian and Northeast Rivers. The shores of Little Indian Lake are low and wet, particularly between it and Mill Lake, but the terrain does rise to the northwest. The area to the north of the canal is also low, wet, and rocky. Again, there might be some archaeological potential in this area but it is most likely under water. The archaeological potential at the present water level should be considered to be low.

Ingram River

This is the one major watercourse within the RoW and it is about eight to ten metres wide, between 50-100 cm deep, and is fairly fast flowing at high water. The higher ground in the northeast quadrant is covered in a young, sparse mixed forest and the banks are low, grassy, and very rocky. There is a small stream that runs from the east into the river, but this could be the result of a watercourse diverted by the highway construction. There is also a small pond ringed by large boulders at the end of the stream but this may be artificial as well. Most of this area is riparian wetland and there were lots of signs of beaver activity. The ground rises slightly to the north, where the number of large granite erratics increases dramatically. There is a high potential area approximately 150m north of the present highway"s centreline, but this was outside of the RoW. This quadrant was deemed to be low potential.

The northwest quadrant has a flat and level shoreline that travels about 10m before rising up sharply to the west for at least 10 m to a very flat and level area covered in alders and young trees. The flat area along the shore gets pinched out by the river and high ground about 70 m north of the bridge. Exposed soils on the high ground appeared to be very sandy. The area to the west of the high ground appears unnaturally flat and there is exposed asphalt over a fairly extensive area. There is also a paved road that leads out to Highway 103. It is uncertain what this area may have been but it could be related to the highway construction. While this area appears to have been disturbed it was felt that some shovel testing should take place along the high ridge as well as down on the flat area immediately adjacent to the river.

A single line of shovel tests was placed at 5 m intervals along the high ground to the west of Ingram River. There were a total of nine tests, all of which were negative. The soils were quite gravelly and asphalt was found in a number of them. This was interpreted as being evidence of disturbance. The area to the west of the test line was covered in asphalt and will have to be tested at a later date when it can be removed. There were three short test lines placed on the flat ground next to the river. This area was very constricted so the tests were place 2.5 m apart. A total of 11 tests were dug and all were negative.

The southeast quadrant of Ingram River was low and very wet with a steep rise about 80 m to the southwest. This was a riparian wetland and was considered to have low potential.

The southwest quadrant was also low and wet with a lot of scrub spruce. There is a small knoll about 50 m south of the highway and 30 m or so from the river. Again, this area was considered as low potential.

Lily Lake

The northwest quadrant of this lake was examined. It is low, wet, and the lake has a sandy bottom. The terrain is very hummocky with a lot of moss covering the ground. This whole area is flagged as wetland. The northeast quadrant is somewhat higher but still low. The land rises up to the east and northeast. The tree cover is mainly spruce and fir with a lot of granite erratics covering the ground. The very south end of the lake has been truncated by the highway and is only a remnant of a wetland now. This area is low potential.

Ingramport/The Puddle

The northeast quadrant in this area has a small stream that is about 2 to 5 m wide but only about 25 cm deep, and it is fairly fast flowing. The shoreline is very rocky and moss-covered and there is a small set of falls not far up the stream. The forest cover is scrubby spruce. This area is low potential. The northwest quadrant is very hummocky and covered with mossy erratics. This area appears to flood at high water and is considered low potential. The southwest quadrant is tidal and has low potential. The southeast quadrant has a small, relatively high point that runs out through a bog. There are some large spruces there and the ground is moss-covered and hummocky. This area will not be affected by the proposed development and is considered low potential in any case.

Dorey Lake

The northwest quadrant of this area is a small, round point with a watercourse running along its east side. The land is flat with some large boulders along the shore. The watercourse is very fast flowing and is about 5 to 8 m wide and very deep. There are a lot of boulders along the northeast edge, which forms a small wet area. On first inspection this area appeared to be very high potential. However, the 1908 GSC map doesn"t show the distinctive point and hints that the watercourse may have been diverted to a certain extent. In any case, it was decided that the area should be tested and, to that end, three test lines were placed over the point, each 5 m apart, and tests were placed at 5 m intervals. A total of seventeen tests were dug and all were negative. The rocky/gravelly, sterile nature of the soils from the test pits suggests this area may have been previously disturbed, possibly by the building of the highway or some earlier development.

The northeast quadrant of Dorey Lake has a rocky shore with a small tributary running onto it very close to the highway. The tributary is about 1 to 1.5 m wide and fast flowing. It runs through a culvert/road about 12 m from the watercourse. The road basically parallels the watercourse. This area is much higher than the northwest quadrant and is almost a knoll. There is a lot of exposed, rocky ground. The land is lower and flatter to the north, basically across from the northwest quadrant. This area looks to have a low potential for archaeological resources.

The southeast quadrant has a very rocky shore with undulating ground covered by young spruce. There is a small rock mound in this area but it is most likely a Crown land survey post support. This area is low potential for archaeological resources.

The southwest quadrant is dominated by a hiking trail and large bridge that were built on the old railway. The land in this area, through which the fast flowing stream passes, is low, rocky and wet. It is low potential for archaeological resources.

Sawler Lake

The northeast side of Sawler Lake is very rocky and rough and is considered low potential. The northwest quadrant has a small cove and a round point that had one of the few flat areas on it about 8 m south of the shore. The rest of the area is undulating ground and the shore is very rocky. The forest is a fairly mature and open mixed one. It was concluded that the majority of area was likely low potential but the flat area described above was identified for testing to confirm this prediction. Three 25 m tests lines were established 5 m apart and tests were placed along the lines at 5 m intervals. A total of 18 tests were dug but all were negative. The conclusion was that this area was of low archaeological potential.

6.2.4.4 Paleontological Resources

There are no known paleontological sites in the Assessment Area.

6.2.4.5 Heritage Buildings

There are no registered heritage properties within the Assessment Area.

6.2.5 Potential Interactions, Issues and Concerns

This section evaluates the potential for Project-related activities to affect Archaeological and Heritage Resources. Table 6.7 provides a summary of the potential environmental effects resulting from the Project-VEC interactions, which are discussed below.

Table 6.7 Project Activity – Environmental Effects Interaction Matrix for Archaeology and Heritage Resources

Potential Interactions Between Project Activities, Including Other Projects and Environmental Effects Valued Environmental Component: ARCHAEOLOGICAL AND HERITAGE RESOURCES	
Project Activities and Physical Works†	Potential Environmental Effects
	Project Related Change in Archaeological and Heritage Resources
Construction	
Site Preparation	✓
Roadbed Preparation	✓
Watercourse Crossing Structure Construction	✓
Surfacing and Finishing	
Operation and Maintenance	
Project Presence	
Infrastructure Maintenance	
Winter Maintenance	
Vegetation Management	
Other Projects and Activities	
Existing and Planned Linear Features	✓
Residential and Commercial Land Use	✓
Recreational Land Use	
Resource Land Use	✓

† See Table 4.1 and Section 2.3 for list and details of specific activities and works.

6.2.5.1 Construction

Certain activities associated with Project construction (*i.e.*, grading, blasting) will cause surface or subsurface disturbance that could affect archaeological and heritage resource sites. These disturbances, if left unmitigated, could result in the loss of the resource and the potential knowledge to be gained from its interpretation. As mentioned in Section 6.2.4, the Assessment Area has a low potential for First Nations archaeological resources. The Assessment Area also has a low potential for historic archaeological resources.

6.2.5.2 Operation and Maintenance

There are no predicted interactions between the Project archaeological and heritage resources during operation and maintenance. Therefore, this Project phase is not considered further in the assessment of this VEC.

6.2.6 Other Projects and Activities

Projects and activities that result in subsurface disturbances have the potential to affect archaeological and heritage resources. As no archaeological and heritage resources were previously recorded for the Assessment Area or discovered during the archaeological survey for this Project, and no known archaeological sites have been encountered during the development of other Project and activities listed in Table 6.8, it is anticipated that there are no potential cumulative environmental effects on Archaeological and Heritage Resources.

6.2.7 Environmental Effects Assessment

This section provides an evaluation of key potential Project-VEC interactions as summarized in the environmental effects assessment matrix (Table 6.8).

Table 6.8 Environmental Effects Assessment Matrix for Archaeological and Heritage Resources

Environmental Effects Assessment Matrix Valued Environmental Component: ARCHAEOLOGICAL AND HERITAGE RESOURCES							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects** **(A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Construction							
Site Preparation Roadbed preparation	Project-related change in archaeological and heritage resources (A)	• Complete archaeological testing in high potential area (portion of Ingram Lake untested) or monitor during construction if necessary • Report any features, artifacts, or other cultural material to NSM prior to proceeding with construction activities • Archaeological Contingency Plan	2	3	5/6	I	2

Table 6.8 Environmental Effects Assessment Matrix for Archaeological and Heritage Resources

Environmental Effects Assessment Matrix Valued Environmental Component: ARCHAEOLOGICAL AND HERITAGE RESOURCES							
Project Activity (See Table 4.1 for list of specific activities and works)	**Potential Environmental Effects, Including Cumulative Environmental Effects (A = Adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Watercourse Crossing Structure Construction	Project-related change in archaeological and heritage resources (A)	• Complete archaeological testing in high potential area or monitor during construction if necessary • Report any features, artifacts, or other cultural material to NSM prior to proceeding with construction activities • Archaeological Contingency Plan	1	3	4/6	I	2

Key

Magnitude:
1= Low: *e.g.,* minor impairments to cultural resources appreciation or effects to non-significant historic period heritage feature, *e.g.,* loss of individual artifact.
2 = Medium: *e.g.,* loss of historic or cultural resources not of major importance, or pre-disturbed heritage site/artifacts present, however, no or little chance of intact features.
3 = High: *e.g.,* intact "significant" heritage site, pre-contact and/or contact period, features present, portion or all of site will be destroyed or lost.

Geographic Extent:
1 = <1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101 - 1,000 km^2
5 = 1,001 - 10,000 km^2
6 = >10,000 km^2

Duration:
1 = <1 month
2 = 1 - 12 months
3 = 13 - 36 months
4 = 37 - 72 months
5 = >72 months

Frequency:
1 = <11 events/year
2 = 11 - 50 events/year
3 = 51 - 100 events/year
4 = 101 – 200 events/year
5 = >200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not Applicable
(A) = adverse
(P) = positive

6.2.7.1 Construction

Certain activities associated with Project Construction (*i.e.*, grading, blasting) will cause surface or subsurface disturbance that could affect archaeological and heritage resource sites. These disturbances, if left unmitigated, could result in the loss of the resource and the potential knowledge to be gained from its interpretation. As mentioned in Section 6.2.4, the Assessment Area has a low potential for First Nations archaeological resources. The Assessment Area also has a low potential for historic archaeological resources.

Any features, artifacts, or other cultural material that is found during ground disturbance will be reported to the Nova Scotia Museum prior to proceeding with Construction activities. Section 5.2 of the Generic EPP, which contains a contingency plan for heritage resources, will be implemented during construction, as required, to address any previously unknown resources discovered during ground disturbance.

6.2.7.2 Assessment of Cumulative Environmental Effects

As no significant archaeological and heritage resources were discovered within the proposed RoW of this Project and no known archaeological sites have been encountered during the development of other projects and activities in the area, it is anticipated that there will be no cumulative environmental effects on Archaeological and Heritage Resources.

6.2.8 Determination of Significance

Table 6.9 evaluates the significance of potential residual environmental effects on Archaeology and Heritage Resources resulting from any interactions between Project activities and the VEC, after taking into account any proposed mitigation. The table also considers the level of confidence of the Study Team in this determination.

Table 6.9 Residual Environmental Effects Summary Matrix for Archaeology and Heritage Resources

Residual Environmental Effects Summary Matrix Valued Environmental Component: ARCHAEOLOGICAL AND HERITAGE RESOURCES				
Phase	Residual Environmental Effects Rating, Including Cumulative Environmental Effects*	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Construction	NS	2	N/A	N/A
Operation and Maintenance	N/A	N/A	N/A	N/A
Project Overall	NS	2	N/A	N/A

Key

Residual Environmental Effect Rating:	Probability of Occurrence: based on professional judgment
S = Significant Adverse Environmental Effect	1 = Low Probability of Occurrence
NS = Not-significant Adverse Environmental Effect	2 = Medium Probability of Occurrence
P = Positive Environmental Effect	3 = High Probability of Occurrence
Level of Confidence	Scientific Certainty: based on scientific information and statistical analysis or professional judgment
1 = Low Level of Confidence	1 = Low Level of Confidence
2 = Medium Level of Confidence	2 = Medium Level of Confidence
3 = High Level of Confidence	3 = High Level of Confidence
	N/A= Not Applicable

*As determined in consideration of established residual environmental effects rating criteria.

In summary, adverse residual environmental effects on Archaeology and Heritage Resources during Project construction are predicted to be not significant. The majority of the Assessment Area has been highly disturbed by past construction activities which may have had an adverse effect on any archaeological and heritage resources. If the remaining high potential area is tested prior to construction, and proper mitigative measures are implemented, there should be no adverse environmental effects on archaeological and heritage resources.

6.2.9 Follow-up and Monitoring

Due to the potential for there to be unknown archaeological resources within the Assessment Area, the following mitigation is required:

- The area west of Ingram River was not tested fully due to the presence of asphalt that could not be removed. Steps should be taken to remove this impediment so shovel testing can proceed in this area;
- If the construction or development of ancillary elements is planned for areas with potential for archaeological resources that have not been surveyed by a professional archaeologist, then a pre-construction archaeological assessment of these areas will be conducted, the results of which will be reported to NSTIR, prior to development of the ancillary elements; and
- If suspected archaeological and heritage resources are encountered during construction, the procedures described in Section 5.2 of the EPP (Archaeological Contingency Plan) will be implemented, including the cessation of construction activities in the area of the discovery and contacting the Nova Scotia Museum.

7.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The definition of environmental effects under Section 2(1) of the *CEAA* includes “any change to the project that may be caused by the environment”. Project design will include consideration of physical environment characteristics and their potential effects on the Project. Potential effects of the environment on the Project are described below.

Climate Change and Storm Events

The following discussion on potential effects of climate change on the Project has been drawn from the hydrotechnical evaluation of the Project prepared by RV Anderson (refer to Appendix B).

There is general consensus among the international community of climate scientists that the climate is changing due to anthropogenic changes of the atmosphere. An increasing body of observations gives a collective picture of a warming world and other changes in the climate system (IPCC 2001). Bruce (2002) stated there has been a small increase in precipitation throughout the Atlantic Provinces, with a greater fraction of total precipitation since about 1940 falling in heavy rain and snow events. If the trend of increasing frequency of shorter duration (one day or less) heavy rainfall in spring and early summer continued, drainage facilities will be more frequently overtaxed. The hydrological report completed for the Project (Appendix B) contains additional information on climate change, particularly as it may affect precipitation and hydrology.

Although the uncertainty associated with local projections of climate change over North America remains large, some generalizations about climate change can be made. All of North America will very likely warm during the 21st century. The lowest winter temperatures are likely to increase more than the average winter temperature in northern North America. In much of Canada, annual mean precipitation is very likely to increase, with precipitation increasing in winter and spring and decreasing in summer (IPCC 2007). Atlantic Canada is predicted to experience more storm events, increasing storm intensity, storm surges, rising sea level, coastal erosion and flooding (Vasseur and Catto 2008). Coastal communities and their infrastructure will be most vulnerable to these changes.

A background paper titled “Water Sector: Vulnerability and Adaptation to Climate Change” contains a discussion of the climate trends associated with an increase in the global mean temperature due to increased greenhouse gases (particularly carbon dioxide, CO2) in the atmosphere (GCSI and AES 2000.) Based on General Circulation Models (GCMs), and assuming a doubled CO2 atmosphere, a 0% to 20% increase in winter precipitation and small increases in summer precipitation are projected for Atlantic Canada. Although trend analyses of Canadian data are limited, some analyses of heavy one-day events have been undertaken that seem to indicate an increase in heavy precipitation events in Atlantic Canada. Model results indicate there will be an increased frequency of heavy one-day rains in a doubled CO2 climate, with return periods halved, *e.g.*, a 20-year return period rainfall becomes a 10-year event. If the frequency of short duration high-intensity precipitation increases as projected, then greater soil erosion and sedimentation is likely, and more pollutants will be washed into rivers and lakes due to urban runoff. The above information, in particular the change in the return period of storm events, should be considered during the design of the watercourse structures.

While models typically predict global climate response, models exist that generate local scale climate responses. One such model for Nova Scotia has predicted a warming of 5°C by 2080, with an increase in precipitation of 12% to 15% in some areas, and a decrease in other areas (Lines 2007). Seasonal changes in precipitation are also predicted across the Atlantic region, with regional variation ranging from a 5% to 20% change, primarily evident in a shift from snow to rain (Lines 2007).

Projected changes in temperature and precipitation for Kentville, Nova Scotia, were obtained by downscaling from the CGCM2 and HadCM3 global climate models (Lines 2006). Kentville is approximately 60 km northwest of Hubbards. By the end of the century, average annual maximum and minimum air temperature are expected to rise 3.8°C to 4.1 °C and 3.0°C to 4.1 °C respectively, while precipitation could increase by up to 20% (Lines 2006). The projected change in climate would affect the amount, timing, and direction of runoff events by altering the intensity, seasonality and distribution of rainfall, the amount of evaporation, and the timing of snowmelt.

Swansberg *et al.* (2004) used statistical downscaling to predict changes in temperature, precipitation, and river discharge at several locations in New Brunswick. Their work was based on a GCM scenario of tripling the atmospheric CO_2 concentrations over pre-industrial levels, which is considered to be a conservative scenario. Projected changes for the period 2010 to the end of the century relative to late 20th century conditions (1961-1990) included a potential mean annual daily precipitation increase of 9% to 14% in southern New Brunswick, and a change in mean annual discharge for the Canaan River at East Canaan of 13% by 2050, and 26% by the end of the century. Although the climate of New Brunswick differs from that of the Halifax area, the study"s results indicate the potential magnitude of climate change effects on precipitation and stream flows in the Maritimes.

There is no doubt that climatic change would alter hydrologic systems, as precipitation is the main driver of variability in the water balance over both space and time (IPCC 2007). Therefore, design flows cannot be solely based on past conditions. Considering projections of increased annual precipitation and greater rainfall intensity during storms, peak flows likely will increase with time during the long service life of the drainage infrastructure under Highway 103.

As future upgrading to the capacity of drainage infrastructure under the twinned highway could be very costly and disrupt transportation and the environment, it may be best to design for future rather than current flow conditions. This would also provide greater capacity to handle extreme flood flows in the interim, whether or not these flood events are associated with climatic change. Considerable uncertainty exists about the magnitude of any changes in precipitation, but nevertheless changing hydro-climatic conditions should be considered during hydraulic design of drainage infrastructure under Highway 103. As projections are for an increase in annual precipitation in Kentville, Nova Scotia, of up to 20% by the end of the century (Lines 2006), RV Anderson (2010a) suggests that an increase the design peak flows also by 20% would be reasonable.

Extreme Precipitation

Precipitation can fall as rain, freezing rain or snow or as some combination of these depending on the time of year. Extreme rain events during construction can create difficult working conditions and result in work stoppages. Rain is an expected work difficulty and the construction schedule considers delays due to potential rain events. In the event of extreme rain, the EPP is designed to ensure that environmental loads (*e.g.*, sediment-laden water) are addressed appropriately to minimize the potential environmental effects. The EPP also ensures that the integrity of the proposed Project is not compromised. If unusual wet periods or excessive rain events do occur, this can result in Project delays and an associated delay in completion and can result in additional capital cost.

Excess water is addressed by the proper sloping of the road surface to allow for run-off. Proper roadbed design prevents settlement and rutting which result in water pooling on the roadbed, potentially leading to hydroplaning. Water control off the road surface is mitigated through proper ditching along and between the lanes. These issues are addressed in standard highway designs.

Thunderstorms can produce extremes of rain and wind; however, most of these storms are relatively short-lived. During the operational phase of the proposed Project, extreme rain may limit visibility. Ice and snow may interfere with the operation of vehicles on the highway. Ice and snow are controlled through snow ploughing, and sand and salting of the roadways. Snow and ice can result in visibility issues. Under extreme conditions operation of the highway can be temporarily suspended at the discretion of RCMP and NSTIR officials. However, since the frequency of extreme events is low, this is highly unlikely for this portion of the proposed highway.

Sea Level Rise and Flooding

Increased temperatures may contribute to an increase in ocean volume (*i.e.*, sea level rise). Although estimates vary, global sea level rise is expected to be upwards of approximately 0.5 m by 2100 (Wigley and Raper 1992; IPCC 1995; Forbes *et al.* 1997); emerging evidence suggests that a global mean sea level rise of up to 1.3 m may be plausible during this time (Forbes *et al.* 2009).

Relative sea level has been changing systematically throughout south eastern Canada for thousands of years, due to the interplay between crustal loading (by ice or water) and the level of the global ocean (Forbes *et al.* 1997). Tide-gauge data from Halifax indicate a rising trend of 0.36 m/century since 1920 (Shaw and Forbes 1999). It is estimated that as much as a third of this may be due to global rise in sea level (Grant 1975). Low-lying coastal lands are subject to inundation under high tides and storm surges. The frequency of such flooding and the landward limits of flooding will increase with a rise in mean relative sea level. Approximately 80% of the Atlantic Region's coast is considered to be highly sensitive to sea-level rise, but the southern coast of Nova Scotia around St. Margaret's Bay may be less vulnerable. The tidal influence in St. Margaret's Bay at Boutilier‟s Point has a range of 5.7 m with a mean high tide of 2.8 m (RV Anderson 2010a).

According to the hydrological report completed for the Project (RV Anderson 2010a; Appendix B), overall, the potential for flooding along the small watercourses is low. Few of the watercourse crossings have large drainage basins, steep channel slopes, or significant flood plains that increase the potential for flooding. All of the larger watersheds are regulated by hydro-electric dams, which would reduce flood peaks. There is little to no development in or near the flood plains of most watercourses that could be affected. Furthermore, consideration will be given during design to ensure that the construction of the proposed new highway does not initiate or aggravate local flooding upstream of small culverts. Based on the field inspections, the majority of structures seem adequate to handle flood flows, but the sizing of culverts will be reviewed during highway design (RV Anderson 2010a).

Acid Drainage

Based on the type of bedrock underlying the RoW, a very small risk of acidic rock drainage (characterized by depressed pH, and elevated concentrations of acidity, sulfate, hardness and metals) would be expected. In Nova Scotia, acid rock drainage is most commonly associated with slate from the Halifax Formation of the Meguma Group and coal bearing shales. The bedrock geology underlying the proposed twinning generally consists of massive Middle to Late Devonian aged monzogranite, which is not known to be a significant acid drainage risk. However, mineral occurrence (copper, uranium and tin) are noted in the central portions north of Head of St. Margaret‟s Bay (MacDonald 1994). Considering this, the potential for acid drainage production in the vicinity of the proposed twinning of Highway 103 is considered to be low.

Contaminated Sites

If contaminated soils are encountered during the course of construction, the sites will be managed in accordance with the Guidelines for Management of Contaminated Sites in Nova Scotia (NSDOE 1996). If a potentially contaminated site is encountered, the owner of the site will be notified. The site will be evaluated in a timely manner to determine whether there are off-site impacts or unacceptable on-site impacts. If impacts or risks are identified, the owner is required to: advise affected third parties, if appropriate; determine whether active remediation or ongoing site management is to be implemented; and submit a contaminated site Notification Report to NSE.

Summary

The Project will be designed to account for potential effects of the environment on the Project. Significant adverse effects on any VECs due to effects of the environment on the Project are not considered likely.

8.0 MALFUNCTIONS AND ACCIDENTAL EVENTS

Malfunctions and accidental events associated with the Project have potential to result in environmental effects. Potential malfunctions and accidental events associated with the Project include spills of hazardous materials, failure of erosion and sediment control structures, fires, and vehicular collisions.

Precautions and preventative measures will be taken to minimize potential for the occurrence of malfunctions and accidental events that may occur during the life of the Project and to reduce the impacts of any associated environmental effects. It is difficult to predict the precise nature and severity of malfunctions and accidental events. However, the probability of serious accidental events or those causing significant adverse environmental effects is low, particularly when construction and operation procedures incorporate environmental protection and contingency and emergency response plans. Construction, and operation and maintenance procedures will be conducted in accordance with relevant regulations, guidelines and accepted industry practice.

8.1 Spills

Spills of petroleum, oils, or lubricants (POLs) may occur during construction during refuelling of machinery, maintenance activities or failure of hydraulic lines. These spills are generally localized and readily cleaned up by on-site crews using standard spill remediation equipment. However, even small spills can have very serious effects, particularly on migratory birds and fish and fish habitat. In the unlikely event of a large spill, soil, groundwater, and surface water contamination may occur, thereby potentially adversely affecting the quality of groundwater, fish and fish habitat, and wetland habitat, and resulting in the ingestion/uptake of contaminants by wildlife. Depending on the nature of the spill, it could also potentially affect residential, commercial, and other land uses.

The EPP contains best management procedures to minimize the likelihood of spills and instructions for crew training and orientation in spill prevention and management (refer to Appendix F of the EPP which contains a Spill Contingency Plan). POLs and other hazardous materials will be handled in accordance with applicable regulations and with the procedures noted in the EPP and Standard Specifications. Construction equipment will be frequently inspected for possible fuel and hydraulic system leaks and leaks detected will be repaired immediately where possible. If the repair cannot be completed immediately, drip pans or alternative containment will be put in place to prevent loss of POLs to the environment. Equipment refuelling and maintenance will be conducted at designated sites, away from residential and known cultural or heritage properties, and not within 30 m of a wetland or watercourse or other areas known to be frequented by migratory birds.

A large spill of contaminants (*i.e.*, tanker accidents during highway operation) could result in a significant effect on the terrestrial or aquatic environment. In this unlikely event, local and provincial emergency response procedures will be invoked to minimize impacts. Emergency response and contingency plans are accepted and effective means to limit the severity of accidental effects. These plans and procedures will be implemented through the EPP and supported through training programs.

Significant adverse effects on any VECs due to accidental spills are not considered likely to occur.

8.2 Erosion and Sediment Control Failure

Potential effects of erosion on the Project may include, but are not limited to:

- erosion causing slope instability;
- sedimentation along drainage channels, resulting in improper function; and
- degradation and break-up of pavement surface from ice and frost.

Construction activities will include clearing of vegetation. The rate of erosion of disturbed/exposed surfaces can be much greater than the rate from an undisturbed setting. The key to minimizing erosion is to minimize exposure and extent of disturbance. Standard highway construction practices and design strategies such as installation of erosion control structures and work progression help to ensure effects of erosion are minimized or prevented.

Failure of erosion and sediment control structures can also result in environmental effects. For example, failure of a sediment control structure could result in the release of a large quantity of sediment-laden runoff to receiving watercourses with adverse effects on fish and fish habitat. Erosion and sediment control measures will be implemented according to the Sediment and Erosion Control Handbook for Construction Sites (NSDOE 1988); the Generic EPP and Standard Specifications, and the NSE Watercourse Alteration Specifications NSE (1997 and revisions). Control measures will be monitored by an environmental inspector, particularly after a heavy precipitation event or snow melt. Remedial action including pumping, runoff diversion and additional control measures will be taken as necessary. In the event of a failure, Project construction will be shut down until controls are restored. An erosion and sediment control failure leading to a significant adverse effect on any VECs is considered unlikely if best management practices are adhered to.

8.3 Fires

Project construction activities could result in fires due to activities such as equipment refuelling, brush burning and careless smoking. Fires may result in habitat loss, sensory disturbance, direct mortality to wildlife, loss or damage of property and resources, and loss or damage to archaeological and heritage resources. Fire fighting chemicals could enter surface water, affecting fish and fish habitat if allowed to disperse and persist.

Specific mitigation includes: proper supervision of brush fires; compliance with conditions of burning permits; regular work inspections; proper design and use of chemical storage areas and provision of firefighting equipment. Material management and operational procedures will further reduce the frequency and extent of accidental fires related to the Project. Burning on the RoW will not be permitted and hazardous materials storage areas will bear appropriate flammability warning signs where applicable.

In the unlikely event of a fire, local emergency response and fire fighting capability will be able to reduce the severity and extent of damage. A fire prevention procedure will be included in the EPP to reduce the potential for fires along with training and orientation information for work crews. Adverse effects on air quality (*i.e.*, exceeding regulatory limits) could result due to fires; however these accidents are unlikely to occur and would be rapidly controlled by first responders. Any such effects on local air quality would be localized and temporary therefore no significant effects on air quality are predicted as a result of fires. A significant adverse effect on any VECs due to fires is therefore considered unlikely.

8.4 Vehicular Collisions

While traffic collisions are inevitable, the twinning of Highway 103 along the proposed section is expected to have a significantly improved collision rate compared with the existing Highway 103. As noted in Section 1.3 and Section 2.3 (Purpose and Need for the Project and Project Activities, respectively), the twinning will result in a controlled access four lane divided highway with collision rates expected to be considerably lower than those on the existing two lane highway.

Any construction project that affects public highways has the potential for transportation-related malfunctions and collisions, which could result in effects on public health and safety and/or environmental effects, such as those described in Section 6.1, Spills. However, the following features of the Project will minimize the number, severity and effects of malfunctions and accidents in the Assessment Area:

- The opposing roadways of the new highway will be separated by a median;
- All entrances, exits and crossings of the new highway will be by interchanges, overpasses or underpasses;
- The horizontal and vertical alignments will be designed and constructed to resemble the existing lanes and in accordance with current freeway design guidelines;
- The cross section of the new alignment will resemble the existing lanes; and
- The divided highway will improve traffic flow on the highway.

Vehicular collisions are not expected to have a significant effect on the environment.

8.5 Summary

In summary, with adherence to best management practices, including adherence to the EPP and, if necessary, implementation of emergency response and contingency procedures, opportunities for malfunctions or accidental events as a result of this Project are minimized. In the event of occurrence, significant adverse environmental effects are not likely. Significant effects from fires on local air quality and large spills on the terrestrial and/or aquatic environment are possible but are highly unlikely to occur.

9.0 ENVIRONMENTAL MANAGEMENT AND MONITORING

9.1 Environmental Management

NSTIR is committed to the effective management of all Project activities with potential to result in serious adverse biophysical and socio-economic effects within the Assessment Area. This commitment has been demonstrated during the Project planning phase through the completion of a preliminary environmental screening to identify potential resources that may require particular attention to minimize adverse effects on sensitive areas. NSTIR is also committed to effective implementation of the environmental design and mitigation measures specified previously in this document including other measures described in this section.

NSTIR has a Generic EPP which will be enhanced to include Project-specific requirements. The EPP will combine generic protection measures applicable to all highway construction activities in the province with environmental protection measures specific to this Project, including measures specified in this document and applicable approval conditions. In particular, environmentally sensitive areas will be identified with specific protection measures included as appropriate. The EPP will also contain requirements for the contractor to complete a work progression schedule for approval by the NSTIR Project Engineer. Monitoring requirements and other follow-up plans will also be included as needed.

9.2 Emergency Response and Contingency Planning

Accidental events resulting in potential adverse environmental effects may occur during Project construction and operation (refer to Section 8.0). These events may include: spills of fuels and other hydrocarbons; failure of erosion and sediment control measures; fires; and vehicular accidents. It is difficult to accurately predict the precise nature, probability and severity of these events on the environment. Material management and operational procedures will reduce the frequency and extent of accidental events. Emergency response and contingency planning are accepted and effective means to limit the severity of effects.

NSTIR will work with contractors to ensure that in addition to the generic plans, site-specific contingency plans are in place to address these events as well as to address unlikely encounters with extreme storm events, failure of erosion and sediment control measures, archaeological resources, contaminated sites and acid producing bedrock.

9.3 Monitoring Programs

Different types of environmental monitoring occur at different phases of a Project and for different purposes. Once the alignment details are finalized, pre-construction monitoring and site-specific survey activities will be implemented to establish baseline conditions for certain VECs, as specified in this document or subsequently required under conditions of regulatory approval (see Section 9.3.1). Two types of environmental monitoring, which are normally carried out during and after construction, are environmental compliance monitoring (ECM) and environmental effects monitoring (EEM). ECM involves monitoring of activities by regulatory authorities and NSTIR, to ensure compliance with all regulatory requirements and self-imposed environmental commitments. EEM is environmental monitoring which may be undertaken to assess the accuracy of impact predictions, and to evaluate the effectiveness and identify the need to alter or improve mitigative and compensatory measures.

9.3.1 Pre-Construction Monitoring

Rare Plant Survey

A follow-up survey is recommended to better assess the abundance and distribution of Southern Twayblade along the proposed RoW. A monitoring program should be established for populations found adjacent to the new RoW. More detail is included in Section 5.4.

Bird Species at Risk Survey

Prior to construction, it is recommended that Canada Warbler and Rusty Blackbird surveys be conducted between chainage 17+600 and 19+000 m. These surveys would assess the abundance of these species in this area and determine how important the habitat is to these species and which areas are most heavily used by them. This information would be used to better assess the effect of the Project on these species and help to fine tune mitigation measures to reduce adverse effects of the project on them. The information collected could also be used as pre-disturbance data for monitoring studies to assess the efficacy of mitigation.

Also prior to the onset of construction activities, a Long-eared Owl breeding habitat modeling exercise will be undertaken to determine the locations of potential Long-eared Owl nesting sites within the Assessment Area. Long-eared Owls nest earlier than most bird species so it would be necessary to truncate the period when clearing could occur in order to prevent the destruction of active nests. Areas having high potential for nesting Long-eared Owls could be easily modeled so the reduced clearing period would only apply to a small subset of terrestrial habitats present in the Study Corridor. In these areas the period during which clearing could not occur would extend from March 1 to August 31.

Archaeology Survey

A follow-up archaeological survey has been recommended in an area of high potential near the Ingram River that could not be accessed during the field study because the area was paved. A survey of the property prior to construction would enable an assessment of potential for resources in areas that may be affected by construction. In absence of a pre-construction survey, construction monitoring should be undertaken during excavation activities close to this property. More detail is included in Section 6.2.

Well Water Survey

Based on final project design, a well water survey will be developed by NSTIR to assess the quality and quantities of wells within 300 m of the centreline of the final alignment (refer to Section 5.2 of the EA Report and Section 4.2.3 of the Generic EPP). If blasting is required, the construction contractor will conduct additional surveys based on discussions with a blasting contractor.

Pre-Blast Survey and Monitoring

Detailed design surveys will indicate where, if at all, blasting will be required. If blasting is conducted, a pre-blast survey of all properties that would potentially be affected by construction blasting will be performed. A pre-blast survey and monitoring program will be developed when design details, field conditions and the amount of bedrock that requires blasting is fully defined.

The area that would be affected by blasting operations depends largely upon the magnitude of blasts required to achieve the desired volume of cut in bedrock. The number of properties to be surveyed will be determined by the contractor.

For each residence and outbuilding to be inspected, external and internal conditions will be recorded. Landowners who will not permit examination of their properties will be asked to sign a waiver to this effect.

Monitoring of ground vibration with one or more seismographs and monitoring of air blast with a decibel meter will be carried out for each blast; refinements may have to be made to the charge weight when actual site specific vibration data becomes available.

In the event of blast damage claims, the construction contracts will stipulate that such claims be dealt with promptly. A telephone number, to which claims and inquiries about the operations could be directed, will be made public by the contractor.

9.3.2 Environmental Compliance Monitoring

NSTIR will establish an ECM program to ensure that all regulatory requirements and commitments are being met. ECM can be divided into two elements: regulatory environmental surveillance; and self-regulatory environmental compliance monitoring. Regulatory environmental surveillance is carried out by regulatory authorities. Self-regulatory environmental compliance monitoring is that which NSTIR undertakes to monitor its own activities against internal and external environmental standards. Self-regulatory ECM overlaps with regulatory environmental surveillance where the external standards which are being monitored are regulatory in nature. However, self-regulatory ECM is a much broader concept and is an important tool for the implementation of mitigation, particularly where government regulations are vague or non-existent. Self-regulatory ECM can involve:

- Monitoring of all environmentally-sensitive activities to ensure compliance with internal and external non-regulatory environmental standards;
- Coordination of communication with regulatory authorities; and
- Provision of on-site environmental advice to project personnel.

The principal mechanism for ECM will be the Generic EPP, which provides the practical framework for the implementation of the environmental requirements of the Project. The EPP will also provide a common reference document against which compliance can be judged by both regulatory authorities and NSTIR.

9.3.3 Environmental Effects Monitoring

EEM involves taking repetitive measurements of environmental variables over time to detect changes caused by external influences directly or indirectly attributable to a specific human activity or development. EEM is generally undertaken to:

- Improve environmental understanding of cause and effect relationships;
- Provide an early warning of undesirable change in the environment; and
- Verify earlier predictions of impacts and effectiveness of mitigative measures.

The EEM program will be incorporated into the EPP and will be updated as required, as information regarding the predicted impacts and effectiveness of mitigative measures is collected.

Routine monitoring of dust is not anticipated. If required however, air sampling will be conducted in accordance with NSE and Environment Canada methodologies for High-Volume air sampling of TSP matter. Erosion and sediment control structures will be routinely inspected and maintained appropriately. Surface water quality, site and habitat restoration, and bank stability and protection will be monitored regularly during construction and thereafter until soils have been permanently stabilized. Where habitat restoration is undertaken, monitoring programs will be implemented. The Salt Management Strategy (Appendix C) will help identify the type of habitat along the RoW that may require monitoring for potential road salt-related impacts. Archaeological monitoring and follow-up work the Project will be undertaken at the direction of the Nova Scotia Museum.

9.4 Compensation Programs

9.4.1 Compensation for Land Acquisition

NSTIR's land acquisition and compensation policy will generally follow the guidelines developed under the Nova Scotia *Expropriation Act*. Property expropriation under the Act, however, only occurs when negotiations between individual property owners and/or their legal representatives fail in reaching a fair and equitable settlement.

The corridor for the Project was acquired when the existing highway was constructed however there are some requirements for additional land to accommodate access roads. Once the need for additional land is determined, the process of land acquisition begins. Normal practice is to determine the local market value in accordance with recognized real estate appraisal practices for properties directly impacted and those which may be injuriously affected as appropriate. Acquisition and Disposal Officers will contact property owners to negotiate a mutually acceptable settlement. If negotiations fail, the property is formally expropriated and the claim is scheduled to be heard by the provincial Expropriation Board.

There are a few additional actions which could assist in reducing some of the potential adverse impacts of relocation from these properties. These include landowner notification at the earliest possible time in the planning and design stages of the proposed alignment. Early property purchases are considered in cases where: the property may already be on the market; the majority of the property will be impacted by the alignment; and when NSTIR is fairly confident the alignment will be approved, requiring certain properties to be acquired. There are, however, risks associated with early property purchases. If properties are acquired too early, before Project approval, there is a risk that the environmental assessment, survey and detailed design may reveal issues previously unknown which may warrant changes to the Project, possibly changing the location of impacts and properties to be acquired.

9.4.2 Compensation for Lost Habitat

DFO has developed the Policy for the Management of Fish Habitat (1986) under the federal *Fisheries Act*, which applies to all Projects and activities in or near water that could alter, disrupt or destroy fish habitat by chemical, physical, or biological means (refer to Section 5.3). The guiding principle of this policy is to ensure no net loss of the productive capacity of fish habitat. All activities which have the potential to affect watercourses inhabited by fish must be approved in advance by NSE and DFO. Development of compensatory fish habitat is a typical approach to compensation when there is potential for a loss of the productive capacity of the habitat. NSTIR has initiated discussions with DFO regarding the likely need for HADD compensation.

10.0 SUMMARY AND CONCLUSIONS

NSTIR proposes to twin an existing 22 km two-lane section of Highway 103, which extends from west of Exit 5 at Upper Tantallon to approximately 2 km west of Exit 6 at Hubbards, Nova Scotia. The Project includes ramp configuration changes at Exit 6, one overpass and two multiplate underpasses along 16 km of access roads, and several watercourse crossings, as well as temporary ancillary elements. Construction is anticipated to begin in 2016 and will take approximately five years to complete. It is anticipated that the highway will be maintained and remain in operation indefinitely.

This Project is subject to federal environmental assessment under *CEAA*. This EA Report has been prepared to meet the Terms of Reference prepared jointly by federal and provincial departments to meet the requirements of a *CEAA* screening level assessment.

The assessment of potential Project effects on the environment considers biophysical and socio-economic effects on the following VECs:

- Atmospheric Resources
- Groundwater Resources
- Aquatic Environment
- Vegetation
- Wildlife and Wildlife Habitat
- Wetlands
- Land Use
- Archaeological and Heritage Resources

Mitigation and monitoring have been proposed to reduce or eliminate potentially adverse effects for each VEC (refer to Table 10.1 for summary). The significance of residual environmental effects (*i.e.*, after mitigation has been applied), including cumulative effects was also predicted for each VEC.

In general, potential adverse effects on these VECs will be short term and/or highly localized and can be effectively mitigated through technically and economically feasible methods recommended in this report. Significant adverse residual effects are therefore not considered likely for all VECs during Project construction and operation. Significant adverse effects on atmospheric resources (air quality), and terrestrial and aquatic environments are possible in the unlikely case of an accidental event resulting in a large fire or severe spill.

With the implementation of the proposed mitigation and monitoring, no significant adverse residual environmental effects (including cumulative effects) are predicted to occur as a result of routine Project construction or operation and maintenance activities. A positive effect will be realized by the Province of Nova Scotia with the development of this Project as it will improve the current safety performance and level of service along this stretch of Highway 103.

Table 10.1 Summary of Mitigation, Monitoring and Follow-up

Potential Environmental Effect	Proposed Mitigation	Proposed Monitoring and Follow-up
ATMOSPHERIC ENVIRONMENT (Section 5.1)		
• Change in Air Quality (A) • Change in Sound Quality (A) • GHG Emissions (A)	• Follow Generic EPP and applicable guidelines and regulations • Apply dust suppressants where feasible • Follow equipment maintenance schedules • Preserve natural vegetation where practical • Minimize activities that generate large quantities of dust during high winds • Environmental awareness sessions to include vehicle idling • Notify residents in advance of construction and provide contact information in event resident wants to file noise complaint	• Ambient monitoring of dust or noise conducted during construction as appropriate
GROUNDWATER (Section 5.2)		
• Change in groundwater quality (A) • Change in groundwater quantity (A)	• Preconstruction well survey • Preblast surveys as required • Ripping instead of blasting where practical near residential areas • Erosion and sediment control measures to reduce surface runoff • Remedial action as necessary to restore damaged wells and provide temporary potable water as needed • Follow Generic EPP (including Spill Contingency Plan) • Drainage and vibration controls • Follow Salt Management Plan • Minimize extent of clearing where practical	• Preconstruction well survey • Preblast surveys (if required)
AQUATIC ENVIRONMENT (Section 5.3)		
• Direct mortality (A) • Change in habitat (A) • Change in surface water quality (A)	• Maintain fish passage for all species that use the watercourses for life-cycle purposes • Follow Generic EPP and Standard Specifications, NSE Watercourse Alteration Specifications (1997), DFO (1998) draft document Guidelines for the Protection of Fish and Fish Habitat: The Placement and Design of Large Culverts, and DFO"s blasting guidelines (Wright and Hopky 1998) • Follow conditions of Water Approval • Erosion and sediment control measures • Limit area of clearing within 30 m of watercourses to the extent possible • Heavy machinery use during clearing will be kept a minimum of 10 m from watercourse banks • Minimize in-water work; work in the dry (or in isolation) where practical	• HADD authorization and compensation, if required • Monitoring during Construction to include TSS (based on precipitation events); regular inspection of erosion and sediment control measures; and inspection of hazardous materials storage areas

Table 10.1 Summary of Mitigation, Monitoring and Follow-up

Potential Environmental Effect	Proposed Mitigation	Proposed Monitoring and Follow-up
	• Installation to occur from June 1 to September 30 where practical unless otherwise approved by DFO • Clean rock used below high water level for infilling (where required) • HADD Authorization application to DFO and preparation of compensation Plan if required • No storage of chemicals and POLs and no equipment maintenance and refuelling will occur within 30 m of a watercourse or wetland • Structure sizing should be equal to or greater than existing structures (and meet DFO guidelines for fish passage) • Proper design of ditching for infrastructure maintenance • Maintain buffer zone within 30 m of watercourse where practical during vegetation management • No herbicide use within 30 m of watercourse (or less if prescribed on herbicide label)	
VEGETATION (Section 5.4)		
• Change in habitat quality (A) • Change in habitat quantity (A) • Loss of Species of Conservation Concern (A)	• Project design (narrow median where practical to minimize footprint) • Limit Project-related off road activity • Follow Generic EPP • Employee environmental awareness training • Flagging and avoidance of Species of Conservation Concern • Transplanting of Species of Conservation Concern • Follow Wetland Alterations Approval conditions • Erosion control measures • Minimize area of disturbance where practical • Ensure that culverts are properly sized and installed to prevent flooding or draining of wetlands • Adhere to Salt Management Plan • Modify mowing heights in areas where Species of Conservation Concern are present • Control of woody vegetation in wetland performed with , machines operated from outside of wetland or use of hand tools • Survey sections of Wetland 249 to determine distribution of southern twayblade prior to vegetation management	• Follow-up surveys to determine distribution and abundance of boreal felt lichen and southern twayblade (pre-construction) • Prior to initiation of Project construction, conduct survey for plant Species of Conservation Concern along roadside shoulder to determine if species have continued to persist and whether mitigation measures for highway maintenance practices are still necessary • Monitor transplanted populations on semi-annual basis during year 3 and year 5 after construction and develop adaptive management plan as necessary

Table 10.1 Summary of Mitigation, Monitoring and Follow-up

Potential Environmental Effect	Proposed Mitigation	Proposed Monitoring and Follow-up
WILDLIFE (Section 5.5)		
• Change to habitat quantity (A) • Change to habitat quality(A) • Direct mortality (A)	• Limit Project-related off road activity • Follow Generic EPP • Clear outside of breeding bird season (May 1 to Aug 31 for most species) where practical. If clearing must take place during the bird breeding season, a contingency program (consisting of nest surveys and avoidance of active nests) will be undertaken to ensure compliance with the *Migratory Birds Convention Act.*	• Prior to construction, conduct Canada Warbler and Rusty Blackbird surveys between 17+600 and 19+000 m to assess species abundance and use of habitat, and refine mitigation if necessary • Prior to clearing, conduct Long-eared Owl modelling exercise to predict potential nesting sites and truncate clearing if necessary
• Loss of Species of Conservation Concern (A)	• Employee environmental awareness training • Clear only the area required for the project • Keep activities to disturbed RoW where feasible • Ensure that culverts are properly sized and installed to prevent flooding or draining of wetlands • Consider replacement of pond habitat lost in Wetland 277 for Rusty Blackbird • Schedule construction activity in area between 17+000 and 19+000 m outside sensitive period of breeding season (early May to early June) for Rusty Blackbird, to extent practical • Consider use of artificial nests for Common Loon on Mill Lake prior to blasting • Conduct blasting near Mill Lake outside incubation period for Common Loon (early May to mid-July) to extent possible • Consider use of artificial nests for Barn Swallow approximately 50 m from construction area at Mill Lake and Little Indian Lake • If reinforced concrete deck supports are used at Mill Lake and Little Indian Lake crossings, consider adding shelves to provide suitable nesting sites for Barn Swallows • Consider placement of Tree Swallow nest boxes in forest habitat adjacent to Little Indian Lake, Mill Lake and Dorey Lake prior to construction • Consider modeling to identify areas of high potential for Long-eared Owl and reduce window for clearing in these areas (*i.e.*, no clearing from March 1 to August 31 in these areas) • Consider establishing 100 m buffer around nest site of Broad-winged Hawk when building access road near 0+600; if not possible, ensure clearing is done prior to breeding season • Schedule vegetation management for periods outside of the nesting season for most bird species (May 1 to August 31)	

Table 10.1 Summary of Mitigation, Monitoring and Follow-up

Potential Environmental Effect	Proposed Mitigation	Proposed Monitoring and Follow-up
	• Schedule maintenance activities on Mill Lake and Little Indian Lake bridges outside of breeding season for Barn Swallows (mid-April to mid-September) where possible • Adhere to Salt Management Plan	
WETLANDS (Section 5.6)		
• Change in wetland quality (A) • Change in wetland quantity (A) • Loss of wetland function (A)	• Follow Generic EPP • Minimize work in and near wetlands • Narrow median design will reduce impacts in some areas along alignment • Design culverts to minimize wetland draining or flooding • Erosion control measures • Document location of and establish 30 m non-disturbance buffers for wetlands located south of existing highway • Flagging of wetland boundaries for avoidance • Use of clean, pH neutral, non-leaching, coarse fill materials within wetland areas • Employee awareness training	• Water Approval application for wetland alteration • Wetland habitat compensation and follow-up monitoring.
	• Use of silt fencing along roadbed toe of slope at Little Indian and Sawler Lakes to keep nesting snapping turtles out of construction sites • Adherence to mitigation described above for Common Loon and other bird Species of Conservation Concern • Adherence to Water Approval for Wetland Alteration conditions including wetland compensation • Cleaning of construction machinery prior to entering wetlands • Follow NSTIR Salt Management Plan • No herbicide use in wetlands	
LAND USE (Section 6.1)		
• Change in land use (A)	• Temporary detours provided if necessary • Follow Generic EPP that includes guidelines for reducing noise and air emissions • Minimize dust through the application of water • Fair market value compensation for acquired properties • Maintain access to lands where possible • Construction of access roads to maintain access to forestry and NSPI operations • Reasonable accommodation to allow forestry operations access to adjacent lands during construction • Follow NSTIR Salt Management Plan	• No specific monitoring or follow-up recommended

Table 10.1 Summary of Mitigation, Monitoring and Follow-up

Potential Environmental Effect	Proposed Mitigation	Proposed Monitoring and Follow-up
ARCHAEOLOGICAL AND HERITAGE RESOURCES (Section 6.2)		
• Project-related change in archaeological and heritage resources (A)	• Complete archaeological testing in high potential area (portion of Ingram Lake untested) or monitor during construction as necessary • Report any features, artifacts, or other cultural material to NSM prior to proceeding with construction activities • Archaeological Contingency Plan (Section 5.2 of the Generic EPP)	• Complete subsurface testing in high potential area • Pre-construction survey of areas for ancillary elements as required

In conclusion, the potential adverse environmental effects of this Project can be successfully managed and significant effects are not likely. This twinning project is important to the Province of Nova Scotia as it will increase safety and comfort for motorists travelling on Highway 103 and facilitate transportation of large volumes of people and goods to and from the nearby communities of the South Shore.

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APPENDIX A

TERMS OF REFERENCE

Appendix C - Scope of Work
CEAA Environmental Screening Report

The work will proceed logically through the following key components of the environmental impact assessment process. The Consultant will prepare a final stand alone document that details the following components, and the results of the environmental impact assessment. This report is to meet the requirements for completing a screening level environmental assessment under the Canadian Environmental Assessment Act, including all requirements identified in Section 16(1). From herein, it will be referred to as the "Report". Also refer to Transport Canada's Proponent's Guide for Environmental Assessment.

http://www.tc.gc.ca/programs/environment/environmentalassessment/recent_publications.htm

The Report shall include, but not be limited to, the following components:

1.0 Description of the Project

This section of the Report shall describe the project as it is planned to progress through the construction, operations, decommissioning and abandonment phases of its life. Any assumptions that underlie the details of the project design shall be described. Where specific codes of practice, guidelines and policies apply to items to be addressed, those documents should be cited and included as appendices to the Report. Include a list of major project activities, works, including ancillary and temporary works, their locations, scheduling details and estimates of their magnitude or scale (quantified, if possible). Sources of public funding shall also be identified.

Items to be addressed shall include, but not necessarily be limited to the following. Also refer to the Canadian Environmental Assessment Agency's guidance on "Addressing Need For, Purpose Of, Alternatives To, and Alternative Means, under the Canadian Environmental Assessment Act" which can be found at
http://www.ceaa-acee.gc.ca/013/0002/addressing_e.htm

1.1 Project History and Purpose
Describe the purpose/rationale for the highway.

1.2 Alternatives to the Project
Describe any functional alignment alternatives that would meet the project need and achieve the project purpose. Indicate how the chosen alternative was selected based on the environmental mitigative sequence (impact avoidance, minimization and compensation for residual impacts that cannot be minimized), and considerations of fiscal, socio-economic and other factors that in combination enable a comprehensive decision.

1.3 Highway Corridor Location

Describe the ultimate boundaries of the proposed corridor and highway route in a regional and local context with maps showing existing and proposed land uses, major water bodies, and wetlands, and infrastructure such as dykes, road networks, railways, power lines, mining operations, proximity to settled areas and business parks, individual and community water supplies, waste disposal and water treatment facilities, Mi'kmaq reserves and sites of special interest, archaeological, heritage and protected sites, etc. The Report is to include:

- Property mapping, including Property Identifier Numbers (PID)
- Large scale (1:10000 minimum preferred - 1:25000, 1:50000 acceptable) location map; original base map(s) and/or recent air photos clearly indicating the site location relative to existing communities and transportation facilities, and showing access to the existing transportation network.
- Location of existing interchanges and any new connections/alterations that are currently under construction or proposed.
- Locations of proposed parallel [property] access roads, if known.

1.4 Scope of Work

This section shall include a detailed description of each component of the project, and associated physical works and activities. It shall also include ancillary works such as the relocation of facilities and associated activities. These activities shall include, but not be limited to, those contained in Table 1 following:

Table 1 – Scope of Project

PROJECT PHASE	PROJECT COMPONENTS	
	Core Project Components	Ancillary Works Other Projects and Activities
Construction	General Highway Construction Approximate total construction period (if staged, please list each stage and its approximate duration). Include proposed time frames for surveying, right of way clearing and slash disposal, and timing of highway construction, and construction work adjacent to watercourses. Areas requiring major cut and or fill operations Acceptable types of borrow material Site Preparation Roadbed Preparation Watercourse Crossings Structures and facilities Interchanges and intersections Erosion control measures Illumination Landscaping Road signaling Drainage and stormwater management Proposed road paving materials. Pit and quarry operations	Utility relocation as required Material stockpiling Excavation as required for installation of various components Pavement construction as required Vehicle types, truck routes, hours of operation of vehicles to be used in the highway construction Potential tree trimming and/or removal from highway median Erosion and sedimentation control measures Seed and cover Criteria for the selection of candidate sites for the disposal of excess/waste excavated rock and overburden, including the locations of any currently known planned disposal sites. Sites for the disposal of organic soil, slash, grubbing and wood fibre, including locations of any currently known or planned disposal sites.
Operations / Maintenance	Proposed opening date Winter de-icing operations (sand and salt applications) Winter snow plowing Line painting Highway shoulder maintenance Structures maintenance / rehabilitation Resurfacing Barrier maintenance (e.g. guiderail replacement) Storm drainage system repairs (e.g. ditching, replacing worn structures) Drainage structure maintenance/clean out (as required) Collision Management (investigation, vehicle removals etc.) Other maintenance: landscaping, fencing, signs, illumination, utilities, graffiti removal	Lane closures Equipment maintenance operations Production of granular materials Surplus material disposal
Decommission / Abandonment	No plans for decommissioning identified within the planning horizon (lifespan of the facility)	Not applicable

2.0 Description of the Environment

This section of the Report shall identify the study area and shall describe the seasonal variability in environmental components through the use of original baseline studies or existing data where appropriate. As applicable, the Consultant must also consider the effect of storms and other key temporal frequencies on relevant environmental components (e.g., significant tidal frequencies). The Report shall clearly indicate baseline data/information that is not available or existing data that cannot accurately represent environmental conditions in the project area over four seasons and other key temporal frequencies. If the background data has been extrapolated or otherwise manipulated to depict environmental conditions in the project area, modelling methods and equations shall be described and shall include calculations of margins of error.

Discussion of these environmental issues shall include, but not necessarily be limited to, those listed below.

2.1 General Description of the Corridor

Include a general description of the local terrain, including features such as nearby watercourses, wetlands, dwellings, wells, public roads and topography within the study area, discussion of the area to be affected by the undertaking, and a description of those sensitive aspects of the biophysical environment that may be adversely affected by the project. Include a discussion of the interrelationship of environmental components, and their sensitivity to disturbance.

2.2 Regulatory Environment

List all the permits, licenses, approvals, guidelines, land use zoning, and other forms of authorization required for the undertaking, together with the names of the authorities responsible for issuing them (e.g. federal government department, provincial government department, municipal government department, etc.) for all phases of this project. Include discussion of Federal Coordination Regulations and Responsible Authority determination.

2.3 Area Geography and Local Topography

Describe the study area geography and topography including features such as lakes, streams, and wetlands within the study area. Also describe those features outside the study area that influence features within the proposed corridor or are required as part of future environmental permitting documents (e.g. wetlands, known occurrences of rare/endangered/threatened species, etc.). The study area for site specific criteria is shown on the attached plan, and was described in Section 3.0 in the RFP.

2.4 Bedrock, Surficial Geology and Soils

Provide a general description of the bedrock and the surficial geology of the study area, to include but not necessarily be limited to discussion of:

- The bedrock geology along the proposed corridor.
- Acid production/consumption, location and quantity data for all bedrock formations that will be encountered and disturbed by the highway proposal

- The surficial cover including overburden depth, soil types, permeability and porosity, and all areas of high erosion risk.
- The potential for disturbance of contaminated soils. Where the Project will involve the confinement, removal or remediation of contaminated soils or sediments, information on the containment, disposal or treatment method – including the potential environmental and any related human health effects associated with the method – should be provided. When drawing conclusions about the significance of impacts, reference should be made to the appropriate guidelines.
- Any areas having known or proven economic mineral deposits, areas under advanced mineral exploration, and the location and extent of existing and abandoned mines, pits and quarries.

Describe the Acts and Regulations which are applicable to blasting on the highway work.

2.5 Air Quality

The Report should provide a description of air quality in the vicinity of the Project.

Describe the weather patterns along the proposed route as they relate to highway operation, maintenance and safety. Include how snow, ice and wind conditions may be expected to change with geographic conditions and season, and how these relate to the proposed project. Indicate how precipitation events will change over time due to climate change.

2.6 Surface Water Quality and Quantity

The Report should identify the major watersheds and the name, location and characteristics of all water bodies in the Project area, and include discussions on potential impacts of the Project on surface water quality and quantity. The analysis should include potential effects from storm water run-off and spills, during the construction and operation phases. The Report should describe the existing water quality to the extent possible, and indicate whether the water bodies are a source of potable water.

The Report should also indicate whether any of these watercourses are navigable, and whether approval under the *Navigable Waters Protection Act* (NWPA) will be required ***A navigability inquiry has been conducted on this project. Water bodies considered navigable are: Ingram River, Little Indian Lake, Mill Lake, Puddle Lake, Sawler Lake, Dory Lake, the Puddle and an unnamed brook.***

2.7 Groundwater Quality and Quantity

The Report should provide a description of groundwater resources in the study area (including the depth of the water table), and should indicate whether the groundwater is a source of potable water

Discuss NSTIR's commitment to complete a well water quality and quantity survey of all domestic and other wells within the expected impact area of the highway corridor, prior to construction.

2.8 Habitat Identification

Identify the following types of habitat. Appropriate field surveys shall be conducted as part of the identification. These surveys shall be completed in sufficient detail to meet the information requirements of government stakeholders. The timing of these surveys shall be agreed upon with government stakeholders, and the dates to be included in the Report. *Species of special conservation* concerns are understood to include those floral and faunal species: 1) listed by the Committee on the Status of Endangered Wildlife in Canada [COSEWIC] and designated by the *Species at Risk Act* (SARA); 2) identified as S1, S2, and S3 by the Atlantic Canada Conservation Data Centre [AC CDC]; and, 3) designated in the provincial *Endangered Species Act*, or of otherwise high conservation priority according to the NS Department of Natural Resources or the Canadian Wildlife Service.

In conjunction with the section on vegetation, wildlife and migratory birds, the Report should indicate whether there are any known species of concern present in the study area, including those species listed under the SARA.

The SARA is intended to provide protection for individuals of wildlife species at risk listed under Schedule 1 of the Act, their residences (dwelling places, such as a den or nest or other similar area that is occupied or habitually occupied by one or more individual during part or all of its life cycle) and critical habitat (that part of areas used or formerly used by the species to carry out their life processes that is deemed essential for survival or recovery).

SARA requires that when a federal EA is carried out on a project that may affect a listed species or its critical habitat: adverse environmental effects must be identified; mitigation measures must be taken to avoid or lessen adverse effects; and environmental effects monitoring must be conducted. Furthermore, if any listed wildlife species, its critical habitat or the residences of individuals of that species may be adversely impacted by the project, the Responsible Authorities for the CEAA assessment must notify the competent Minister responsible for the listed species. Environment Canada can provide assistance with this.

Existing background information should be collected to determine whether any species of conservation concern are known or expected to use the site or adjacent lands within the zone of influence of the project. Environment Canada's species at risk search tool (http://www.speciesatrisk.gc.ca) should be consulted to assist in determining whether the ranges of any SARA Schedule 1 listed species at risk overlap with the site.

2.8.1 Vegetation

The Report should provide a description of vegetation and dominant plant communities in the study area (within the zone of influence of the Project). The habitats within the zone of influence of the Project should be described and mapped in relation to the Project works and activities.

Identify flora habitat within the study area, including but not limited to habitat along the beds of streams, in bogs and other wetlands. This section should identify typical species of flora, flora species-at-risk and potential habitat for species-at-risk in the study area.

2.8.2 Wetlands

The Report should provide a description of wetlands in the study area and within the zone of influence of the Project (i.e., affected watersheds/sub-watersheds). The Consultant must incorporate and map all of the wetlands noted in the *NS Wetland Database* and any other wetlands identified during field surveys within the 1000 m-wide study corridor.

For wetlands that are likely to be directly affected by the Project, the Consultant shall provide the following information to ensure a comprehensive evaluation of project effects (and simplify future applications for a NS Environment (NSE) Wetland Alteration Approval (see also guidance given http://www.gov.ns.ca/snsmr/paal/nse/paal586.asp):

- Name, location and key boundaries
- Size and anticipated project footprint (area to the nearest 10 m^2)
- Estimation of anticipated in-filling
- Classification type(s) from the NS Wetland Database
- Surrounding land use
- Historic impacts on the wetland
- Species at risk (aquatic and terrestrial species based on field investigations and ACCDC/NS Museum records)
- Fish and fisheries (determine connectivity with up- and down-gradient water courses, presence of downstream fish barriers; liaise with staff of NS Fisheries and DFO as well as local watershed and fish and wildlife organizations)
- Dominant vegetation (from NS Wetland Database and botanical surveys)
- Birds and critical nesting periods
- Other wildlife and habitat concerns (refer to the NS Natural Resources Significant Species and Habitat Database)
- Other Functions and Values of Concern to the Local Community
- Hydrological character
- Hydrogeological character
- Property Ownership

2.8.3 Fish and Fish Habitat

Identify and map fish habitat. The descriptions shall include but not be restricted to stream size, bottom composition, stream gradient at each potential watercourse crossing, and annual temperatures and sediment loading where data is available from appropriate regulatory and resource agencies. Fish spawning, rearing, nursery, food supply and migration areas are to be evaluated within the predicted zone of influence. Describe criteria utilized for determining the zone of influence this project has on the fish habitat of the watercourse or waterbody involved.

The relative distribution, abundance, composition and socio economic importance of valued fishery components within the predicted zone of influence is to be determined. Fish species (commercial and recreational), age, health and diversity shall be described. Also discuss fishing location, amount caught and fishing methods used. Electrofishing shall be carried out per Fisheries and Oceans Canada permits and requirements.

DFO have walked the alignment and identified approximately 20 watercourses and water bodies being crossed by the twinning. The Consultant should also examine all these watercourses and discuss their connectivity to receiving watershed, and identify any compensation opportunities. The fish assessment is to be done in June during high flows. Additional assessment should be completed for salmonids in September, if water temperatures and flows permit. The exact schedule is to be discussed with DFO upon contract award. These water crossing locations are shown in Appendix G.

2.8.4 Wildlife, including Migratory Birds

The Report should provide a description of wildlife and migratory birds that are present in the study area (including species that may only use the study area on a seasonal basis), and should identify any impacts the Project may have on wildlife or avian communities or their habitat.

Identify any wildlife management areas, ecological reserves, managed wetlands, protected areas, designated areas, ecologically sensitive areas, and any other important habitats.

Identify the species of fauna (including migratory species) that are typically found in the area. Identify any fauna species-at-risk found in the area, as well as any potential habitat. This includes mammals, reptiles, amphibians and invertebrates.

Identify any bird (including migratory species) habitat. Any rare or endangered species of birds should be identified in this section of the Report. Habitat is to include staging areas for migratory birds, water fowl, wintering areas, important foraging areas for migratory birds, and bat hibernaculae. Consider avian species of special conservation concern, colonial nesters, and avian species sensitive to disturbance or habitat fragmentation. Appendix E contains the Environment Canada guidelines for the study of migratory birds.

The Report should also note that the "incidental take" of migratory birds and the disturbance, destruction or taking of the nest of a migratory bird are prohibited under section 6 of the *Migratory Bird Regulations*. "Incidental take" is the killing or harming of migratory birds due to actions, such as economic development, which are not primarily focused on taking migratory birds. As no permit can be issued for the incidental take of migratory birds or their nests as a result of the proposed activities, they should describe measures to avoid incidental take, which may include timing restrictions to avoid nesting birds during vegetation removal, site access, staging or stockpiling.

2.9 Existing and Anticipated Land Uses

Describe the patterns of land use and settlement along the proposed highway corridor. Also include a discussion of anticipated development. Include a discussion of any municipal or community services.

2.10 Traditional Land Uses

Discuss any current use of lands and resources for traditional purposes by aboriginal persons, including the impact on Mi'kmaq current use of land and resources for traditional purposes. A MKS study of this area has not been completed.

2.11 Historical, Archaeological Paleontological and Architectural Resources

Identify any areas containing features of historical, archaeological paleontological and architectural importance and describe the nature of the features located in those areas. This shall include features related to the Mi'kmaq.

2.12 Social, Economic and Recreational aspects of the Community

Describe the community character along the proposed highway corridor. This shall include but not be limited to recreation opportunities, employment, and individual well being. Describe any commercial, recreational and Mi'kmaq fishing in the area. Describe the commercial and recreational species caught, fishing location, amount caught, and fishing methods used.

2.13 Noise and Vibration

The Report should provide a qualitative description of the neighbourhoods and land uses near the Project site, and should identify the location of and distance from residential communities and other sensitive receptors in the study area, such as hospitals, daycares and senior's residences. Aerial photos or maps to support the text should be included. The Report should describe the existing ambient conditions, using actual measurements where possible, together with a description of land uses and point sources that contribute to existing conditions.

Describe the average noise levels and sources that characterize the study area. Background ambient noise levels should be characterized for various locations along the corridor where traffic noise on the proposed highway could be expected to be heard and felt to be a negative impact, i.e. residential areas, commercial areas, recreational and institutional areas.

Provide a baseline study representative of all residential and other sensitive areas (e.g. commercial, recreational and institutional) within two hundred (200) metres of the proposed right of way and at any other areas where traffic noise could be expected to have a significant negative impact. The methodology for the study is to follow that approved by NSE. Compare ambient noise levels to the NSE guidelines.

For the purposes of bidding on this proposal, assume the baseline study will be carried out at ten (10) sites. The location of these sites will be determined in consultation with TIR. Provide a cost per site value if additional sites are required.

2.14 Transportation

Describe the existing road conditions in the area, including traffic volumes and traffic types, and the road surface conditions. TIR will provide this information.

3.0 Environmental Effects and Proposed Mitigation Measures

The Report shall identify and predict the magnitude and importance of project effects, both positive and negative, on the valued environmental components (VECs) that arise from the project scoping, public comments and the Consultant's consideration of the 'existing environment'. This section shall address socioeconomic and community impacts as well as impacts on the bio-physical environment. This section is to include discussions of cumulative environmental effects, of the effects of malfunctions or accidents, and of project activities on those components of the environment considered at risk.

Socio-economic effects, as defined by CEAA, include the effect of any change in the environment on "physical and cultural heritage" as well as "any structure, site or thing that is of historical, archaeological, palaeontological or architectural significance".

Valued Ecosystem Components

The Report should indicate how the VECs considered in the assessment were identified and selected. Through the course of the EA, it may be appropriate to refine the definition of the VECs selected for detailed analysis and cumulative effects assessment. For example, beyond considering "migratory birds" as a whole, the assessment should ultimately place an emphasis on those migratory bird species that would have the greatest sensitivity to the project (e.g. species with declining populations and already subject to cumulative effects due to such stresses as habitat loss).

The environmental protection objectives for each VEC shall be identified upfront based on applicable legislation, policies, and site-specific considerations (e.g., no net loss of wetland function as set out in the Federal Policy on Wetland Conservation) . These objectives can guide the interpretation of impact significance and determination of appropriate mitigation and follow-up measures.

Each VEC shall be analyzed in the context of the following:

Environmental Effects

In predicting and evaluating the potential adverse and beneficial environmental effects of the project, the Report should provide substantial detail and state clearly what elements and functions of the environment may be lost or enhanced, where, how much, for how long, and with what overall effect.

The Report should indicate the degree of uncertainty in predicting the potential adverse and beneficial environmental effects identified. The Report should provide a comprehensive analysis of the short and long-term effects of the project on the environment and on interactions, and indicate the sensitivity of the function, integrity, and health of the environment to these predicted effects. With respect to the biological environment, while consideration of species-specific effect is essential, due consideration should also be given to impacts on biological processes and ecosystem health and integrity. Evaluation of project effects on those wetlands that are likely to be directly effected should also take into account the provincial requirements of a NS Wetland Alteration Approval (specifically, application of the mitigative sequence to decision-making; see http://www.gov.ns.ca/snsmr/paal/el/paal586.asp and the "Operational Bulletin Respecting Alteration of Wetlands"; further discussion on wetland evaluations is provided below in Section 3.6.

The prediction of potential adverse and beneficial environmental effects should be based on clearly stated hypotheses of causal relations. The Report should specify the indicators used and how these indicators would measure and verify these effects in subsequent monitoring, especially to distinguish the effects of the project from those of other activities or processes.

Mitigation

The Report should identify measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Project, including cumulative effects. This should include erosion and sediment control measures that may be required to control drainage that may be discharged into watercourses or waterbodies in the project area, and associated storm water management plans.

The Report should describe general and specific measures intended to mitigate the potentially adverse environmental effects of the project. Mitigation is defined as the elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.

Mitigation measures should be consistent with the requirements of all relevant legislation, regulations, guidelines, policies, management plans, specifications, and best management practices. The Consultant should specifically refer the NSTIR's Generic Environmental Protection Plan for the Construction of 100 Series Highways (Generic EPP; see http://www.gov.ns.ca/tran/enviroservices/govEPP100.asp). Mitigation should be considered in a hierarchical manner with impact avoidance measures identified first, reduction measures second and compensation last.

Mitigation measures are to be outlined for all VECs within the physical, biological and socio-economic environment. All proposed components of mitigation should be described by phase, timing and duration. Information must be provided on methods, equipment, procedures, and policies associated with the proposed mitigation or restitution. Standard management strategies are to be identified and established where none exist. The Report should discuss and evaluate the effectiveness of the proposed measures and assess the risk of mitigation failure and the potential severity of the consequences. Information should be provided on similar mitigation methods used with similar projects and the degree of success achieved.

The Report should indicate what other mitigation measures were considered (including the various components of mitigation) and explain why they were rejected. Trade-offs between cost savings and effectiveness of the various forms of mitigation should be justified. The Report should identify who is responsible for the implementation of these measures and the system of accountability.

Compensation

As part of the proposed measures to mitigate potentially adverse environmental effects, the Report should outline its compensation plans and policies for addressing adverse residual environmental effects, including compensation for: harmful alteration, disruption, or destruction (HADD) of fish habitat in accordance with Fisheries and Oceans Canada's policy for the Management of Fish Habitat; damage caused by the proponent's activities to the environment, to property, or to the land and resource use of others; and loss of wetland function in accordance with both the NS Wetland Designation Policy and the Federal Policy on Wetland Conservation where avoidance of impacts in not possible.

The Report should also include a discussion of past compensation measures taken for other infrastructure projects, and the successes of such measures.

Significance

The Report should contain a detailed analysis on the significance of the potential adverse residual environmental effects it predicts. Residual effects include the adverse effects that may remain at each stage of the project after proposed mitigation measures are implemented, including emergency response and contingency plans. It should contain sufficient information to enable the reviewers to understand and review TIR's judgment of the significance of effects. The Report should define the terms used to describe the level of significance. The Report should use the following criteria to assess the significance of effects:

- magnitude;
- geographic extent;
- timing, duration and frequency;
- degree to which effects are reversible or can be mitigated;
- ecological and social/cultural context;
- possibility of occurrence;

The determination of significance and likelihood of residual environmental effects are at the core of the decision about the project. It will dictate whether a responsible authority can take a course of action with respect to the project, or whether additional consideration of the project is needed through public review. For this reason, the Report must include clear statements of whether the adverse environmental effects, taking into account any mitigation measures, are significant, not significant or uncertain. It should be noted that a determination of significant effects or uncertainties (associated with the significance) could lead to a public review of the project through a mediation or a panel review as specified by Section 23 of the *Canadian Environmental Assessment Act*.

In the Report, the methods used to determine significance should be clearly documented and the results of that determination should be easily linked to these methods. These methods should include not only an analysis of the results and professional judgment, but also consultations with both the public and appropriate experts. This section of the Report should document the assumptions that entered into the determination of significance and the uncertainty that surrounds predictions made in the environmental assessment. If those results or predictions are later found to be incorrect, the determination of significance may no longer apply. The Report should convey the level of confidence associated with the predictions since this reflects upon the validity of the significance determination. The Report should also note dissenting opinions.

A level one matrix shall be utilized to pinpoint the interaction between activities and general categories of environmental components. A subsequent two level matrix shall be used to provide additional detail regarding the environmental components involved. The Consultant will design and use their own set of matrices based on the identified activities and environmental components for the proposed project. The matrix model is to be acceptable to CEAA Review Agencies. Please note matrix attached, in the Transport Canada document. With the identification of possible impact points, an impact analysis shall follow. This will require a general description of each potential impact, the determination of valued environmental components (VECs), the prediction of impacts and the evaluation of impacts.

This section is to include but not be limited to the following:

3.1 Corridor Selection

Describe the corridor selection process and indicate how the chosen alignment minimizes/mitigates adverse environmental impact.

3.2 Regulatory Compliance

Describe any legislation, regulation, guidelines, policies and specifications that will be adhered to during design and construction of Highway 103. Describe the actions taken to ensure compliance. Also discuss how these will lead to mitigation of environmental impacts.

3.3 Geological Impacts

Discuss the potential impacts of highway construction on mineral deposits that are known in the area as well as the likely consequences. If required, discuss the potential for and impact of acidic water runoff from bedrock disturbed by highway construction.

3.4 Air Quality

The discussion of potential effects should address the impacts associated with the construction phase, such as diesel emissions from the operation of heavy equipment, and the generation of dust during construction activities. Include a discussion of measures that will be taken to provide dust control during highway construction. Also include a discussion of pollutants during the construction period, including airborne emissions and accidental spills.

The discussion of potential effects should also address potential local and regional impacts during operation, such as emissions associated with increased traffic levels. Include potential sources of pollutants during the operation period, including airborne emissions, accidental spills and road de-icing materials. Describe any management strategies to minimize or avoid these releases. The air quality assessment should consider the potential adverse impacts to sensitive receptors. The Report should also address any potential human health effects associated with negative impacts on air quality caused by the Project.

When drawing conclusions about the significance of impacts, reference should be made to the appropriate guidelines, such as the National Ambient Air Quality Objectives. Where positive or neutral impacts are expected, the Report should provide rationale to support the conclusions including quantitative data to the extent possible

Discuss the potential for micro-climate modifications in the vicinity of the project, that may be caused by the construction of large fills.

Predict Greenhouse Gas (GHG) Emissions for the site preparation, construction and maintenance phases of the project. These are to be compared with known levels in the area. Discuss potential loss of carbon dioxide sinks (e.g. trees).

3.5 Impacts on Surface Water, Runoff and the Aquatic Habitat

The environmental effects analysis should identify the potential impact of the Project on watercourses and waterbodies, including the impacts of any water crossing structures that may need to be installed or modified. In particular, the Report should consider potential impacts on water quality resulting from the Project. Construction, operation or maintenance works over or near watercourses, wetlands or other water bodies (such as watercourse crossings and site grubbing) may impact water quality if there is the potential for the release of deleterious substances (including sediment) into receiving waters.

The Report should also describe the site drainage, including storm water management, and should include potential environmental and related human health effects on the water quality and quantity of receiving water bodies from storm water run-off and spills, during both the construction and operation phases. Discuss the criteria used for design of runoff features, i.e. expected runoff volumes, storm design etc. This section shall indicate if allowance has been made for anticipated changes in precipitation, caused by climate change. Discuss the predicted impacts resulting from the disturbance of contaminated soils, in particular the potential impact of contaminated runoff on aquatic habitat. If contaminated soils are to be disturbed, discuss methods to minimize adverse impacts

Specific emphasis should be placed on management measures in the event that contaminated soil or groundwater is encountered. When drawing conclusions about the significance of impacts, reference should be made to the appropriate guidelines, such as the Guidelines for Canadian Drinking Water Quality and the CCME Canadian Water Quality Guidelines as they pertain to aquatic life and existing ambient water quality .

Discuss the potential for soil eroding from highway sideslopes and backslopes into adjacent waterbodies. Present an outline of erosion and sediment control measures that will be used in the following situations: (a) clearing and grubbing of the proposed corridor, (b) installation of water crossing structures, (c) subgrade work, (d) construction of service roads and (e) highway maintenance. The Report shall also provide a discussion of the Environmental Protection Plan for the above activities. Discuss siltation, erosion and runoff control features, storm drainage management procedures and mitigation measures proposed to control sedimentation, to ensure ongoing stabilization of all steep slopes and to maintain ecological integrity of any wetlands in the area.

Discuss NSTIR’s road salt management strategy for this project.

Describe alternatives to disrupting net acid producing bedrock or other relevant bedrock disruption. When no practical alternative to exposing this bedrock exists, contingency plans shall be developed for minimizing the impacts on the aquatic environment.

3.6 Impacts on Groundwater

The Report should identify potential impacts of the Project's demolition, construction, and operation phases on groundwater quality and quantity. This will be particularly relevant in cases where excavation activities and blasting are required. When drawing conclusions about the significance of impacts, reference should be made to the appropriate guidelines, such as the Guidelines for Canadian Drinking Water Quality. Include the following in the analysis:

- Anticipated changes to groundwater quality and quantity and the significance of the anticipated changes, including impacts from groundwater contaminated from road de-icing practices.
- Possible impact on wells in the area.
- Actions that will be taken to moderate negative impacts to groundwater quantity and quality.
- Measures to be employed in the event of an accidental dewatering of domestic water supply wells through highway construction activity.

The Report should note that NSTIR will carry out a detailed survey of water wells within 300 m of the centreline prior to the start of construction (i.e., 600 m corridor width). This information will provide the baseline for future comparisons of water quality and quantity. Copies of water sampling results will be provided to property owners and a copy of the complete report will be provided to NSEL (further details and guidance are provided in NSTIR's Generic EPP, Manual 23, and the Project Engineer's Manual).

3.7 Impacts on Habitat

3.7.1 Impacts on Vegetation

The environmental effects analysis should identify any impacts the Project may have, including the removal of vegetation (particularly in sensitive habitats), potential adverse effects on biodiversity, including the potential for the establishment of exotic invasive plant species (and such as the possible effects on genetic and species diversity); disturbance effects (such as edge effects), and (where relevant) the potential effects of vegetation control, road salt and other operational considerations. Any site/ecological restoration efforts should also be described.

3.7.2 Impacts on Wetlands

The Report should describe and assess potential impacts on wetlands and their functions, taking into consideration both the NS Wetland Designation Policy (which applies to any alteration of wetlands) and the Federal Policy on Wetlands Conservation (which applies to the delivery of all federal programs, services and expenditures). Of relevance to this Project are NSTIR's Environmental Policy that commits us to meeting or exceeding all legislation and environmental standards and a federal commitment to the goal of 'no net loss' of wetland functions of all natural or created wetlands on federal lands and waters, or in areas where wetland loss has reached critical levels. Wetland functions include hydrological, biogeochemical, habitat and ecological functions, as well as social/cultural/commercial values, aesthetic/recreational values, and education and public awareness values. If there is potential for Project activities to encroach on or disturb wetland features, background information on these features should be provided as early as possible, and further guidance should be obtained from the federal and provincial authorities on how to address wetland issues.

Any wetlands that are to be adversely affected by the Undertaking are to be evaluated using a process accepted by both EC and NSE. The consultant must confirm it has an acceptable approach with NSTIR, EC and NSE as soon as possible after Project startup. From a federal standpoint, the North American Wetlands Conservation Council (Canada) Wetland Evaluation Guide is typically required to ensure the project meets the requirements of the "no net loss" federal policy on wetland conservation. NS has a Wetland Designation Policy and an "Operational Bulletin Respecting Alteration of Wetlands" to help facilitate decision making and applications for wetland alteration approvals. Detailed results of field visits (including copies of field data sheets) as well as the detailed wetland analysis should be included in the Report. Each of these wetland evaluations shall be done as a separate "report" and included in an Appendix to the Report.

3.7.3 Impacts on Fish and Fish Habitat

The environmental effects analysis should identify any impacts the Project may have, including the impacts of water crossing structures. Describe the timing of work in and immediately adjacent to watercourses and waterbodies, and the fish passage at watercourse crossings. Fisheries and Oceans Canada (DFO) will review all water crossings for impacts to fish and fish habitat, in accordance with the Habitat Protection Provisions of the *Fisheries Act*.

All water crossing works should be designed in a way that avoids the Harmful Alteration, Disruption or Destruction (HADD) of fish habitat, using appropriate work methods and techniques. However, where impacts are anticipated to be unavoidable and an authorization for the HADD is deemed appropriate by DFO, mitigation measures (including compensation) must be incorporated into the Project, consistent with the No Net Loss Principle, outlined in DFO's Policy for the Management of Fish Habitat (1986). Additional guidance from DFO should be requested as soon as a need for a HADD authorization is identified.

Information required for future HADD's are to be presented in a "stand alone" format, in an Appendix to the Report. A copy of the desired format will be provided to the successful Consultant.

Species of Special Concern

If a potential for species at risk or their habitat(s) to occur within the zone of influence of the project is identified, information on the habitat requirements of the species should be consulted and compared to habitat descriptions for the study area to determine if the project area could support that species. Following consultation with relevant provincial and federal regulators, a qualified biologist should then conduct a thorough inventory of all areas of natural habitat that may be affected by the project and have the potential to support species at risk. A strategy should be developed to protect any identified species at risk, with a primary focus on avoidance. The methods to be used to conduct the biological inventory as well as any measures to protect and identify species at risk should be provided for review and further guidance.

3.7.4 Impacts on Wildlife, Including Migratory Birds

The Report should identify potential impacts on wildlife in the project area. Nova Scotia's Guide to addressing Wildlife Species and Habitat in an EA Registration Document should be used. This guide can be found at http:/www.gov.ns.ca/enla/ea/docs/EAGuideWildSpecies.pdf

Discussion is to include (but not be limited to) the following:

- Impacts of construction and operation of the project on terrestrial and aquatic fauna, with emphasis on species of special conservation concern and their habitat. Include habitat fragmentation in the discussion.
- Measures that will be taken to moderate the impacts of road construction and operation on fauna. Include any plans for landscaping and preservation of existing vegetation.
- Potential impacts on migratory bird habitat.
- Impacts of construction and operation of the project on protected areas, designated areas, ecologically sensitive areas, wildlife management areas, ecological reserves, managed wetlands and other important habitats. This includes but is not limited to such habitats as staging areas for migratory birds, waterfowl, wintering areas, important foraging areas for migratory birds and bat hibernaculae.

Species of Special Concern

If a potential for species at risk or their habitat(s) to occur within the zone of influence of the project is identified, information on the habitat requirements of the species should be consulted and compared to habitat descriptions for the study area to determine if the project area could support that species. Following consultation with provincial and federal regulators, a qualified biologist should then conduct a thorough inventory of all areas of natural habitat that may be affected by the project and have the potential to support species at risk. A strategy should be developed to protect any identified species at risk, with a primary focus on avoidance. The methods to be used to conduct the biological inventory as well as any measures to protect and identify species at risk should be provided for review and further guidance.

3.9 Transportation Impacts

Discuss the anticipated changes in traffic speed and volumes in adjacent residential and commercial areas.

3.10 Impacts on Land Use

Discuss impacts of the highway on the existing land uses and on the proposed future land uses, including but not limited to planning strategies, proposed development, utilities and development boundaries**.** Discuss any impacts cold air drainage may have on agricultural land.

3.11 Impacts on Traditional Land Use

Discuss Mi'kmaw current use of land and resources for traditional purposes, and land claims within the proposed highway corridor. A TEK study has not been completed for the study area.

3.12 Impacts on Historical, Archaeological, Paleontological and Archaeological Resources

Discuss the project related impacts on all structures, sites resources or things of historical, archaeological, paleontological and architectural significance. Describe mitigation measures to preserve, protect, or recover any features of social, cultural or archaeological value that are identified in the proposed highway corridor.

3.13 Social Economic and Recreational Impacts

Discuss the socio-economic and recreational impacts on the following. Please note that the socio economic impacts are to be defined based on the CEAA definition.

- Present and future expansion of commercial/residential/institutional/recreational and resource land uses within the study area.
- Agricultural land and cropping history.
- Recreation in the area, in particular canoeing and hiking.
- The local community.
- Municipal and community services (in particular, drainage issues and waterworks infrastructure).
- impacts on private and commercial property and on human activities.
- Discuss the impacts on commercial, recreational and Mi'kmaq fishing which may be impacted by the proposed project

3.14 Noise impact

The environmental effects analysis should indicate, using quantitative information to the extent possible, what additional contribution the Project may make during both the construction and operation phases. For the construction phase, the analysis should specifically describe what kinds of construction activities are likely to take place in the vicinity of the identified noise receptors. Particular attention should be paid to the potential effects on the identified noise sensitive uses in the study area. Information should be provided for both daytime (16-hour) and night-time (8-hour) scenarios. Specifically, the analysis should include the following:

- Land-use map sensitive sites – (residences, schools, day-cares, hospitals and nursing homes should be highlighted);
- Ambient noise levels;
- Predicted noise levels during construction & operation;
- Indication of any changes in noise levels;
- Comparison of predicted levels with relevant guidelines; and
- Specifics of noise abatement measures.

The Report should also address potential human health effects associated with negative impacts caused by the Project. When drawing conclusions about the significance of impacts, reference should be made to the relevant guidelines. Where positive or neutral impacts are expected, the Report should provide the rationale to support the conclusions, including quantitative data to the extent possible.

Describe measures that will be taken to mitigate noise disturbance during highway construction.

3.14 Remediation/Compensation Plans

Recommend any plans for remediation or compensation that are considered appropriate for any residual impacts mentioned above. This shall include a discussion of anticipated HADD authorizations and wetland alteration approvals. Note that NSTIR already has several 'habitat banks' in place that may be used for compensation requirements of the federal and provincial regulatory agencies.

4.0 Possible Malfunctions or Accidents

The Report should identify any accidents and malfunctions that may occur in connection with the project. This should include the assessment of potential effects from accidental spills (e.g. fuels, oils, hydraulic fluids), as well as other accidents and malfunctions that could be expected to occur, such as power failures, breaks in fibre optic cable and pump failures. The emphasis in this section should be on accidents and malfunctions that are reasonably plausible, but should not be limited to events that occur on a regular basis. The description should include the safeguards that have been established by TIR to protect against such occurrences and the contingency procedures that are in place (see Section 5 of the Generic EPP)..

5.0 Effects of the Environment on the Project

Environmental hazards potentially affecting the project should be described and the predicted effects from these hazards on the proposed project should be documented. This section of the Report should discuss the effect the environment may have on the construction and operation phases of the project, including weather and climate elements. Any necessary climate information to validate statements made in the assessment should be provided. Issues such as erosion, wind, floods, severe precipitation events, land or rock slides, unstable soils, seismic events, or soil contamination should be addressed. In addition, the Report should discuss how the project will address these potential effects in its design considerations. The emphasis in this section should be on environmental conditions that are reasonably plausible, but should not be limited to events that occur on a regular basis.

A reasonable determination of potential climate change is to be made based on information of past and future trends. One important source of climatological data is Environment Canada's Climate Centre.

6.0 Cumulative Environmental Effects

In order to consider the potential cumulative environmental effects of the project, the environmental assessment should identify other projects and activities that have been or will be carried out in the study area, including future projects that are reasonably foreseeable. At minimum, this list should include those projects that HRM, Lunenburg County, and NSTIR have undertaken or plan to undertake in the vicinity of the project. The Report should also attempt to identify other reasonably foreseeable initiatives in the project area, such as projects or activities proposed by local communities, NS Agriculture, and local businesses. The emphasis in this section should be on "reasonably foreseeable" activities, e.g., projects that have already been approved, or that are (or are likely to be) advancing through the regulatory approvals process.

The Report should indicate whether and how these other projects/activities could interact with the proposed project to produce a cumulative effect. The cumulative effects assessment should summarize the residual environmental effects that are expected from the project, after mitigation measures have been taken into account, for both the construction and operation phases. In conducting the analysis, consideration should be given to the length of time over which the environmental effects of the proposed project will occur, not just the period of time during which the project will be constructed.

The approach and methodologies used to identify and assess cumulative effects should be described, including:

- identification of regional issues of concern;
- a comprehensive description of how the VECs were chosen;
- clear justification for the spatial and temporal boundaries used to address cumulative effects;
- a clear description of the analysis undertaken to assess the cumulative effects on the selected VECs, and presentation of the analysis results;
- a clear description of how mitigation measures address the cumulative environmental impacts; and,
- the rationale and methodology for determining whether residual cumulative effects on VECs are significant.

The Canadian Environmental Assessment Agency's guide *Cumulative Effects Assessment Practitioners Guide*, Canadian Environmental Assessment Agency, shall be used.

7.0 Monitoring and Follow-up requirements

Outline monitoring activities that are necessary to ensure that proposed mitigation is implemented and functioning as expected, and actions necessary to maintain the effectiveness of mitigation as long as required to provide the required level of environmental protection.

The Report shall include a framework upon which compliance and effects monitoring will be based throughout the construction, and, if appropriate, the operation of the project. The Consultant should specifically refer to Section 4 of NSTIR's Generic EPP. The discussion on compliance monitoring shall include, but not necessarily be limited to, plans and procedures for surface water and well water compliance monitoring, especially for suspended sediment and pH levels during construction.

Also, a statement indicating whether a follow-up program consistent with Section 38(1) of CEAA is required, including the rationale for this decision. Generally, a follow up program is required if one of the following situations occur:

- The project involves new or unproven technology;
- The project involves new or unproven mitigation measures;
- The assessment's analysis was based on a new assessment technique or model, or there is some uncertainty about the assessment's conclusions;
- The site of the proposed project or its potential area of influence contains critical ecosystem components;
- There is a need to address relevant project-related issues of public concern;
- Cumulative effects assessment was an important or contentious component of the EA; or

- Specific types of environmental effects warrant careful monitoring.

Monitoring may be required for the following: major watercourses; wetlands; areas supporting species of special conservation status; and areas where unique or extensive mitigation is required.

This section shall include the monitoring of any compensation measures required by HADD authorizations and NSE Wetland Alteration Approvals.

8.0 Determination of Significance, Decision and Rationale

The analysis should conclude by summarizing decisions regarding environmental effects (including cumulative effects, and effects from malfunctions and accidents) ***of the entire project***, including the specific mitigative measures, monitoring requirements and concluding on the environmental acceptability of the project. The Canadian Environmental Assessment Agency's "Reference Guide Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects" must be used - http://www.ceaa-acee.gc.ca/013/0001/0008/guide3_e.htm#Reference%20Guide

A recommended EA decision shall be provided, reflecting one of the following options:

1. The project can proceed if the project is not likely to cause significant adverse environmental effects.
2. The project can not proceed if the project is likely to cause significant adverse environmental effects that cannot be justified.
3. The project must be referred to the Minister of the Environment for a panel review if:
   a) It is uncertain whether the project is likely to cause significant adverse environmental effects.
   b) The project is likely to cause significant adverse environmental effects, and a determination must be made whether these effects are justified in the circumstances.
   c) Public concerns warrant a public review.

A statement describing the rationale of the above recommended screening conclusion shall be provided.

9.0 Schedule

Indicate the proposed dates for start of construction and start of operations. Briefly state the reasons for the selection of these dates. This information will be available from NSTIR.

10.0 Proponent Contact

This section of the Report will include the following Proponent Contact:

Mr. David Darrow, P.Eng
Deputy Minister
Department of Transportation and Infrastructure Renewal

PO Box 186
Halifax NS
B3J 2N2
Phone: 902-424-4036
Fax: 902-424-2014

11.0 Expert Department Consultation

Provide a record of consultations and any subsequent discussions and approvals with expert federal and provincial departments, and a discussion of any unresolved issues raised.

12.0 Public Information Program

This section of the Report shall detail any public information program initiated by TIR. The Report shall describe in detail any opportunities that have been or will be provided to allow the public to express their concerns and receive information on the various phases of project development including planning, design, environmental assessment review, and operation.

The results of public consultation and information sessions shall detail any commitments made by TIR. TIR has an Open House planned for the fall of 2009, and the successful Consultant may be expected to attend.

13.0 Supporting information

Provide a summary and interpretation of technical and environmental studies, maps or other information used in making the screening decision.

Appendices

Appendices of the Report shall contain the following:

- Federal Coordination Regulations information;
- Baseline information to be provided in a format easily "brought forward", for future monitoring;
- Wetland information shall be in a format suitable for direct inclusion into wetland alteration approvals;
- HADD information shall be in a format suitable for direct inclusion into HADD Authorizations;
- MKS study;
- Navigable waters informationshall be in a format suitable for direct inclusion in a NWPA application.

Appendix D

DFO EIS Screening Requirements

Habitat Management Division Informational Requirements For Projects Undergoing a Federal Environmental Assessment

Requirement to Conduct an Environmental Assessment

An environmental assessment (EA), specifically a screening, of your project must be conducted in accordance with the Canadian Environmental Assessment Act (CEAA) before an authorization can be issued under the Fisheries Act, section 35(2). As part of the assessment, you must prepare a report that contains the information outlined in CEAA section 16(1). The report must be in the form of an Environmental Impact Statement (EIS). The EIS must be submitted to Habitat Management Division for review, and will assist in fulfilling the requirements of CEAA.

Please note that, if deficiencies are identified, additional information will be requested. Depending on the "level of concern" associated with your project, you may be required to consult with the public, aboriginals or special interest groups (refer to CEAA, section 18(3)).

Project Scope

An EA must be conducted in respect of every construction, operation, modification, decommissioning and abandonment or other undertaking, in relation to the physical work(s) (refer to CEAA, section 15(3)). If you are uncertain about the "project scope" for the purposes of the EA, please contact Habitat Management Division before proceeding.

Valued Ecosystem Components

EAs typically focus on *valued ecosystem components* (VECs). VECs are defined as any part of the environment (biological, physical, social, economic, etc.) that is considered important by those who have some interest or involvement in the project (e.g. proponent, public, scientists, government).

Temporal and Spatial Bounding

Temporal and spatial bounding must be determined early in the assessment. Temporal bounding refers to the time period during which environmental effects could be experienced. Spatial bounding refers to the geographical area that could potentially be affected by the project. In other words, the study area, for the purposes of the assessment, must include any environmental components (e.g. land, water, air, inorganic and organic matter, living organisms, and the interacting natural systems) that could potentially be affected by the project, as scoped above.

Factors to consider: Section 16(1) of the *CEAA* outlines the factors that must be considered during the assessment:

16. (1) Every screening or comprehensive study of a project and every mediation or assessment by a review panel shall include a consideration of the following factors:

(a)the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;

(b)the significance of the effects referred to in paragraph a;

(c)comments from the public that are received in accordance with this Act and the regulations;

(d)measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and

(e) any other matter relevant to the screening, comprehensive study, mediation or assessment by a review panel, such as the need for the project and alternatives to the project, that the responsible authority or, except in the case of a screening, the Minister after consulting with the responsible authority, may require to be considered.

Definition of Environmental Effect

In CEAA "environmental effect" means, in respect of a project,

(a) any change that the project may cause in the environment, including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site, or thing that is of historical, archaeological, paleontological or architectural significance, and

(b) any change to the project that may be caused by the environment, whether any such change occurs within or outside Canada.

Content of EIS

The following provides details on the information that must be included in the EIS. These details are not necessarily all-inclusive. The onus is on the proponent to demonstrate, in the EIS, that the assessment provides a comprehensive and accurate prediction of the effects of the project on the environment, and that the project complies with all federal, provincial and municipal legislation.

The information specified in the checklist below must be included in the Environmental Impact Statement. (Please indicate that the information has been included within the EIS by checking the appropriate boxes). *Failure to provide all of the necessary information will delay the CEAA process.*

Name of Applicant (individual or business):

Contact Person:

Mailing Address:	Telephone Work: ____________________________ Home: ____________________________ Fax No.: ____________________________ E-Mail Address: ____________________________

Site Location
• show the exact location of the physical work(s), and any supporting infrastructure, whether temporary or permanent, on a topographic map or navigation chart (scale 1:10,000) • include an aerial photograph showing the exact location of the physical work(s) and supporting infrastructure
Facility Design
• provide a dimensioned plan view of the physical work(s) drawn to scale • provide a dimensioned cross sectional view of the physical work(s) drawn to scale • include a site diagram showing the location of the physical work(s) and supporting infrastructure • plans should indicate which structures are existing, and which are proposed

Related Infrastructure
Provide information on infrastructure and activities associated with the physical work(s): • vessel traffic • access roads • wharves • temporary bridges • other
Construction\Installation
Provide details on all construction activities including: • construction materials • transportation of construction materials • location where construction will take place • a description of all construction activities • timing of construction activities • transportation of constructed items\structures
Operation
• provide details on operation activities
Maintenance
• provide details on maintenance activities
Decommissioning\Abandonment
• provide details on decommissioning and abandonment activities
Hazardous Materials
• provide information on the use, transportation, storage, disposal, etc. of potentially hazardous materials
Mitigation (includes Restoration, Replacement and Compensation)
Provide information on any plans for mitigating adverse environmental effects, in relation to the following: • construction\installation of the physical work • operation of the physical work • maintenance of the physical work • decommissioning\abandonment of the physical work

Accidents and Contingency Planning

Provide information on potential risks by project phase as a result of the following:

- malfunctions
- accidents

Provide information on the following:

- contingency planning associated with potential malfunctions and accidents

Physical Environment

Describe the physical environment as it relates to the project:

- water (e.g. temperature, width\depth, volume, current, flow direction and speed)
- air (e.g. temperature, wind direction and speed)
- substrate characterization
- climate
- other

Biological Resources and Associated Habitat

Provide information on the biological resources (may be a requirement to provide detailed habitat mapping) that could potentially be affected by both 1) the project, and 2) the project in combination with other projects or activities that have been or will be carried out. For example,

- fish\habitat
- crustaceans\habitat
- shellfish\habitat
- mammals\habitat
- birds\habitat
- species at risk\habitat
- terrestrial\marine vegetation
- other

Other Resource Users

Provide information on activities in the study area that could potentially be affected by both 1) the project, and 2) the project in combination with other projects or activities that have been or will be carried out; including

- commercial, recreational, and aboriginal fishing (timing, proximity to site, etc.)
- recreational activities
- commercial endeavours
- boating and shipping, and associated infrastructure\activities
- cultural events/activities
- use of lands and resources by aboriginal peoples
- land use
- industrial plants
- effluent release into waterbodies
- other

Additional Factors

Provide information on places, activities and items that should be considered during the environmental assessment, including:

- ocean disposal sites (Environment Canada, Ocean Disposal Section)
- pollution sources
- items/sites of historical, archaeological, palenontological or architectural significance (Parks Canada Agency or Museum of Natural History, Curator of

Special Places) • wildlife areas or bird sanctuaries (Environment Canada, Canadian Wildlife Service) • potential or existing marine protected areas (Fisheries and Oceans Canada, Oceans and Coastal Management Division) • federal and provincial parks • protected beaches • other areas

Predicting Environmental Effects	
Provide a prediction of the effect of the project(s) on each of the VECs (e.g. no effect, positive effect, insignificant adverse effect, significant adverse effect) and provide information on any additional plans for mitigation. A list of potential VECs is provided below (*Note: This list is not all-inclusive.)	
Biophysical	• Fish (specific species)
	• Fish habitat (e.g. water quality, substrate, feeding, migration, and spawning)
	• Water quality
	• Substrate
	• Air quality
	• Species at risk
	• Birds\habitat
	• Mammals\habitat
	• Vegetation
	• Environmentally significant areas
Socio-economic	• Aboriginals (current use of lands and resources)
	• Commercial, recreational and aboriginal fisheries
	• Boating\Shipping
	• Physical and cultural heritage
	• Archaeological heritage resources
	• Human health
	• Tourism
	• Recreation (boating, swimming, biking, canoeing)
	• Commerce (e.g. aquaculture operations, processing plants)
	• Economy\jobs
Cumulative Effects	
For the cumulative effects assessment, provide: • a prediction of cumulative environmental effects (i.e. interaction of the effects that are likely to result from the project in combination with the effects of other projects or activities that have been or will be carried out) • associated mitigation and monitoring activities	
Concern about the Project	
Provide information on: • any concerns expressed by the public, aboriginals, community groups, individuals, etc. about the project • interactions and discussions that have occurred in relation to the project • the methods that were used to collect information on public concern	

Monitoring
Provide information on any monitoring activities that will be undertaken including: • sample parameters • sampling locations and schedule • sampling resources/equipment • monitoring parameters • monitoring activities related to VECs

Effect of the Environment on the Project
• Provide information on any changes to the project that may be caused by the environment
Submission of Environmental Impact Statement
• Three copies of the complete EIS (e.g. written submission, plans, maps, aerial photographs) are included. • An additional copy of the complete EIS is included for each of the federal agencies who may be providing funding for the project (e.g. Atlantic Canada Opportunities Agency, Human Resources Development Canada) *Note: Additional copies of the EIS may be required, if there is public concern associated with the project(s).

Appendix E

General Guidelines for Migratory Bird Surveys For Environmental Assessment

Main Areas of Concern (Note: These areas may vary depending on site-specific sensitivities)

- Long term declines of some bird species;
- Loss of habitat and species dependant on those habitats;
- Species which are little known or for which there exists little population information.

General Approach

- Establish a list of priority bird species for the area of interest, using all available sources, including sources for bird species of special conservation concern[1].
- Using habitat maps (e.g. forestry, agricultural, wetland), screen the area for presence of broad habitat classes of avian concern, e.g. older/mature forest, wetlands, grassland/agricultural, salt marsh.
- Select out largest and/or the most significant of those habitats.
- Establish protocol for surveys for each of the habitat types (see Survey Protocols below).
- Consult with CWS of EC and appropriate provincial departments (Natural Resources) regarding proposed methods and approach prior to the finalization of survey planning.
- Conduct surveys.
- Analyze results by screening for significant occurrences of bird species of special conservation concern including, but not necessarily limited to, target species identified in consultations with government departments.
- Write report. Include full database of results, conclusions and recommendations. Review with EC.
- Provide EC with a full electronic, geo-referenced database of results.

[1] Bird Species of Special Conservation Concern includes species listed by the Committee on the Status of Endangered Wildlife in Canada [COSEWIC]; identified as S1, S2, and S3 by the Atlantic Canada Conservation Data Centre [AC CDC]; designated in provincial listings, or of otherwise high conservation priority under the North American Bird Conservation Initiative (NABCI).

Survey Protocols

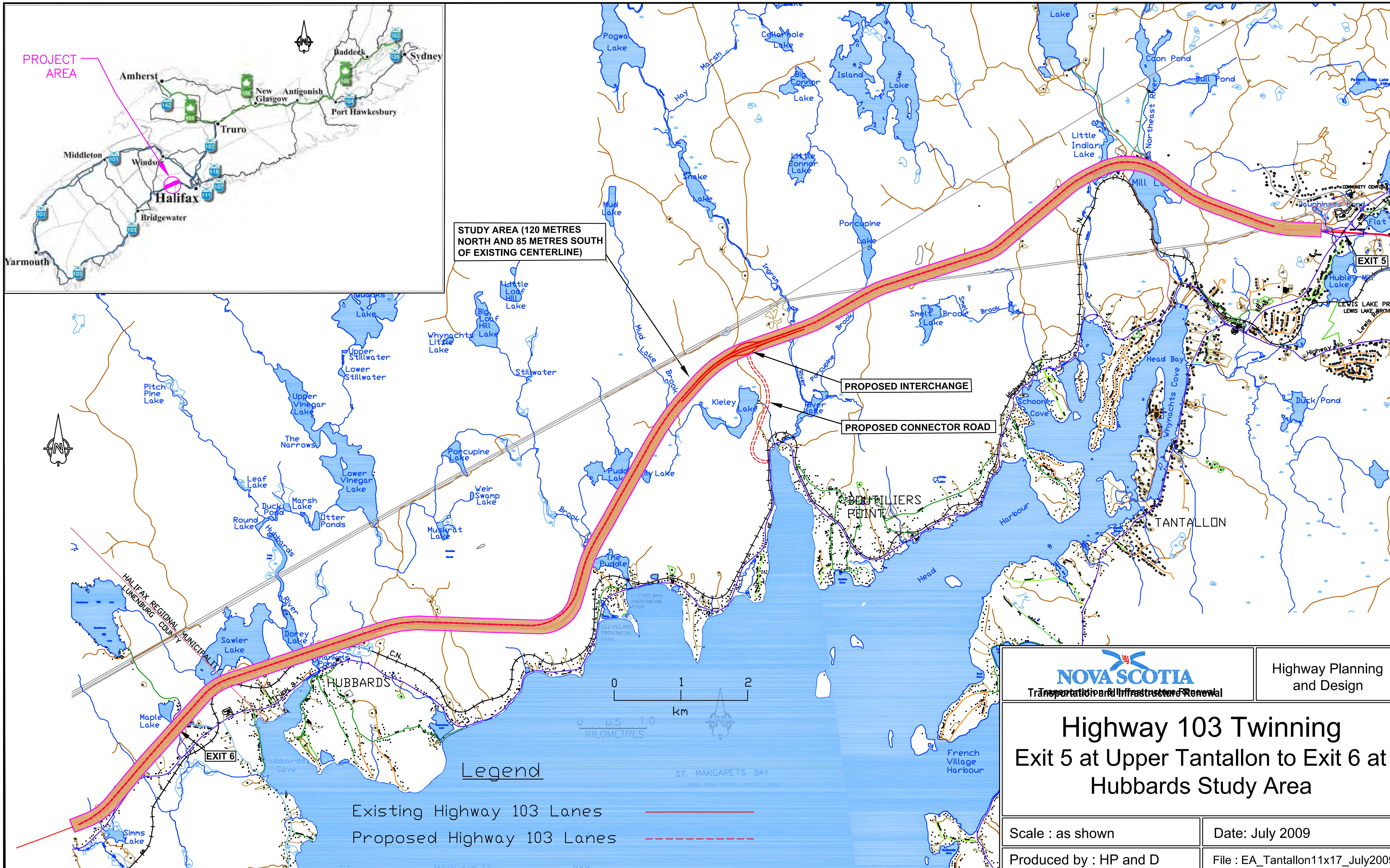
- Select a survey type that is most appropriate for obtaining information relevant to the case in hand. Survey types for consideration should include, but not be limited to, atlas-type surveys, point counts, transects and spot mapping.
- Surveys must be conducted during the peak of the breeding season (see Survey Timing below).
- Personnel highly skilled in identifying birds in the field should be used to conduct the surveys.
- Vocal playbacks should be used where beneficial (Owl survey, hawk species, some wetland species, species that do not vocalise regularly).
- The areas where surveys are to be focussed should be prioritised in consultation with EC.

Survey Timing

- For Owl species and early woodpecker species – April.
- For all other species – early June to early July.

Appendix F

Map of Study Area



NOVA SCOTIA
Transportation and Infrastructure Renewal

Highway Planning and Design

Highway 103 Twinning
Exit 5 at Upper Tantallon to Exit 6 at Hubbards Study Area

Scale : as shown	Date: July 2009
Produced by : HP and D	File : EA_Tantallon11x17_July2009

Appendix G

Water Crossing Locations

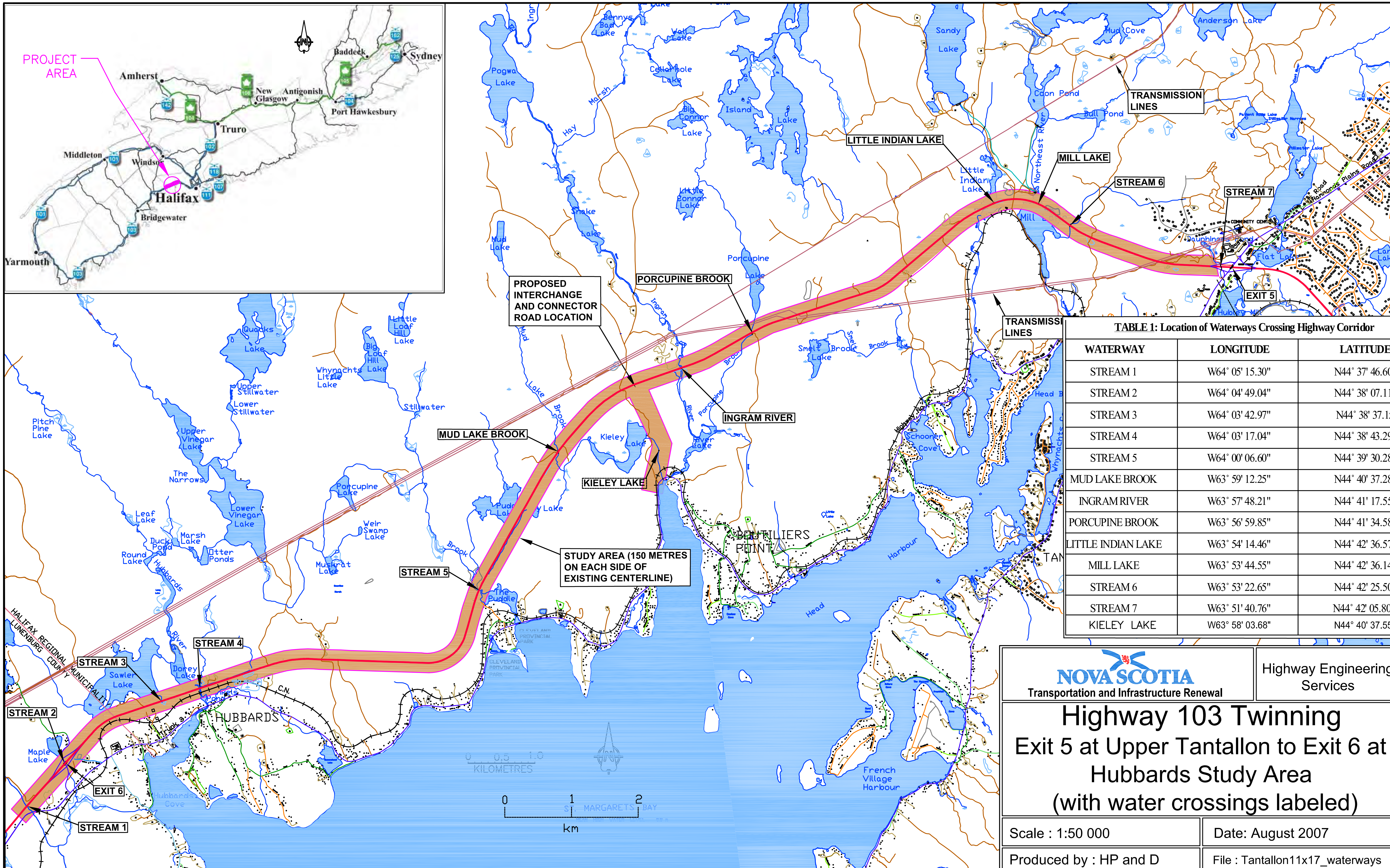


TABLE 1: Location of Waterways Crossing Highway Corridor

WATERWAY	LONGITUDE	LATITUDE
STREAM 1	W64° 05' 15.30"	N44° 37' 46.60"
STREAM 2	W64° 04' 49.04"	N44° 38' 07.11"
STREAM 3	W64° 03' 42.97"	N44° 38' 37.15"
STREAM 4	W64° 03' 17.04"	N44° 38' 43.29"
STREAM 5	W64° 00' 06.60"	N44° 39' 30.28"
MUD LAKE BROOK	W63° 59' 12.25"	N44° 40' 37.28"
INGRAM RIVER	W63° 57' 48.21"	N44° 41' 17.55"
PORCUPINE BROOK	W63° 56' 59.85"	N44° 41' 34.58"
LITTLE INDIAN LAKE	W63° 54' 14.46"	N44° 42' 36.57"
MILL LAKE	W63° 53' 44.55"	N44° 42' 36.14"
STREAM 6	W63° 53' 22.65"	N44° 42' 25.50"
STREAM 7	W63° 51' 40.76"	N44° 42' 05.80"
KIELEY LAKE	W63° 58' 03.68"	N44° 40' 37.55"

NOVA SCOTIA
Transportation and Infrastructure Renewal

Highway Engineering Services

Highway 103 Twinning
Exit 5 at Upper Tantallon to Exit 6 at Hubbards Study Area
(with water crossings labeled)

Scale : 1:50 000 | Date: August 2007

Produced by : HP and D | File : Tantallon11x17_waterways

APPENDIX B

HYDROTECHNICAL EVALUATION

STANTEC NSTIR HIGHWAY 103 EA

HYDROTECHNICAL EVALUATION OF PROPOSED HIGHWAY 103 TWINNING UPPER TANTALON TO HUBBARDS, NOVA SCOTIA

FINAL REPORT

Prepared for:

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RVA Job #092000

February 2, 2010

PROJECT TITLE

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LIST OF DRAWINGS

1.0 INTRODUCTION

R.V. Anderson Associates Limited, acting at the request of Jacques Whitford- Stantec Environment Limited has performed a hydrotechnical evaluation of an area from Upper Tantallon to Hubbards, as part of the Environmental Assessment required for the proposed twinning of the Nova Scotia Department of Transportation and Public Works (NSDTIR) Highway 103 in this area. This report has been prepared solely for the project described above and contains a description of our methodology and findings.

2.0 METHODOLOGY

The objective of the evaluation was to provide a general hydrologic and hydraulic description of all surface water bodies in the vicinity of the proposed project. The scope of work for this evaluation consisted of the following components:

- review of the available mapping to assess the general site drainage patterns and to identify any significant watercourses;
- description of the existing surface water drainage and hydrology;
- determination of the impacts associated with the proposed highway project on surface water drainage;
- evaluation of the effects of the environment on the project, including the potential effects of extreme precipitation, floods, and climate change on the regional hydrology; and
- compilation of a report on all of the findings including any recommendations.

3.0 DESCRIPTION OF THE EXISTING SURFACE WATER DRAINAGE AND HYDROLOGY

3.1 General Area

The Upper Tantallon to Hubbards section of Highway 103 skirts along the northern shore of St. Margaret's Bay west of Halifax, bypassing Boutiliers Point. Several lakes, rivers and brooks cross this section of road and would be impacted by the twinning. Nova Scotia Power also operates several hydro-electric dams north of this section of road. The tidal influence in St. Margaret's Bay at Boutiliers Point has a range of 5.7m with a mean high tide of 2.8m.

3.2 Climate and Hydrology

Nova Scotia has a modified continental climate, with proximity to the coast and elevation determining local variation in climate. Since the relief is not extreme, the coastal influence is the major one in Nova Scotia. The relatively cold waters of the Atlantic Ocean and Bay of Fundy help keep the air temperature over southwestern Nova Scotia on the cool side in spring and summer. The main features of Nova Scotia's climate are ample precipitation, and a wide temperature range without extremes. The total annual precipitation at St Margaret's Bay (Climate Station ID 8204800) is approximately 1364 mm, of which 139 mm falls as snow and 1225 mm as rain. Daily maximum summer temperatures range from 19.8 °C to 23.2 °C, with extreme temperatures of approximately 36°C. (Environment Canada, Canadian Climate Normals 1971-2000, Nova Scotia, http://climate.weatheroffice.ec.gc.ca/climate_normals/stnselect_e .html).

Frequent coastal fog, cloud cover, and cool summers moderate evapotranspiration rates. Based on estimates for Nova Scotia, evapotranspiration and annual groundwater re-charge is estimated as approximately 20% and 10% of the mean annual precipitation respectively, leaving about 955 mm for runoff. Water levels in streams over-lying igneous-rock formations is maintained primarily by surface runoff, and therefore flow in these streams tends to drop during the drier summer months. (Nova Scotia Museum, http://museum.gov.ns.ca/mnh/nature/nhns/T8/t8-1.pdf).

4.0 EXISTING ENVIRONMENT

This section describes the hydrotechnical aspects of the existing environment at the proposed crossing sites. It is intended as a concise presentation of the information upon which subsequent analyses or interpretations can be based. Information for each of the watercourses crossed by the section of Highway 103 was collected through the review of available mapping only. This section presents the relevant information collected from the various sources with respect to the existing surface water environment.

The following 19 crossings (from west to east) of Highway 103 (see Figure 1) in the proposed project area were considered:

1. Unnamed tributary to Hubbards Cove
2. Maple Lake Brook
3. Sawler Lake
4. Dorey Lake
5. Hubbards River
6. Stillwater Brook
7. Unnamed Stream between Lily Lake and Puddle Lake
8. Puddle Lake
9. Mud Lake Brook
10. Unnamed stream approximately half way between Ingram River and Mud Lake Brook
11. Ingram River
12. Porcupine Brook
13. Wetland approximately 1 km east of Porcupine Brook
14. Little Indian Lake (Indian River)
15. Mill Lake (Northeast River)
16. Mill Lake backwater pond
17. Unnamed tributary to Mill Lake approximately 0.5 km east of Mill Lake
18. Unnamed stream approximately 0.75 km west of Exit 5
19. Unnamed stream that runs through Exit 5

Using 1:50 000 scale mapping with a 10-metre control interval, estimates were made of the upstream drainage area, channel length, the length (point-to-point straight line) from the crossing to the most remote point, the length (straight line) from the crossing to the highest elevation, the basin slope (defined as the difference in elevation (+/- 5 m) of the highest point in the basin and the crossing divided by the length (straight line) from the crossing to the highest elevation, and the slope of the watercourse near the crossing. In the case of multiple tributary channels upstream, the longest channel was used to determine the channel length. The estimates should suffice for environmental assessment of the proposed project, but additional and more accurate information should be obtained for design purposes. In particular, the slope of the watercourse near the crossing is a rough estimate only, and field surveys of the channel at and near the proposed crossings likely would be required for design purposes.

4.1 Crossing 1: Unnamed Tributary to Hubbards Cove

The unnamed watercourse at the proposed crossing collects surface flows from a small area north of the existing highway 103 and eventually drains into Hubbards Cove. Mapping shows few residential or commercial structures within the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 1 - CROSSING 1

Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	1.69 km^2
Basin Perimeter	5.81 km
Channel Length	n/a
Length from Crossing to Most Remote Point	2210 m
Length from Crossing to Highest Elevation	2210 m
Basin Slope	2.0 %
Approximate Slope at Crossing Location	~ 2.3 %
% Lakes and Swamps	none

Although no obvious channel was apparent from our mapping, topography shows that some drainage infrastructure may be necessary. A circular concrete culvert of similar or greater size (to be determined during design) than the existing structure would allow drainage from a small drainage basin north of Highway 103 to pass southerly under the highway. The environmental impact of culvert installation on water quantity and quality should be low providing that good construction practices are followed.

4.2 Crossing 2: Maple Lake Brook

Maple Lake Brook at the proposed crossing collects surface flows from a 0.54 km^2 drainage area to the north of Exit 6, which includes Maple Lake. Mapping shows several residential or commercial buildings within the watershed upstream of the proposed crossing, but none in the immediate vicinity of the crossing. There are multiple culverts that handle surface drainage flows at Exit 6, draining from east and west, eventually draining to Hubbards Cove. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 2 - CROSSING 2

Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	0.54 km^2
Basin Perimeter	3.45 km
Channel Length	n/a
Length from Crossing to Most Remote Point	1350 m
Length from Crossing to Highest Elevation	1350 m
Basin Slope	2.6 %
Approximate Slope at Crossing Location	~ 0.7 %
% Lakes and Swamps	~ 14 %

Although no obvious channel was apparent from our mapping, topography shows that Maple Lake drains south under Highway 103, therefore some drainage infrastructure may be necessary. A culvert of similar or greater size (to be determined during design) than the existing structure would allow drainage from the 0.54 km^2 drainage basin under the highway. The environmental impact of the crossing on water quantity and quality should be low providing that good construction practices are followed.

4.3 Crossing 3: Sawler Lake

Sawler Lake is already adjacent to the existing Highway 103 at two locations, with a small buffer between the water and the existing highway. Sawler Lake is fed from Mill Lake and drains to the east into Dorey Lake and eventually Hubbards River. Mapping shows several residential and seasonal dwellings within the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 3 - CROSSING 3

Basin Characteristics Upstream of Crossing in Existing Highway 103

Parameter	Value
Drainage Area	17.01 km^2
Basin Perimeter	20.37 km
Channel Length	1910 m
Length from Crossing to Most Remote Point	6950 m
Length from Crossing to Highest Elevation	6950 m
Basin Slope	1.6%
Approximate Slope at Crossing Location	n/a
% Lakes and Swamps	21%

Widening of the existing roadway will reduce the existing treed buffer zone and possibly eliminate some lake habitat. The environmental impact during construction of adding an additional lane to the highway on water quantity and quality should be low providing that good construction practices are followed.

4.4 Crossing 4: Dorey Lake

Dorey Lake is already adjacent to the existing Highway 103, with a small buffer between the water and the existing highway. Dorey Lake is fed partially from Mill and Sawler Lakes but primarily from the Hubbards River, which exits from Dorey Lake and drains south under the existing Highway 103. Therefore, the basin characteristics of Crossing No. 4 are essentially the same as the basin characteristics of Crossing No. 5. Mapping shows little to no development upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 4 - CROSSING 4

Basin Characteristics Upstream of Existing Crossing

Parameter	Value
Drainage Area	60.77 km^2
Basin Perimeter	41.99 km
Channel Length	14980 m
Length from Crossing to Most Remote Point	12380 m
Length from Crossing to Highest Elevation	11800 m
Basin Slope	1.06 %
Approximate Slope at Crossing Location	n/a
% Lakes, Swamps, and Marsh	21%

Widening of the existing roadway will reduce the existing treed buffer zone and possibly eliminate some lake habitat. The environmental impact during construction of adding an additional lane to the highway on water quantity and quality should be low providing that good construction practices are followed.

4.5 Crossing 5: Hubbards River

Hubbards River at the proposed crossing collects surface flows from multiple lakes north of the existing 103. Mapping shows no residential or commercial buildings within the watershed upstream of the proposed crossing. The existing crossing is a bridge. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 5 - CROSSING 5

Basin Characteristics Upstream of Existing Crossing

Parameter	Value
Drainage Area	60.77 km^2
Basin Perimeter	41.99 km
Channel Length	15050 m
Length from Crossing to Most Remote Point	12380 m
Length from Crossing to Highest Elevation	11800 m
Basin Slope	1.06 %
Approximate Slope at Crossing Location	~ 0.5 %
% Lakes, Swamps, and Marsh	21%

A bridge of greater waterway size (to be determined during design) than the existing structure would allow sufficient drainage and satisfy any Navigable Water concerns. The environmental impact of the crossing on water quantity and quality should be low providing that good construction practices are followed.

4.6 Crossing 6: Stillwater Brook

Stillwater Brook at the proposed crossing collects surface flows from multiple lakes located north of the existing Highway 103. Mapping for this watercourse shows no residential or commercial buildings within the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 6 - CROSSING 6

Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	10.03 km^2
Basin Perimeter	16.31 km
Channel Length	4545 m
Length from Crossing to Most Remote Point (not crossing basin boundary)	5050 m
Length from Crossing to Highest Elevation	4790 m
Basin Slope	0.73 %
Approximate Slope at Crossing Location	~0.8 %
% Lakes and Swamps	4.95 %

A culvert of similar or greater waterway size (to be determined during design) than the existing structure would allow drainage from the 13.06 km^2 drainage basin under the highway. The environmental impact of the crossing on water quantity and quality should be low providing that good construction practices are followed.

4.7 Crossing 7: Unnamed Stream

The unnamed watercourse that drains from Lily Lake to Stillwater brook along the southern edge of the existing Highway 103 collects surface flows from a small watershed area south of Highway 103. Mapping shows few residential or commercial structures within the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 7 - CROSSING 7

Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	0.42 km^2
Basin Perimeter	3.00 km
Channel Length	340 m
Length from Crossing to Most Remote Point	1050 m
Length from Crossing to Highest Elevation	1050 m
Basin Slope	3.2%
Approximate Slope at Crossing Location	n/a
% Lakes and Swamps	9.5%

The existing watercourse will not be impacted by the addition of a new westbound lane located on the north side of the existing Highway 103. The environmental impact of the new lanes on water quantity and quality of this crossing should be low since the new lane will be constructed on the north side of the highway, providing that good practices are followed during construction.

4.8 Crossing 8: Puddle Lake

Puddle Lake is adjacent to the existing Highway 103, with a small buffer between the water and the existing highway. Puddle Lake is fed from a small area north of the existing Highway 103. Mapping shows no residential or commercial structures within the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 8 - CROSSING 8

Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	2.93 km^2
Basin Perimeter	8.45 km
Channel Length	n/a
Length from Crossing to Most Remote Point	3490 m
Length from Crossing to Highest Elevation	3490 m
Basin Slope	2.0%
Approximate Slope at Crossing Location	n/a
% Lakes and Swamps	8.4%

Widening of the existing roadway will reduce the existing treed buffer zone and possibly eliminate some lake habitat. The environmental impact during construction of adding an additional lane to the highway on water quantity and quality should be low providing that good construction practices are followed.

4.9 Crossing 9: Mud Lake Brook

Mud Lake Brook, at the proposed crossing, collects surface flows from Mud Lake located north of the existing Highway 103. Mapping shows no residential or commercial buildings within the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 9 - CROSSING 9
Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	2.87 km^2
Basin Perimeter	8.46 km
Channel Length	1590 m
Length from Crossing to Most Remote Point	3200 m
Length from Crossing to Highest Elevation	2820 m
Basin Slope	1.8 %
Approximate Slope at Crossing Location	0.5 %
% Lakes and Swamps	1.0 %

A culvert of similar or greater waterway size (to be determined during design) than the existing structure would allow drainage from the 2.87 km^2 drainage basin under the highway. The environmental impact of the crossing on water quantity and quality should be low providing that good construction practices are followed.

4.10 Crossing 10: Unnamed Stream

The unnamed watercourse at the proposed crossing collects surface flows from a small area north of the existing Highway 103. Mapping shows no residential or commercial structures within the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 10 – CROSSING 10

Basin Characteristics Upstream of Crossing

Parameter	Value
Drainage Area	0.74 km^2
Basin Perimeter	3.68 km
Channel Length	n/a
Length from Crossing to Most Remote Point	1020 m
Length from Crossing to Highest Elevation	1020 m
Basin Slope	6.1 %
Approximate Slope at Crossing Location	n/a
% Lakes and Swamps	0 %

Although no obvious channel was apparent from our mapping, topography shows that some drainage infrastructure may be necessary. A culvert of similar or greater size (to be determined during design) than the existing structure, would facilitate drainage under the new Highway 103. The environmental impact of the crossing on water quantity and quality should be low providing that good construction practices are followed.

4.11 Crossing 11: Ingram River

The Ingram River at the proposed crossing collects surface flows from multiple lakes north of the existing 103. Mapping for this watercourse shows no residential or commercial buildings within the watershed upstream of the proposed crossing. The existing crossing is a bridge. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 11 - CROSSING 11

Basin Characteristics Upstream of Existing Crossing

Parameter	Value
Drainage Area	107.31 km^2
Basin Perimeter	52.81 km
Channel Length	20 430 m
Length from Crossing to Most Remote Point	17 750 m
Length from Crossing to Highest Elevation	17 750 m
Basin Slope	0.73 %
Approximate Slope at Crossing Location	~ 0.4 %
% Lakes, Swamps, and Marsh	6.5 %

A bridge of greater waterway size (to be determined during design) than the existing structure would allow sufficient drainage and satisfy any Navigable Water concerns. The environmental impact of the crossing on water quantity and quality should be low providing that good construction practices are followed.

4.12 Crossing 12: Porcupine Brook

Porcupine Brook at the proposed crossing collects surface flows from multiple lakes located north of the existing Highway 103. Mapping for this watercourse shows few residential and no commercial buildings within the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 12 - CROSSING 12

Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	4.35 km^2
Basin Perimeter	11.98 km
Channel Length	3830 m
Length from Crossing to Most Remote Point	3850 m
Length from Crossing to Highest Elevation	3850 m
Basin Slope	2.0 %
Approximate Slope at Crossing Location	~ 0.6 %
% Lakes and Swamps	6.6 %

A culvert of similar or greater waterway size (to be determined during design) than the existing structure would allow drainage from the 4.35 km^2 drainage basin under the highway. The environmental impact of the crossing on water quantity and quality should be low providing that good construction practices are followed.

4.13 Crossing 13: Wetland east of Porcupine Brook

As small wetland collects surface flows from a small area north of the existing Highway 103. The wetland appears to drain west along the north edge of the existing Highway 103 into Porcupine Brook. Mapping shows few residential and no commercial buildings within the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 13 - CROSSING 13
Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	0.61 km^2
Basin Perimeter	3.28 km
Channel Length	n/a
Length from Crossing to Most Remote Point	720 m
Length from Crossing to Highest Elevation	720 m
Basin Slope	4.2 %
Approximate Slope at Crossing Location	n/a
% Lakes and Swamps	n/a

Widening of the existing roadway will reduce the existing treed buffer zone and possibly eliminate some wetland habitat. The environmental impact during construction of adding an additional lane to the highway on water quantity and quality should be low providing that good construction practices are followed.

4.14 Crossing 14: Little Indian Lake (Indian River)

Little Indian Lake is already transacted by the existing Highway 103, with a causeway (possibly natural) and a bridge for conveying flow for the Indian River. Little Indian Lake is fed from Sandy and Big Indian Lakes as well as many others in the headwaters. There are also multiple dams that regulate this system, and a pipeline from the Little Indian Lake Dam which flows into the adjacent watershed for power generation. Mapping shows little to no development upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 14 - CROSSING 14

Basin Characteristics Upstream of Existing Crossing

Parameter	Value
Drainage Area	185.09 km^2
Basin Perimeter	84.56 km
Channel Length	26 760 m
Length from Crossing to Most Remote Point	24 650 m
Length from Crossing to Highest Elevation	24 250 m
Basin Slope	0.68 %
Approximate Slope at Crossing Location	<0.5 %
% Lakes, Swamps, and Marsh	12.4 %

Widening of the existing roadway will reduce the existing treed buffer zone and possibly eliminate some lake habitat. A bridge of greater waterway size (to be determined during design) than the existing structure would allow sufficient drainage and satisfy any Navigable Water concerns. The environmental impact during construction of adding an additional lane to the highway on water quantity and quality should be low providing that good construction practices are followed.

4.15 Crossing 15: Mill Lake (Northeast River)

Mill Lake is already transacted by the existing Highway 103, with a causeway and a bridge for conveying flow for the Northeast River. Mill Lake is fed from Coon Pond, Mud Cove and Anderson Lake as well as many others in the headwaters. There are also multiple dams that regulate this system, and a pipeline from the Little Indian Lake Dam which flows into the Mill Lake watershed for power generation. The 1:10 000 scale mapping for this watercourse shows some new housing developments in a small part of the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 15 - CROSSING 15

Basin Characteristics Upstream of Existing Crossing

Parameter	Value
Drainage Area	86.20 km^2
Basin Perimeter	59.77 km
Channel Length	23 360 m
Length from Crossing to Most Remote Point	20 580 m
Length from Crossing to Highest Elevation	20 580 m
Length from Crossing to Most Remote Point (not crossing basin boundary)	21 750 m
Basin Slope	0.7 %
Approximate Slope at Crossing Location	<0.5 %
% Lakes, Swamps, and Marsh	20.6 %

Widening of the existing roadway will reduce the existing treed buffer zone and possibly eliminate some lake habitat. A bridge of greater waterway size (to be determined during design) than the existing structure would allow sufficient drainage and satisfy any Navigable Water concerns. The environmental impact during construction of adding an additional lane to the highway on water quantity and quality should be low providing that good construction practices are followed.

4.16 Crossing 16: Mill Lake Backwater Pond

The Mill Lake backwater pond at the proposed crossing collects surface flows from a small area north of the existing highway 103 and eventually drains into Mill Lake. The 1:10 000 scale mapping for this watercourse shows no residential or commercial structures within the watershed upstream of the proposed crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 16 - CROSSING 16

Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	0.19 km^2
Basin Perimeter	1.81 km
Channel Length	n/a
Length from Crossing to Most Remote Point	350 m
Length from Crossing to Highest Elevation	350 m
Basin Slope	20.0 %
Approximate Slope at Crossing Location	n/a
% Lakes and Swamps	n/a

Widening of the existing roadway will reduce the existing treed buffer zone and possibly eliminate some lake habitat. The environmental impact during construction of adding an additional lane to the highway on water quantity and quality should be low providing that good construction practices are followed.

4.17 Crossing 17: Unnamed Tributary

The unnamed watercourse at the proposed crossing collects surface flows from a 1.54 km^2 drainage area to the north of Highway 103. Mapping shows several residential buildings within the upper reaches of the watershed upstream of the proposed crossing, but none in the immediate vicinity of the crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 17 - CROSSING 17

Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	1.54 km^2
Basin Perimeter	6.44 km
Channel Length	n/a
Length from Crossing to Most Remote Point	2250 m
Length from Crossing to Highest Elevation	2250 m
Basin Slope	2.2 %
Approximate Slope at Crossing Location	n/a
% Lakes and Swamps	~ 1.0 %

Although no obvious channel was apparent from our mapping, topography shows that some drainage infrastructure may be necessary. A culvert of similar or greater size (to be determined during design) than the existing structure would allow drainage from the 1.54 km^2 drainage basin under the highway. The environmental impact of the crossing on water quantity and quality should be low providing that good construction practices are followed.

4.18 Crossing 18: Unnamed Stream West of Exit 5

The unnamed watercourse at the proposed crossing collects surface flows from a small drainage area to the north of Highway 103. Mapping shows no residential or commercial buildings within the immediate vicinity of the crossing, although there is a large power line transmission corridor through this small watershed. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 18 - CROSSING 18

Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	0.38 km^2
Basin Perimeter	2.70 km
Channel Length	n/a
Length from Crossing to Most Remote Point	890 m
Length from Crossing to Highest Elevation	890 m
Basin Slope	2.8 %
Approximate Slope at Crossing Location	n/a
% Lakes and Swamps	~ 1.0 %

Although no obvious channel was apparent from our mapping, topography shows that some drainage infrastructure may be necessary. A culvert of similar or greater size (to be determined during design) than the existing structure would allow drainage from the 0.38 km^2 drainage basin under the highway. The environmental impact of the crossing on water quantity and quality should be low providing that good construction practices are followed.

4.19 Crossing 19: Unnamed Stream at Exit 5

The unnamed watercourse at the proposed crossing collects surface flows from a small drainage area to the north of Highway 103. Mapping shows some suburban residential and a large commercial development within the immediate vicinity of the crossing. The following table presents the basin characteristics that were obtained from 1:50 000 scale mapping.

Table 19 - CROSSING 19

Basin Characteristics Upstream of Proposed Crossing

Parameter	Value
Drainage Area	0.78 km^2
Basin Perimeter	3.40 km
Channel Length	470 m
Length from Crossing to Most Remote Point	1180 m
Length from Crossing to Highest Elevation	1180 m
Basin Slope	4.5 %
Approximate Slope at Crossing Location	n/a
% Lakes and Swamps	~ 1.0 %

A culvert of similar or greater size (to be determined during design) than the existing structure would allow drainage from the 0.78 km^2 drainage basin under the highway. The environmental impact of the crossing on water quantity and quality should be low providing that good construction practices are followed.

5.0 IMPACT ASSESSMENT, MITIGATION AND MONITORING

Since surface water supplies are sensitive to the environmental effects resulting from development activities. The key environmental issues for surface water resources from a linear development such as twining of Highway 103 may include:

- interference with drainage,
- interference with the local flood regime, and
- degradation of the water quality of surface water resources.

Surface water quality can be directly affected by groundwater quality and quantity, and vice versa.

5.1 Drainage

The potential interference with the local drainage by the construction and operation of the proposed twinning of Highway 103 may consist of the blockage or alteration of existing drainage patterns or the creation of new drainage channels over previously undisturbed terrain. Surface water resources are hydraulically linked to groundwater resources and aquatic habitat.

Based on the mapping exercise undertaken for this project, the watercourses along the proposed road alignment generally are well defined with all of the existing local drainage concentrated through the channels. However, since sme of the watercourses have small drainage areas, the additional drainage area from the proposed highway (road surface, median, ditches, etc.) needs to be considered. Therefore the design of the structures should account for the additional flows from less permeable surfaces.

5.2 Flooding

Overall the potential for flooding along the small watercourses is low. Few of the watercourse crossings have large drainage basins, steep channel slopes, or significant flood plains that increase the potential for flooding. All of the larger watersheds are regulated by hydro-electric dams, which would reduce flood peaks. There is little to no development in or near the flood plains of most watercourses that could be affected. Furthermore, consideration should be given during design to ensure that the construction of the proposed new highway does not initiate or aggravate local flooding upstream of small culverts. Based on the field inspections, the majority of structures seem adequate to handle flood flows, but the sizing of culverts should be reviewed during highway design.

5.3 Sediment Runoff

Existing overland drainage patterns could result in the transport of suspended solids to the nearest stream or wetland. The potential for the entrance of sediment laden runoff, however, is considered minimal in the majority of the watercourses as the general terrain outside of the flood plain and riparian zone is well vegetated. During construction, steep highway embankments could lead to sediment entering the watercourses, but the use of standard erosion and sediment control measures should adequately mitigate the effects of sediment laden runoff on nearby surface water sources of watercourses. Any watercourses having steep banks should have an augmented level of erosion and sediment control measures.

5.4 Runoff Containing Contaminants

To assess the significance of surface runoff from the proposed new highway, the annual volume of surface runoff from the proposed driving surface within each watercourse was estimated and compared to the mean annual flow in each of the impacted watercourses. The annual volume of surface runoff from the proposed additional driving surface was estimated using: a design road width of 10 m (which includes the roadway surface and shoulder but excludes the median area and roadside ditch) and 5 m for access ramps, lengths of highway draining to each watercourse (assuming highway will follow the natural topography), a mean annual precipitation of 1364 mm/year (refer to subsection 3.2), and a runoff coefficient of 1.0 (since all precipitation on the highway driving surface ends up as surface runoff). The mean annual flow in each of the watercourses was estimated using the drainage area (as measured from the 1:10 000 scale mapping) and a mean annual runoff amount of 955 mm/year (refer to subsection 3.2). The results from the assessment are presented in Table 20.

Table 20 – Pre-Design Surface Runoff Estimates and Comparison					
Crossing (Location)	**Additional Roadway Area (m^2)**	**Additional Annual Runoff (m^3)**	**Watershed Area (km^2)**	**Annual Flow (m^3)**	**%**
Crossing 1: Unnamed tributary to Hubbards Cove	9 300	12 685	1.69	1 613 950	0.79%
Crossing 2: Maple Lake Brook	4 170	5 688	0.54	515 700	1.10%
Crossing 3: Sawler Lake	16 800	22 915	17.01	16 244 550	0.14%
Crossing 4: Dorey Lake	33 950	46 308	60.77	58 035 350	0.08%
Crossing 5: Hubbards River	33 950	46 308	60.77	58 035 350	0.08%
Crossing 6: Stillwater Brook	28 170	38 424	10.03	9 578 650	0.40%
Crossing 7: Unnamed Stream between Lily Lake and Puddle Lake	n/a	n/a	0.42	401 100	n/a
Crossing 8: Puddle Lake	11 550	15 754	2.93	2 798 150	0.56%
Crossing 9: Mud Lake Brook	10 330	14 090	2.87	2 740 850	0.51%
Crossing 10: Unnamed stream approximately half way between Ingram River and Mud Lake Brook	10 760	14 677	0.74	706 700	2.08%
Crossing 11: Ingram River	21 943	29 930	107.31	102 481 050	0.03%
Crossing 12: Porcupine Brook	10 330	14 090	4.35	4 154 250	0.34%
Crossing 13: Wetland approximately 1 km east of Porcupine Brook	12 730	17 364	0.61	582 550	2.98%

Table 20 – Pre-Design Surface Runoff Estimates and Comparison					
Crossing 14: Little Indian Lake	22 640	30 881	185.09	176 760 950	0.02%
Crossing 15: Mill Lake	4 200	5 729	86.20	82 321 000	0.01%
Crossing 16: Mill Lake backwater pond	6 420	8 757	0.19	181 450	4.83%
Crossing 17: Unnamed tributary to Mill Lake approximately 0.5 km east of Mill Lake	10 420	14 213	1.54	1 470 700	0.97%
Crossing 18: Unnamed stream approximately 0.75 km west of Exit 5	6 740	9 193	0.38	362 900	2.53%
Crossing 19: Unnamed stream that runs through Exit 5	7 340	10 012	0.78	744 900	1.34%

The results presented in Table 12 indicate that the volume of runoff from the driving surfaces of the proposed new highway lanes ranges between 0.02 and 4.83 % of the mean annual flow in the impacted watercourses. Locations identified as having a runoff volume to mean annual runoff less than 10 % are unlikely to have a significant potential impact on the watercourse. Based on these preliminary hydrologic estimates, the volume of contaminants in surface runoff from the proposed new highway lanes (considering usual contaminants in highway runoff and excluding accidental spills and similar unforeseen events) are considered not great enough to have a major effect on downstream water quality, and thereby aquatic life.

6.0 CLIMATE CHANGE ASSESSMENT

There is general consensus among the international community of climate scientists that the climate is changing due to anthropogenic changes of the atmosphere. An increasing body of observations gives a collective picture of a warming world and other changes in the climate system (IPCC, 2001a). Bruce (2002) stated there has been a small increase in precipitation throughout the Atlantic Provinces, with a greater fraction of total precipitation since about 1940 falling in heavy rain and snow events. If the trend of increasing frequency of shorter duration (one day or less) heavy rainfalls in spring and early summer continued, drainage facilities will be more frequently overtaxed.

Although the uncertainty associated with local projections of climate change over North America remains large, some generalizations about climate change can be made. All of North America will very likely warm during the 21st century. The lowest winter temperatures are likely to increase more than the average winter temperature in northern North America. In much of Canada, annual mean precipitation is very likely to increase, with precipitation increasing in winter and spring and decreasing in summer (IPCC, 2007). For Nova Scotia, projections are for more runoff, high spring flows a month earlier than present, and summer low flows less than present and earlier.

A background paper titled "Water Sector: Vulnerability and Adaptation to Climate Change" contains a discussion of the climate trends associated with an increase in the global mean temperature due to increased greenhouse gases (particularly carbon dioxide, CO_2) in the atmosphere (GCSI and AES, 2000.) Based on General Circulation Models (GCMs),and assuming a doubled CO_2 atmosphere, a 0% to 20% increase in winter precipitation and small increases in summer precipitation are projected for Atlantic Canada. Although trend analyses of Canadian data are limited, some analyses of heavy one-day events have been undertaken that seem to indicate an increase in heavy precipitation events in Atlantic Canada. Model results indicate there will be an increased frequency of heavy one-day rains in a doubled CO_2 climate, with return periods halved, e.g. a 20-year return period rainfall becomes a 10-year event. If the frequency of short-duration high-intensity precipitation increases as projected, then greater soil erosion and sedimentation is likely, and more pollutants will be washed into rivers and lakes due to urban runoff. The above information, in particular the change in the return period of storm events, should be considered during the design of the watercourse structures.

While models typically predict global climate response, models exist that generate local scale climate responses. One such model for Nova Scotia has predicted a warming of 5°C by 2080, with an increase in precipitation of 12% to 15% in some areas, and a decrease in other areas (Lines, 2007). Seasonal changes in precipitation are also predicted across the Atlantic region, with regional variation ranging from a 5% to 20% change, primarily evident in a shift from snow to rain (Lines, 2007).

Projected changes in temperature and precipitation for Kentville, Nova Scotia, were obtained by downscaling from the CGCM2 and HadCM3 global climate models (Lines, 2006). Kentville is approximately 60 km northwest of Hubbards. By the end of the century, average annual maximum and minimum air temperature are expected to rise 3.8°C to 4.1°C and 3.0°C to 4.1°C respectively, while precipitation could increase by up to 20% (Lines, 2006). The projected change in climate would affect the amount, timing, and direction of runoff events by altering the intensity, seasonality and distribution of rainfall, the amount of evaporation, and the timing of snowmelt.

Swansberg et al. (2004) used statistical downscaling to predict changes in temperature, precipitation, and river discharge at several locations in New Brunswick. Their work was based on a GCM scenario of tripling the atmospheric CO_2 concentrations over pre-industrial levels, which is considered to be a conservative scenario. Projected changes for the period 2010 to the end of the century relative to late 20th century conditions (1961-1990) included a mean annual daily precipitation may increase by 9% to 14% in southern New Brunswick, and a change in mean annual discharge for the Canaan River at East Canaan of 13% by 2050, and 26% by the end of the century. Although the climate of New Brunswick differs from that of the Halifax area, the study's results indicates the potential magnitude of climate change effects on precipitation and stream flows in the Maritimes.

There is no doubt that climatic change would alter hydrologic systems, as precipitation is the main driver of variability in the water balance over both space and time (IPCC, 2006). Therefore, design flows cannot be solely based on past conditions. Considering projections of increased annual precipitation and greater rainfall intensity during storms, peak flows likely will increase with time during the long service life of the drainage infrastructure under Highway 103.

As future upgrading the capacity of drainage infrastructure under the twinned highway could be very costly and disrupt transportation and the environment, it may be best to design for future rather than current flow conditions. This would also provide greater capacity to handle extreme flood flows in the interim, whether or not these flood events are associated with climatic change. Considerable uncertainty exists about the magnitude of any changes in precipitation, but nevertheless changing hydro-climatic conditions should be considered during hydraulic design of drainage infrastructure under Highway 103. As projections are for an increase in annual precipitation Kentville, Nova Scotia, of up to 20% by the end of the century at (Lines, 2006), RV Anderson Associates Limited suggests that an increase the design peak flows also by 20% would be reasonable.

Approximately 80% of the Atlantic Region's coast is considered to be highly sensitive to sea-level rise with researchers predicting an average increase in sea-level rise of 50 cm by 2100, but the southern coast of Nova Scotia around St. Margaret's Bay may be less vulnerable.

7.0 CONCLUDING REMARKS

Adequate hydraulic design considering both present-day and future hydraulic conditions should be carried out for all new structures. As long as the application of normal standards and sound engineering judgment are used during design and construction, the proposed project should not result in detrimental hydrologic or hydraulic impacts.

Several existing small culverts in nearby roadways and access ramps need to be considered during highway design. If these culverts are removed or the drainage pattern significantly altered, then adequate provisions need to be made for local drainage by installing additional culverts.

Throughout the period of highway construction, erosion and sediment control measures should be installed and maintained. Based on experience with erosion and sediment control measures in eastern Canada, it is recommended that these measures are designed (1) to function to the applicable water quality limits during a 1 in 2 year return period storm event and (2) to withstand a 1 in 10 year return period event without incurring significant damage.

8.0 REFERENCES

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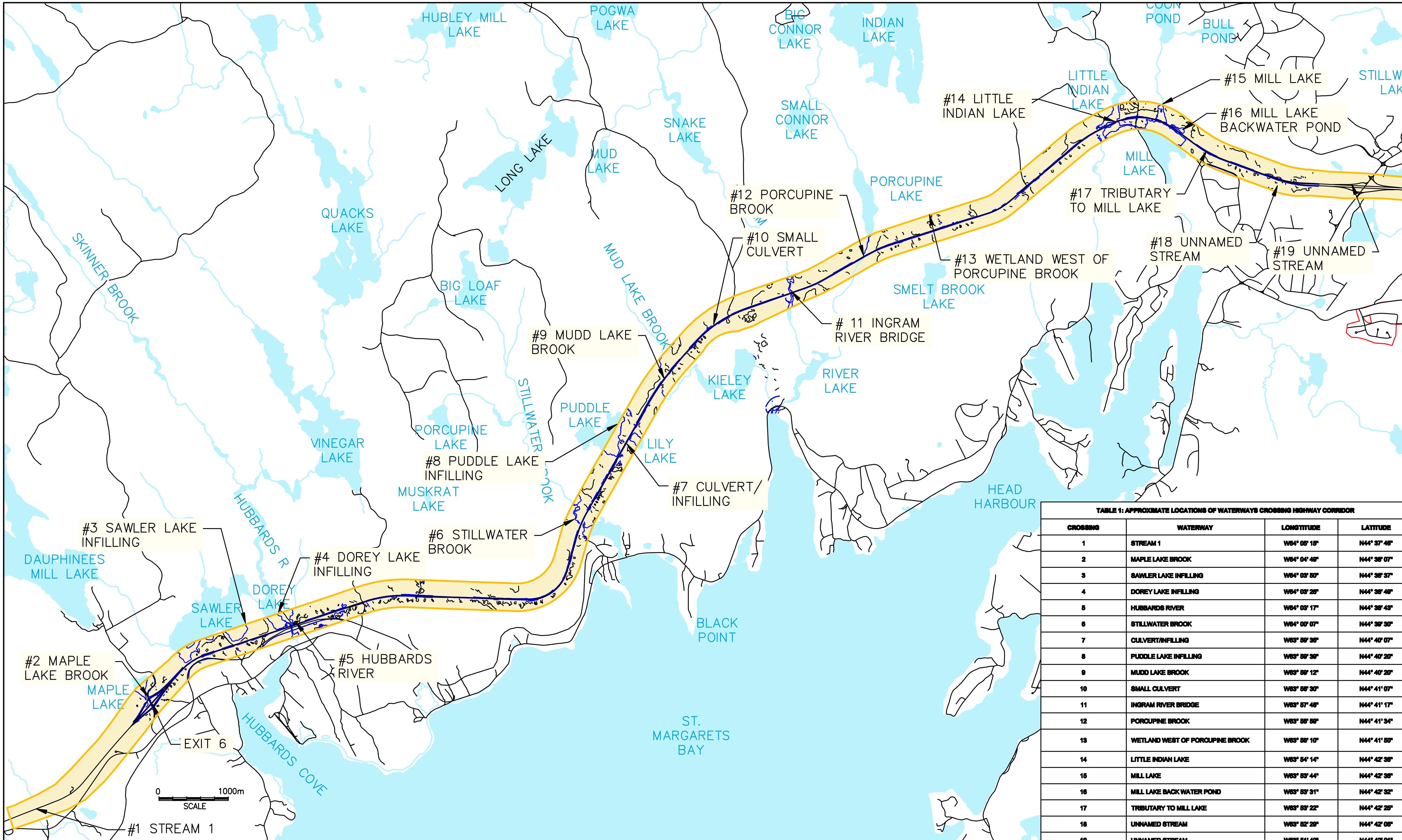


TABLE 1: APPROXIMATE LOCATIONS OF WATERWAYS CROSSING HIGHWAY CORRIDOR

CROSSING	WATERWAY	LONGTITUDE	LATITUDE
1	STREAM 1	W64° 05' 15"	N44° 37' 46"
2	MAPLE LAKE BROOK	W64° 04' 49"	N44° 38' 07"
3	SAWLER LAKE INFILLING	W64° 03' 50"	N44° 38' 37"
4	DOREY LAKE INFILLING	W64° 03' 26"	N44° 38' 49"
5	HUBBARDS RIVER	W64° 03' 17"	N44° 38' 43"
6	STILLWATER BROOK	W64° 00' 07"	N44° 39' 30"
7	CULVERT/INFILLING	W63° 59' 36"	N44° 40' 07"
8	PUDDLE LAKE INFILLING	W63° 59' 39"	N44° 40' 20"
9	MUDD LAKE BROOK	W63° 59' 12"	N44° 40' 20"
10	SMALL CULVERT	W63° 58' 30"	N44° 41' 07"
11	INGRAM RIVER BRIDGE	W63° 57' 46"	N44° 41' 17"
12	PORCUPINE BROOK	W63° 56' 59"	N44° 41' 34"
13	WETLAND WEST OF PORCUPINE BROOK	W63° 56' 10"	N44° 41' 50"
14	LITTLE INDIAN LAKE	W63° 54' 14"	N44° 42' 36"
15	MILL LAKE	W63° 53' 44"	N44° 42' 36"
16	MILL LAKE BACK WATER POND	W63° 53' 31"	N44° 42' 32"
17	TRIBUTARY TO MILL LAKE	W63° 53' 22"	N44° 42' 26"
18	UNNAMED STREAM	W63° 52' 29"	N44° 42' 06"
19	UNNAMED STREAM	W63° 51' 40"	N44° 42' 01"

R.V. Anderson Associates Limited engineering · environment · infrastructure	PROJECT TITLE: STANTEC NSTIR HIGHWAY 103EA	SCALE: 1 :50 000	DATE: FEBRUARY 2, 2010
	DRAWING TITLE: FIGURE 1: HIGHWAY 103: APPROXIMATE LOCATIONS OF WATERWAY CROSSINGS	PROJECT NO.: 092000	DWG NO.: 092000 – 1

APPENDIX C

SALT MANAGEMENT STRATEGY

Salt Management Plan

Highway 103 Twinning – From Exit 5 at Upper Tantallon to 2 Km West of Hubbards (Exit 6), Halifax County, Nova Scotia

1.0 Project Description

NSTIR proposes to twin the two-lane, two-way section of Highway 103 between Upper Tantallon to Hubbards to a four-lane divided highway. The Project is the construction, operation and maintenance of approximately 22 km of two-lane controlled access highway to extend west of Exit 5 to 2 km west of Exit 6 on Highway 103. Travelling west, the new lanes will parallel the current roadway on the north side of the existing lanes from the end of the existing four-lane section of highway west of Exit 5. The lanes will remain on the north side and end near Simms Settlement. It is noted that a new interchange and connector road scheduled for future construction to provide access from Highway 103 to St. Margarets Bay Road (Trunk 3) are not included in the current scope of assessment.

Excluding Exit 5 and Exit 6, there are currently no grade separated structures planned for intersecting roads along the twinning. While Exit 6 will be maintained, it is expected that the ramp configurations will be modified to improve traffic flow and safety. The only structures planned for this section are water conveyance structures required to accommodate several watercourse crossings along the alignment. In addition, to accommodate access to properties that would be severed by the twinning, one overpass, two multiplate underpasses and approximately 16 km of access roads are planned.

2.0 Background

Numerous studies have confirmed that elevated chloride levels in surface waters are linked to winter maintenance activities (*i.e.* salt storage and application of road salt as a deicing agent). Significant salt releases into aquatic areas of small drainage size put these areas at high risk. Surges of high chloride concentration from road salt typically occur during the winter and thaw months. Small streams, ponds, and wetlands close to the salted highway are susceptible to high salt loading, and combined with soil erosion due to salt-damaged vegetation, can exert stress on the aquatic ecology. Rapid changes in stream chloride levels during and following the winter salting period, rather than the high absolute values of chloride, may also stress fish and other aquatic life.

Salt stored in the groundwater and soils may also be released to streams over a several month period. Salt released during low flow summer months may be more concentrated when biotic activity is the highest. It is estimated that between 10% and 50% of salt applied to roads enters into the groundwater system and between 20% and 45% of chlorides applied to roads travels through the groundwater system and re-enters surface waters. In the rural areas along the proposed alignment, much of the road salt may enter the subsurface along the highway where no surface drainage exists.

Overall, harmful effects on aquatic life from salt pollution depends on oxygen supply in the water, water circulation, size of waterbody and drainage basin, temperature, length of exposure to salt, salting intensity, precipitation, topography, and type of highway drainage system.

Elevated levels of sodium chloride in soils may affect soil structure, soil pH, soil fertility, and the mobilization of trace metals. Extensive salt infiltration into soils can decrease the fertility of soils and subsequently be detrimental to plant growth.

3.0 Notification of Intent to Prepare a Salt Management Plan

As per Section 15(a) of the "Code of Practice for the Environmental Management Of Road Salts", published April 3, 2004, the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) notified Environment Canada on June 23, 2004, that they moved forward with the development of a Salt Management Plan (SMP). The SMP was developed to comply with the requirements of the aforementioned Code of Practice. In addition, NSTIR reports information annually to Environment Canada on their performance with respect to their SMP, as it is implemented and updated.

The SMP provides a mechanism through which NSTIR can commit to implementing salt best management practices on the section of Highway 103 from Exit 5 at Upper Tantallon to 2 km west of Exit 6 at Hubbards.

With respect to salt application, the objective of NSTIR's SMP is to reduce the negative impacts of road salts by delivering the right amount of road salts in the right place at the right time. In pursuing this goal consideration has been given to using the most recent advancements in the application of anti-icing and de-icing materials, winter maintenance equipment, and road weather information systems. In addition, personnel have been trained in salt best management practices and the monitoring of the effectiveness of road salt application techniques is undertaken by winter maintenance personnel.

4.0 Existing Winter Maintenance Program

Winter Maintenance on Highway 103, between Exit 5 at Tantallon and Exit 6 at Hubbards, is serviced by NSTIR's Beechville Base. This base has a fleet of seven trucks, all of which are outfitted with electronic spreader controls and automatic vehicle location (AVL) devices which allow tracking of the units by GPS. The AVL devices also provide instantaneous information to the base regarding whether the spreading units are plowing or salting. Six trucks are outfitted with vehicle mounted infra-red thermometers. Beechville Base has its own brine making tank and four trucks are equipped with pre-wet tanks. At Exit 6 there is a Road Weather Information System (RWIS) station that provides pavement and site specific atmospheric forecasts that assist winter maintenance personnel in making salt management decisions.

In 2008, thermal mapping of Highway 103 between Exit 5 and Exit 6 was completed that allows for Night Icing Potential (NIP) forecasts for this highway. Forecasts, in map format, indicate the earliest predicted time for the onset of black ice/frost in 1 km segments along this section of highway.

5.0 Existing Biophysical Environment

The following is a brief summary of the existing biophysical environment on this section of Highway 103:

1. There are approximately 121 domestic wells within 300 m of the highway centerline. It may be necessary in certain situations that clay lined ditches be constructed to drain salt laden water away from domestic wells.
2. There are 43 watercourses within the RoW, ranging from small drainage channels to large river systems. American eel and brook trout are the most common species, but Atlantic salmon was also observed in one system (Ingram River). Most watercourses (all but three) exhibited pH levels below 6.5 units (minimum level before stress is induced on fish and eggs).

3. Ten species of conservation concern were found in the Study Corridor during terrestrial field surveys, many of which were found in close proximity to the existing highway, suggesting they may be tolerant of road salt applications that are currently typical along the existing Highway 103.
4. A total of 323 wetlands have been identified within 500 m of the existing highway centerline. The Project is anticipated to result in direct alteration of 109 wetlands (for a total loss of 18 ha of wetland habitat).

6.0 Approach to the Salt Management Strategy

The following general activities form the basis for the development of the SMP on this section of Highway 103:

1. Identification of salt vulnerable areas specific to the proposed alignment, using Annex "B" in the Code of Practice as a guide.
2. Determination of site specific salt vulnerable areas to be monitored along the highway alignment.
3. Identification of applicable management strategies that can be incorporated in the design, construction, operation and maintenance of the proposed highway.
4. Implementation of a monitoring program during winter, thaw and summer months (*i.e.* 3 events).
5. Comparison of results to baseline samples to evaluate effectiveness of the strategy.

7.0 Salt Vulnerable Areas

Annex "B" of the Code of Practice lists a number of considerations that agencies should look for when identifying *Salt Vulnerable Areas*.

Based on the existing biophysical environment along this specific alignment, the following salt vulnerable areas that should be considered in the salt management strategy include:

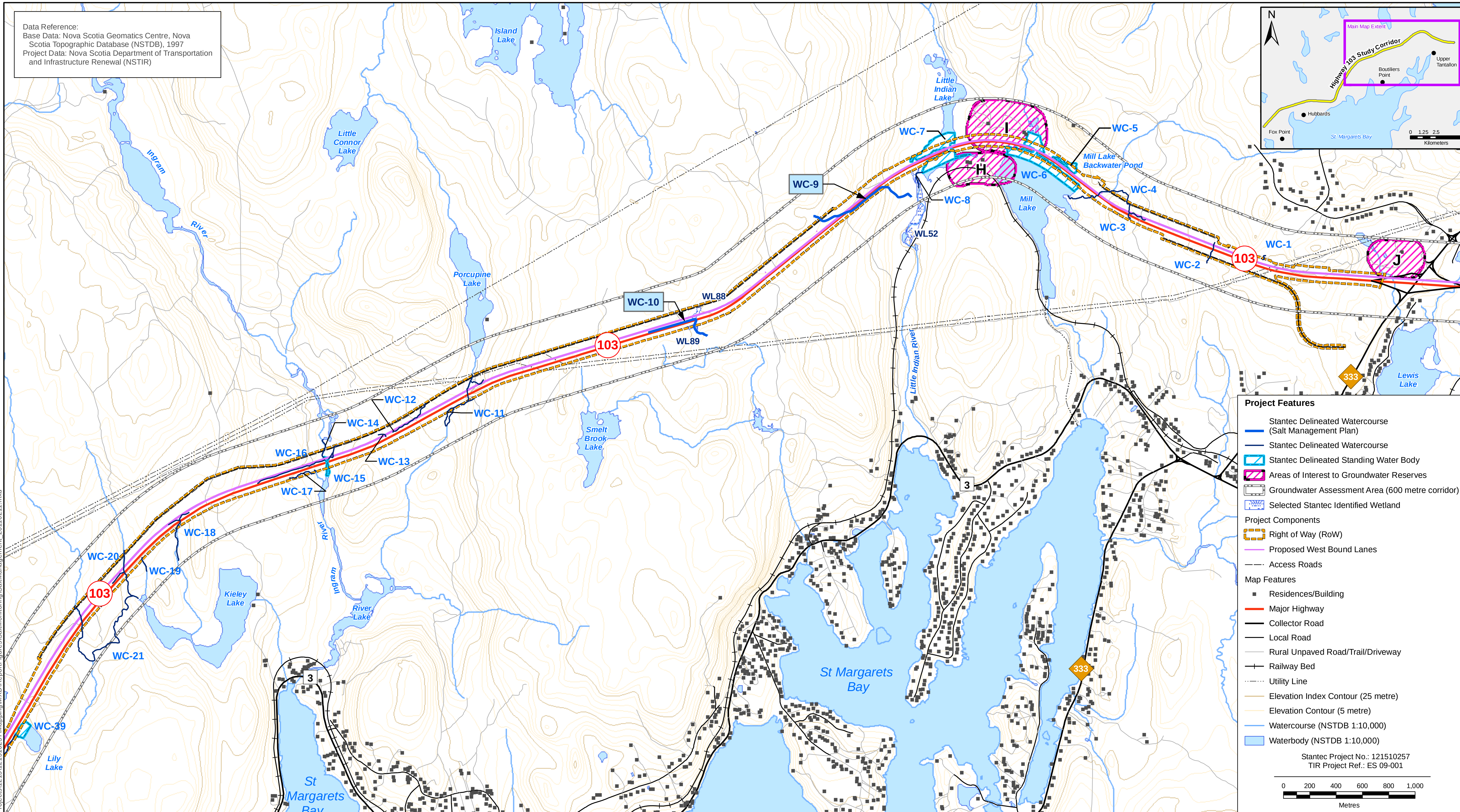
- Wetlands adjacent to the highway with potential low-dilution and long residence times (*i.e.* Wetland WL-52, WL-89, WL-99, WL-289, WL-323, WL-324);
- Rare and uncommon vegetation that could potentially be affected by increased salt loading (i.e., the area between Mill Lake WC-6 and Porcupine Brook WC-11); and
- Fish species found in watercourses WC-29 and WC-35.

7.1 Salt Vulnerable Areas Along RoW Identified for Monitoring

An analysis of Salt Vulnerable Areas along the proposed Highway 103 twinning has identified the following locations for monitoring based on the *CEAA Screening Level Environmental Assessment Report for Highway 103 Twinning* (Stantec 2011) (Table 1). Refer to Figures 1 and 2 for the proposed monitoring locations.

Table 1 Salt Vulnerable Areas for Monitoring

Area	Feature, Location	Importance
1	WC-9	Sensitive flora
2	WC-10	Sensitive flora
3	WC-29	Aquatic biota
4	WC-35	Aquatic biota



DATE: Feb. 14 2011

PREPARED BY: R. Sutcliffe

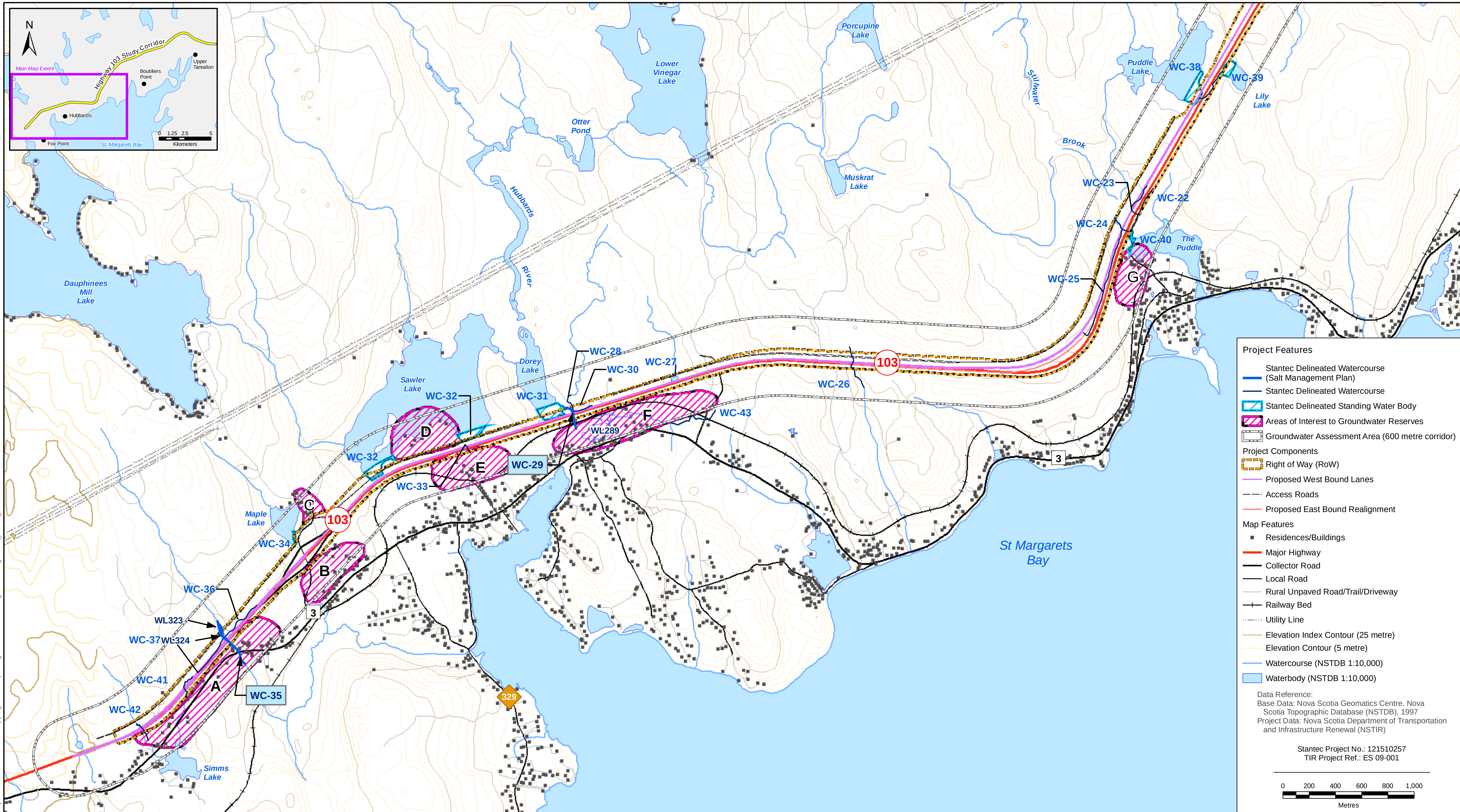
NOVA SCOTIA Transportation and Infrastructure Renewal

Highway 103 Twinning Project, Salt Management Plan

Water Quality Monitoring Stations

FIGURE NO.: 1

Stantec



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DATE: Feb. 14, 2011	Highway 103 Twinning Project, Salt Management Plan	FIGURE NO.: 2
PREPARED BY: R. Sutcliffe	**Water Quality Monitoring Stations**	Stantec
NOVA SCOTIA Transportation and Infrastructure Renewal		

WC-9

WC-9 a small, perennial, unnamed stream originates from a spring north of Highway 103. The stream runs south and crosses under the highway through a 600 mm diameter concrete culvert. Once on the south side of the highway the watercourse flows east within the ditch for approximately 500 m, where it veers into the mixed forest south of Highway 103 and flows southeast for 225 m until dissipating into Wetland 52 before draining into the Little Indian River. As a result of the stream dissipating into the wetland, WC-9 does not provide a direct connection to the Little Indian River and therefore fish passage is interrupted between the river and the unnamed stream. Stream velocity during the assessment period was low and flow measurements averaged 0.02 m^3/s.

This location was chosen as a monitoring location based on a species of sedge (*Carex foenea)* found in the upper reaches of the watercourse which is secure but uncommon within the province of Nova Scotia and the sensitive vegetation found throughout Wetland 52.

WC-10

WC-10 is an unnamed stream that originates from Wetland 99 located in the north ditch of highway 103. The stream follows the ditch along the north side of the highway through a 600 mm corrugated culvert under an old logging road, continues through an additional wetland before passing under the highway through a 600 mm concrete culvert. South of Highway 103 the watercourse runs south east and drains into a wetland approximately 130 m from the highway. Stream flow during the assessment period was low and averaged 0.04 m^3/s. A presence/absence electrofishing survey was performed on October 2, 2009 with 179 s of effort in a 15 m section upstream until fish habitat diminished. The 80 m downstream reach was fished as well, but no fish were observed.

This location was chosen as a monitoring location based on a two species found adjacent to the highway. The two species of concern include a false foxglove *Agalinis neoscotica* which is secure but uncommon within the province of Nova Scotia and a species of twayblade *Listera australis* which is extremely rare and is at risk within Nova Scotia.

WC-29

Hubbard's River originates from the top of the watershed; the existing highway intersects with the River at a point south of Dory Lake. At this location, below the outlet of the lake and upstream of the existing highway, the river exhibits a riffle type habitat. Upstream of the existing highway Hubbard's River was approximately 10 m wide with a depth of approximately 40 cm and a flow that averaged 3.76 m^3/s at the time of the survey. A large still-water area (Shenkles Pond) was located 125 m downstream of the existing highway; off the left side (looking downstream) of the river a portion of this area is also demarcated as Wetland 289 (a large swamp). On the right side of the river, a sheltered pool was observed upstream of Shenkles Pond. These two areas provide excellent habitat for various freshwater species including those caught during the Environmental Assessment field studies.

This location was chosen as a monitoring location based on the sensitive wetland vegetation and the species observed during the electrofishing survey performed on September 30, 2009 these results are included in Table 2.

Table 2 Electrofishing Results for WC-29

Fish Results		Number	Size
Scientific Name	Common Name	Caught	Range (cm)
Anguilla rostrata	American eel	60	10 - 51
Catostomus commersoni	White sucker	3	12.9 - 14
Salvelinus fontinalus	Brook trout	1	14

WC-35

WC-35 is a perennial stream that originates from north of the highway and runs south through Wetland 323 and Wetland 324 to Hubbards Cove. WC-35 forks approximately 110 m north of the highway into an east and west channel; the two channels merge again before entering a 1800 mm concrete culvert. Downstream the watercourse meanders over substrate dominated by boulder and large cobble that was entrenched within a stone lined channel between two residences. The stream runs under Highway 3 through a box culvert. Downstream of the highway the watercourse continues through a mainly coniferous forest along the west banks and a residence along the east bank. Several foot paths cross the stream below the Highway 103 crossing. A pool was noted shortly downstream of the highway crossing and gravel beds were present further downstream. Flows during the assessment period averaged 0.04 m^3/s in the thalweg.

This location was chosen as a monitoring location based on sensitive wetland vegetation and the species caught during the Environmental Assessment electrofishing survey performed on October 1, 2009 (refer to Table 3).

Table 3 Electrofishing Results for WC-35

Scientific Name	Common Name	Number Caught	Size Range (cm)
Salvelinus fontinalus	Brook trout	2	10 - 17.9
Anguilla rostrata	American eel	1	30

8.0 Evaluating Impacts

The potential adverse effects on groundwater, surface water and vegetation during the operation and maintenance of this section of highway are changes in water quality due to increased salt runoff and toxicity to vegetation due to aerial spray or changes in soil structure and fertility due to the replacement of calcium and potassium ions by sodium ions.

The following table can be used to determine if there are impacts to aquatic biota.

Table 4 Table for Evaluating Negative Impacts

Exposure	Surface Water – Aquatic Biota	Groundwater – Groundwater Biota	Soil – Soil Integrity, Soil Organisms, and Vegetation
Protective of Organisms for Short-Term Exposure	< 140 mg/L of chloride	< 140 mg/L of chloride	-
Protective of Organisms for Long-Term Exposure	< 35 mg/L of chloride	< 35 mg/L of chloride	< 60 mg Na/L and < 90 mg Cl/L
5 % of Species Experience Effects from Chronic Exposure	About 210 mg/L	About 210 mg/L	-
10 % of Species Experience Effects from Chronic Exposure	About 240 mg/L	About 240 mg/L	-
Protect Life From Acute and Lethal Effects	< 150 mg/L	< 150 mg/L	-
Damage to Plants	-	-	Concentrations of 16 mg Na/kg and 30 Cl/kg
Source: Environment Canada. 2004. Code of Practice for the Environmental Management of Road Salts. Annex A: Environmental Impact Indicators for Road Salts.			

9.0 Management Strategies

The potential environmental concerns for salt runoff on this section of Highway 103 are minimal. The following is a list of management strategies that should be considered in the design, construction, operation and maintenance of, based on the salt vulnerable areas identified.

1. Apply de-icing chemical through pre-wetting or direct liquid application and implement anti-icing principles to minimize salt use on this section of highway.

   Presently pre-wetting is being carried out on this section of Highway 103. In addition, a Road Weather Information System (RWIS) station is located at Exit 6 (Lunenburg County). This RWIS station includes environmental sensors that collect data at the roadside; develop forecasts and tailor information into an easily understood format; and display information for use by winter maintenance personnel. The tailored information provides real time atmospheric and road weather information necessary for NSTIR personnel to carry out snow and ice removal in the most efficient and due diligent manner.

   Thermal mapping of Highway 103 between Exit 5 and Exit 6 has been developed which allows for Night Icing Potential (NIP) forecasts for this section of highway. Forecasts, in map format, indicate the earliest predicted time for the onset of black ice / frost along 1 km segments of this highway.

2. Ensure runoff collected in median catch basins is not directed into the areas designated as salt vulnerable areas.

3. Investigate the following highway design considerations in areas designated as salt vulnerable on this project:

   - Where possible, widen ditches to provide storage for snow accumulation; and

   - Where possible, flatten backslopes in cuts upwind of the highway to reduce snow fall accumulation on highway.

4. Ensure maintenance mowing of median and immediate shoulders of highway is undertaken. Uncut grass is better as it prevents snow from drifting with the exception of grass right next to the highway.

10.0 Monitoring Program

1. Water samples should be taken in watercourses WC-9, WC-10, WC-29 and WC-35 to provide background concentrations of chloride and sodium. Samples will be taken in the watercourses on the south side of Highway 103 at the approximate edge of the RoW.
2. Monitoring should be carried out during winter, thaw and summer months (three events) at the above noted locations to determine chloride and sodium concentrations. Test results should be compared to baseline concentrations of chloride and also to the exposure chloride concentrations to determine if there are potential negative effects to aquatic biota.
3. Visual observation of the rare and uncommon plants should be carried out by an experienced botanist for two seasons to determine if there is salt damage as a result of aerial spray.

APPENDIX D

MI' KMAW KNOWLEDGE STUDY

MI'KMAQ ECOLOGICAL KNOWLEDGE STUDY

Highway 103 Section 1 (a) Exit 5 to Exit 6

Prepared for
Highway Planning and Design
Transportation and Infrastructure Renewal
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CMM Environmental Services
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November 2010

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1.0 INTRODUCTION

1.1 Confederacy of Mainland Mi'kmaq Environmental Services

CMM Environmental Services is a program operated by the Lands, Environment, and Natural Resources Directorate of The Confederacy of Mainland Mi'kmaq (CMM) that provides fee for environmental consulting services. CMM provides advisory services to six Mi'kmaw communities in the province of Nova Scotia: the Paqtnkek First Nation, Annapolis Valley First Nation, Bear River First Nation, Glooscap First Nation, Millbrook First Nation, and Pictou Landing First Nation.

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1.2 Project Description

This section of Highway 103 is west of Halifax and is referred to as Section 1 (a). Construction to this section involves twinning of Highway 103 from Exit 5 to Exit 6. The anticipated completion of this construction is 10 years.

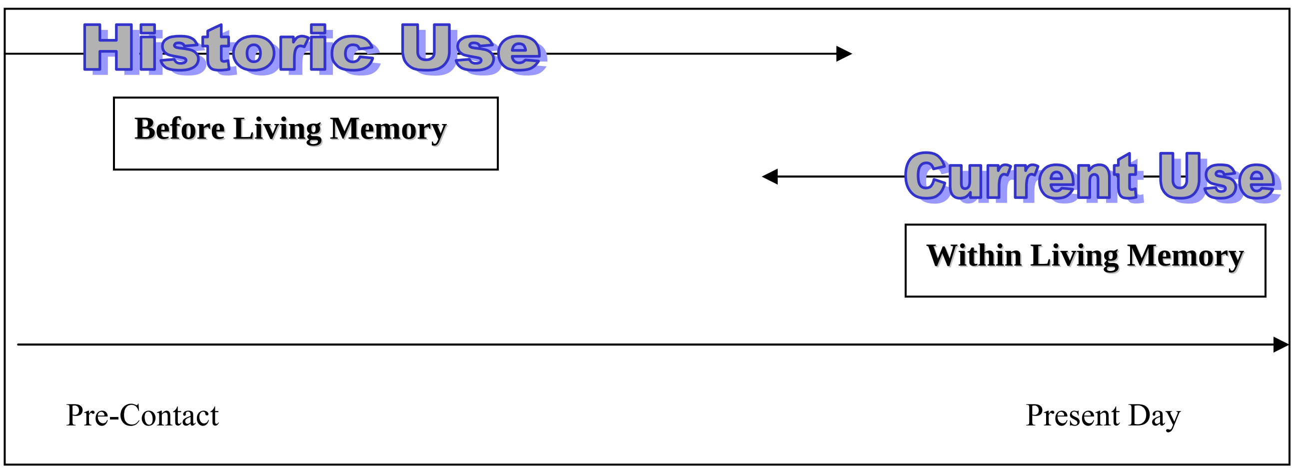
2.0 DEFINITION OF TERMS

Living Memory is the memory of living Mi'kmaw. The period of time included in living memory varies from knowledge holder to knowledge holder. Living memory often extends to the parent and grandparent of the knowledge holder and can be estimated at three to four generations.

Current Mi'kmaq Land and Resource Use occurred within living memory or is occurring at the present day (Figure 1)

Historic Mi'kmaq Land and Resource Use occurred before living memory (Figure 1)

Figure 1: Historic and Current Use Timeline



Mi'kmaw Ecological Knowledge is the collective body of knowledge which Mi'kmaq possess based on their intimate relationship with their natural surroundings, which involves exploitation, conservation and spiritual ideologies, and has been passed on from generation to generation, "*kisaku kinutemuatel mijuijij*", elder to child.

Mi'kmaq Land and Resource Use Sites are locations where Mi'kmaq land and resource use activities have taken place or are taking place at present day. These sites may or may not display physical evidence of Mi'kmaq use.

Mi'kmaw/Mi'kmaq: *Mi'kmaq* means the Family and is an undeclined form. The variant form, *Mi'kmaw,* plays two grammatical roles: 1) it is the singular of Mi'kmaq, and 2) it is an adjective in circumstances where it precedes a noun.

Mi'kma'ki is the Mi'kmaw homeland (Atlantic Provinces and Gaspé Peninsula).

Specific Land Claim arises when a First Nation alleges that the federal government has not honoured its treaties, agreements or legal responsibilities. According to federal policy, a valid specific claim exists when a First Nation can prove the government has an "outstanding lawful obligation". The Mi'kmaq is currently pursuing several specific land claims in Nova Scotia.

Comprehensive Claim is based on underlying Aboriginal Title to traditional territory that has not been dealt with by treaty or other means. Aboriginal Title to lands exists as a legal right derived from First Nations historical occupation and possession of their tribal lands. The process of negotiating the settlement of comprehensive claims, which is known as modern-day treaty making, clarifies access and ownership to land and resources. Currently, the Mi'kmaq has a comprehensive claim to all lands within the province of Nova Scotia including all inland and adjacent waters.

3.0 PURPOSE AND SCOPE OF THE MI'KMAQ ECOLOGICAL KNOWLEDGE STUDY (MEKS)

3.1 Purpose of the Mi'kmaq Ecological Knowledge Study

The purpose of the Mi'kmaq Ecological Knowledge Study is to support the integration of Mi'kmaq knowledge of use and occupation of Mi'kma'ki into development decisions via the environmental assessment process.

3.2 Scope of the Mi'kmaq Ecological Knowledge Study

The MEKS includes:

1) a study of historic and current Mi'kmaq land and resource use;
2) an evaluation of the potential impacts of the Project on Mi'kmaq use and occupation and constitutionally based rights;
3) an evaluation of the significance of the potential impacts of the Project on Mi'kmaq use and occupation; and
4) recommendations to proponents and regulators that may include recommendations for mitigation measures, further study, or consultation with Mi'kmaq.

3.3 Not included in the scope of the Mi'kmaq Ecological Knowledge Study

3.3.1 Section 35 Consultation

This MEKS study is not consultation for justification of the infringement of constitutionally protected aboriginal and treaty rights. If the project involves possible infringements of Mi'kmaq constitutional rights, the MEKS recommends further action.

3.3.2 Archaeological Screening and Resource Impact Assessment

This MEKS study is not an Archaeological Screening or Archaeological Resource Impact Assessment. Results presented in this study can inform and be informed by archaeological screenings and assessments.

3.3.3 Notification of Mi'kmaw individuals or communities of the Project

This MEKS study is not intended to inform or notify Mi'kmaw individuals or communities of the Project, solicit the opinions or concerns of Mi'kmaw individuals or communities on the Project, or promote the Project to Mi'kmaw individuals or communities.

4.0 METHODOLOGY

4.1 Historic Mi'kmaq Land and Resource Use

Historic Mi'kmaq land and resource use occurred before living memory. The study of historic land and resource use paints a broad portrait of Mi'kmaq use and occupation of Mi'kma'ki in centuries past.

4.1.1 Study Area

The historic land and resource use study area is in the Mi'kmaq district of Sipekni'katik district (wild potato area). Sipekni'katik encompasses the parts of Lunenburg County, Halifax County, Kings County, Hants County, Colchester County, and the many river systems within the Mi'kmaq district.

4.1.2 Methods

Research resources from the following institutes were consulted: The Confederacy of Mainland Mi'kmaq Research Library, Nova Scotia Public Archives, Dalhousie University, Saint Mary's University, St. Francis Xavier University, and the Nova Scotia Museum.

4.1.3 Limitations

Recorded documents are the primary source of information for the study of historic Mi'kmaq land and resource use. There are no recorded documents in the pre-contact period and recorded documents in the post-contact period are not comprehensive. Furthermore, existing documentation has largely been written by people of a different culture. This means that information may either not be completely accurate or may be incomplete.

4.2 Current Mi'kmaq Land and Resource Use

Current Mi'kmaq land and resource use occurred within living memory or is presently occurring. The MEKS includes a study of:

1) Current Mi'kmaq land and resource use sites
2) Species of significance to Mi'kmaq
3) Mi'kmaw Communities

4.2.1 Study Areas

The study areas are described in Figure 2.

4.2.1.1 Current Mi'kmaq Land and Resource Use Sites

The study area for current Mi'kmaq land and resource use sites is the proposed area of development – five km radius surrounding proposed project site. Please see Figure 2 and 3.

4.2.1.2 Species of Significance to Mi'kmaq

Study areas are marked on Figure 2.

4.2.1.3 Mi'kmaw Communities

The study area for Mi'kmaw communities is a five km radius surrounding the proposed project site.

4.2.2 *Methods*

4.2.2.1 Current Mi'kmaq Land and Resource Use Sites

Mi'kmaq Knowledge on current land and resource sites will be gathered through a review of information collected through oral interviews with Mi'kmaw knowledge holders.

All individuals, whom will be interviewed, will sign consent a form. Knowledge will be gathered in accordance within the spirit of the *Mi'kmaq Ecological Knowledge Protocol* and an application to complete research was submitted to Mi'kmaw Ethics Watch.

Knowledge collected is reported in a general format only. No names or specific locations are published. Collected knowledge will be digitized and compiled to allow for an analysis of potential impacts of the project on current Mi'kmaq land and resource use.

4.2.2.2 Species of Significance to Mi'kmaq

A system of stratified random sampling was employed to identify flora species present in the study areas of significance to Mi'kmaq. Plants were surveyed in the spring 2010 and the fall 2010. Information collected is reported in a general format only. The names of the species are not recorded.

4.2.2.3 Mi'kmaw Communities

A review of outstanding specific land claims within the study was undertaken by CMM. There is one specific land claim identified within the project area; the area in question is in the head waters and surrounding area of Ingram River. The claim is approximately 610 meters south of Highway 103 [Section 1 (a)]. This record of outstanding specific land claim in no way infers that other specific land claims may not arise in the future.

4.2.3 Limitations

While every attempt was made to document all available Mi'kmaw knowledge, the knowledge gathering process may not have captured some available Mi'kmaw knowledge. It is also recognized that over generations of cultural and political suppression, much Mi'kmaq knowledge has been irretrievably lost.

5.0 RESULTS

Results of the study are divided into two categories:

1) historic land and resource use, that is, use that occurred before living memory, and
2) current land and resource use, or use that occurred within living memory or is occurring at the present day

Land and resource use may be for hunting, burial/birth, ceremonial, gathering, or habitation purposes.

5.1 Historic Mi'kmaq Land and Resource Use

5.1.1 Pre-Contact Introduction

Mi'kma'ki or the Mi'kmaw Homeland is traditionally composed of seven districts: Kespek (last water), Siknikt (drainage area), Epekwitk aq Piktuk (lying in water and the explosive place), Kespukwitk (last flow), Sipekni'katik (wild potato area), Eskikewa'kik (skin dresser's territory), and Unama'kik (Mi'kmaw territory) (Native Council, 1994, p. 3). Traditionally, Mi'kma'ki territory is within parts of Quebec, parts of New Brunswick, Prince Edward Island, and Nova Scotia. The proposed section of the highway is within the Sipekni'katik district (wild potato area).

Within the Mi'kmaw districts, there were many parts that required aquatic navigation, and Bernard Hoffman writes about the topographical description of Mi'kma'ki: "the Micmac country was ideally suited to the use of the canoe, being interlaced with streams and dotted with lakes. The distance from the headwater of one drainage system to another is usually short, and could be traversed by easy portage (ONIGENN). Thus the Micmac could travel by river routes from one side of Nova Scotia to the other…" (Hoffman, 1955, p. 144). With such a vast territory, the Mi'kmaq developed an efficient means of transportation to maintain the land and to harvest the resources from the land and waterways. To maintain a presence on their territory, the Mi'kmaq had several means of transportation which included: “the birchbark canoe, the back-pack and tumpline, and “toboggan” and snowshoes. Of these the birchbark was the most important…” (Hoffman, 1955, p. 139).

Travel was often a factor in acquiring food and “[p]rior to European colonization of Nova Scotia, coastal and offshore waters provided transportation routes and abundant food sources for the Mi’kmaq. Camps were often located in coastal areas where the Mi’kmaq subsisted on various types of life, including cod. When the Mi’kmaq went into open waters, the Mi’kmaq placed tree boughs at the front to keep bigger fish from attacking the birch bark canoe…” (Davis and Browne, 1996, vol. 1, p. 339).

Besides being resourceful in their travel, the Mi’kmaq also realized that choosing a good location was important, and “[e]arly Mi’kmaq people chose campsites along the coast, based on the availability of fresh water and firewood and a place to beach canoes. They chose places…such as peninsulas or islands, and high ground, where they could keep a lookout for…food species, such as a porpoise” (Davis and Browne, 1996, vol. 1, p. 344).

5.1.2 General overview of the Study Area

Geographically, Sipekni’katik lies within the Meguma Terrane in Nova Scotia. The Meguma Zone covers the southern mainland of Nova Scotia; the Zone expands and extends to the ocean “beneath younger sedimentary rocks” (Davis and Browne, 1996, Vol. 1, p. 20). The Zone consists of “quartzite, slate, schist, gneiss, minor volcanic rocks and iron formation” (Ibid. p 16). With such variety of resources, “the Mi’kmaq and their ancestors acquired an impressive knowledge of the geology of their land by using rocks and minerals to develop one of the first technologies – the working of stone” (Ibid. p 322). “The earliest stone tool made by Nova Scotia Indians were large knives, choppers, and scrapers. They were both core and large flakes. These early tools were simply made by removal of a few large flakes. Such tools are found in a few places in the province in the lowest layers of Indian occupation of a campsite” (Stoddard, 1967(?), p. 2).

The coastal area of Sipekni’katik is near the section of the proposed project. This area includes the southwestern section of Lunenburg County and southwestern section of Halifax County near St Margaret’s Bay. For this section, there is a listing of high saltwater marshes. In the two counties, Halifax County has 173 hectares and Lunenburg County has 111 hectares of high salt water marshes. In these marshes, the Mi'kmaq would gather sweetgrass for their decorative work (Davis and Browne, 1996, vol. 1, p. 421). Contemporarily, the Mi'kmaq, also, use the sweetgrass for spiritual purposes. Note: the number of hectares mentioned is not the total of hectares in the proposed area but a portion.

5.1.3 Results

Historically, there are various reports of Mi'kmaq occupation and activity in the Sipekni'katik area. Ruth Whitehead writes about Messamouet who had traveled to France before 1580, and he had stayed with Sieur de Grandmont (Governor of Bayonne) (Whitehead, 1991, p. 23). Bernard Hoffman, also, writes about Messamouet and his travel to France (Hoffman, 1955, p. 523).

In 1604, the Mi'kmaq were engaged in a fur trade with the French. Captain Rossignol, a French trader, was also involved in the fur trade at Port Rossignol: the port was also known as Port Senior, and the port is now known as Liverpool. De Monts, under the authority of the French monarch, "confiscated, and gave the name of the Captain" (More, 1972, p. 5). According to De Monts, Rossignol was engaged in an illegal fur trade; therefore, De Monts confiscated his furs and named the port after Rossignol. De Monts had earlier landed southerly at Port Mouton, so named because a sheep had jumped overboard (Ibid. p 5).

Another record is by Samuel de Champlain who, in 1604, writes about an Indian village called Elnoi Ogsaoei (Indian Point), which is located in the LaHave area. At the time, there were four or five Mi'kmaq village in area and Elnoi Ogsaoei was one of the villages. And shortly after in 1606, Sakumow Messamouet is recorded as the District Chief "of the LaHave drainage" (Hoffman, 1955, pp. 522- 523). A year after (1607), Jean de Biencourt de Pourtincourt visited the area and met with a Mi'kmaq Chief called Martin. With this timeline in mind, it is a possibility that Martin was Messamouet.

Messamouet was also involved with Membertou, the celebrated District Chief from the Port Royal area, in the Almouchiquois event of 1607 (Hoffman, 1955, pp. 522- 523).

Messamouet, also, passed on information about a copper mine to Champlain during his visit. Several years after in 1612, Messamouet, along with many other Mi'kmaq, may have died in an epidemic (Whitehead, 1991, p. 39).

In 1731, there was much European activity with ships in the St. Margaret's Bay. And while camping at Indian Point in St. Margaret's Bay, El-go-mard-dinip and other Mi'kmaq captured a Spanish ship (Whitehead, 1991, p. 96). Later on, a large number of Europeans arrived in the mid-southern coast of Nova Scotia. In 1749, Colonel Edward Cornwallis, along with approximately two thousand for hundred settlers, arrives in Chebucto (Halifax). The settlers soon spread east to Dartmouth and Chezzetcook. The settlers also moved westward toward Mahone Bay where the newcomers found cleared land by the Mi'kmaq (Upton, 1979, p. 48).

As more Europeans continued to migrate in Acadie region, and there was an urgency to address treaty terms between the Mi'kmaq and the British, and in 1760 there was a missionary working in Acadie, Father Manach. Manach compiled a list of Mi'kmaw Chiefs who had to be contacted for treaty negotiations (Upton, 1979, pp. 57 - 58). According to Manach's list, Claud Piguidawalwet was the District Chief of Sipekni'katik (Segepenegatig or Chigabennakadik) at the time (Hoffman, 1955, p. 518). But another missionary, Father Pacifique names Jean-Baptiste Cope as the Chief, and Cope may have been Chief earlier than 1750 (Ibid. p 535). The Cope family was dominate in the area and had 7 of 15 hunting areas (Ibid. p 536).

Approximately 70 years later, Thomas C. Haliburton records there are still moose in Nova Scotia. He writes a lengthy description of moose in Nova Scotia and mentions that the moose are still plentiful (Haliburton, 1829, pp. 391- 393).

In Nova Scotia and in other Mi'kmaq districts, treaty terms between the Mi'kmaq and the British were still being negotiated, and in the spring of 1760, Paul Laurent, who was the recognized Chief of the LaHave Mi'kmaq, went to Halifax to sign a treaty. The Passamaquoddys and the St. John River Indians had already signed the treaty. On the same day, Michel Augustine, Chief of Richibucto Indians and Claude Renie, Chief of Shubenacadie and Musquodoboit district, also signed (Hutton, 1961, p. 150).

On the question Mi'kmaq lands, usually the Mi'kmaq land grants were subject to licence of occupation. In Nova Scotia, the Mi'kmaq were allowed to own land. In 1786, Philip Bernard, Solomon Bescoloon, and Thomas Ambroise, from La Have Indians were granted 550 acres (CMM records. PANS RG 20 "C," v. 95, pp.72-73).

There were many changes, which came about with European settlement, that affected the Mi'kmaq at the time, and by 1850, Mi'kmaq displacement was taking place at Ingram River. This displacement came with the effects of dam construction and log drives which was causing flooding, and fish weirs were being destroyed (Upton, 1979, p. 95).

Historically, the Mi'kmaq were accustomed to fish weir technology, and much earlier in 1607, Marc Lescarbot writes about fishing in the Port Royal area. Fish would come up some rivers "in such quantities that they carried away the nets which had been set for them. Fish were abound there in like manner everywhere, such is the fertility of this country. In order to catch them they [Mi'kmaq] made a hurdle, or weir, across the brook, which they place almost erect, propped up by wooden bars, like the buttresses, and leave a space therein for the fish to pass, which find themselves caught at the fall of the tide…"(Lescarbot, 1914, pp. 236 -237).

Roger Lewis also writes a description about Mi'kmaq fish weir technology. The description is based on the 2004 discovery of fish weirs along the Mersey River. The discovery was made when the Mersey River was lowered to repair the Hydro system. The Mersey River is approximately 79 kilometers southwest of the project. He writes that "[a] fish weir (say weer) is a wooden or stone barrier or trap placed at the mouth of a river or in a river channel to capture fish for food. It is the oldest of known fishing practices and has been used as far back in time as 8,000 years ago "(Lewis, 2007, p.6)

"While remnants of this ancient fishing technology are found on most of the rivers in Nova Scotia, the majority of fish weirs identified to date have been found in the rivers located in the southwest part of the province." (Lewis, 2007, p. 6). Lewis identifies four types of weirs: wooden stake weir, v-shaped weir (large version) found in waters in the interior, v-shaped (small version) weir set at head of tide, and a circular or rectangular weir found above a head tide. Each type of weir was designed to catch a certain fish, i.e., larger fish like sturgeon would be caught in the wooden stake weir set at the mouth of a river (Ibid. p 6).

A much earlier description of Mi'kmaq fish weir technology is recorded in 1593 when Richard Strong from Falmouth, Master of the Marigold, reports about his travels to Newfoundland and Unama'kik (Cape Breton). Navigation wise, he was confused when he landed in Cape Breton when he had wanted to fish near Newfoundland. After several landings in Cape Breton to replenish their water, he met people (Mi'kmaq) who were feasting, and a misunderstanding resulted in Strong retreating back to his ship. About his exploring Strong writes: "And here, haveing neede of fresh water, we went againe on shore, and, passing somewhat more into the lande, wee founde certain round pondes artifically made by the Savages to keepe fish in, with weares [weirs] in them to take fish. To these pondes wee repayred to fill our caske with water" (Whitehead, 1993, p.19). Citing Strong as source, Paul Chaisson concludes that the Mi'kmaq were fish farming in 1593 (Chaisson, 2006, p. 178).

Geographically, the use of fish weirs [Mi'kmaq word for weir is nesakun (Prins, 1996, p. 219)] was widespread among the Mi'kmaq, and Wallis and Wallis offered three descriptions of this fish harvesting technology, which is similar to Roger Lewis' description, practiced at Siknikt (Richibucto River and Eel Ground, N.B. area). Firstly, a'bi or net "…sometimes fifty yards in length, is made of intertwined branches of birch, elder, or other tree or bush" (Wallis and Wallis, 1955, p. 28). The a'bi was made with a triangular shape and set from the shore and extended out. The fish would be driven to the apex, and the a'bi was drawn to shore where the fish were harvested. Secondly, a'biloteg'an (net trap) is another version of a fish weir. It is a semi-circular net and set near the shore. A'biloteg'an had a swing door that was opened with the rising tide and closed as the water receded and then the fish were harvested. Thirdly, lokaskadeg'an was made of brush. Horizontal sticks were set with smaller sticks in a crossed like fashion. Lokaskadeg'an had two doors on each end, which were fastened with a horizontal stick called tci'bila'an. The centre of the weir had a kulnade'ganddite (stake at the centre) with wa'adegan (bait) on it. Ka'agan is the door of the weir. Lokaskadeg'an was used in the Richibucto River and Eel Ground, N.B. (Ibid. pp. 28 -29).

Mi'kmaq fishery and trade history in Lunenburg County is recorded by Mary Wentzell's recollection (1910 - 1920) of Indian Point. She had lived there for 90 years. She recalls how the "…Indians came from the reserve in Gold River by canoe to trade salmon for tobacco and molasses. That was summer barter. The salmon was never weighed. It was just a swap…"(Whitehead, 1991, p. 318). This version of trade had begun much earlier in history, and "[b]y the late 1700's, colonists and Mi'kmaq were involved in commercial exploitation of rivers by trading their salmon catch with dealers along the coast" (Davis and Browne, 1996, vol. 1, p. 349).

With such fishery resources, the Sipekni'katik district would have been a favourable habitation site for the Mi'kmaq. With such extensive knowledge and expertise in travel by water, the Mi'kmaq would have traveled and utilized the resources from the Atlantic Ocean, the rivers, bays and adjoining waterways. This proposed section of highway [Section 1 (a), Highway 103] has numerous waterways, coves, and a large bay in the vicinity: St. Margaret's Bay would have offered an opportunity to harvest marine species. There are also many lakes that would have provided food for the Mi'kmaq (Wright's Lake, Panuke Lake, Sandy Lake, etc.) on the northern section of the proposed project; there are rivers (Ingram River, Hubbards River, and Indian River) that extend inland and empty into the ocean; plus there are several coves (Whynachts Cove, Schooner Cove, and Cowlow Cove).

With geography that is interspersed with rivers, bays, and coves, the Sipenki'katik district would have been conducive to Mi'kmaq habitation, and there are numerous archaeological records of Mi'kmaq occupation in the surrounding area. Following is a list of some of these sites (quotes and description of these sites are taken directly from the Maritime Archaeological Resource Inventory Site Survey Forms):

BdDa – 1. This site is on the north side of Highway 103 and Hubbards (Halifax County). It is on the north side of Sawlor Lake. It is a prehistoric site and dates back 3000 years plus. A plummet and other artifacts were found in the area.

BdCx – 1. This site is located at Indian Point (Cellar's Cove) at St. Margaret's Bay (Halifax County). It is a prehistoric site dating back 500 plus years. A shell midden was found, and the site was mainly destroyed.

BdCx – 2. This site is located at Indian Point at St. Margaret's Bay (Halifax County). According to H. Piers, the site is a "burial complex."

BdCx -3. This site is located at Glen Haven (Frostfish Cove) by St Margaret's Bay (Halifax County). It is a prehistoric site dating back 500 years plus. A shell midden was found, and the site was mainly destroyed. There is speculation that the site was a large and important site.

BdCx – 5. This site is located at Indian Point (Sand Cove), St Margaret's Bay (Halifax County). It is a prehistoric site and dates back 500 plus years. A shell midden and burial site are recorded.

BeCx – 33. This site is located at the south end of Wright's Lake, north of Highway 103 (Halifax Country). This was a settlement site. About forty quartz flakes were found, and the site is not diagnosed for a time period.

BeCx – 35. This site is located on the western shore of Wright's Lake (Halifax County). This site is a combination of pre-contact and historic site settlement. Fifteen quartz flakes and historic artifacts were found.

BeCx – 39. This site is located at the Pockwock River, eastern shore of Wright's Lake (Halifax County). The function and age of the site is undetermined. The only signs of function were the discovery of flakes; this discovery is a sign of tool production.

BeCx – 43. This site is situated on the western side of Oak Island, near Wright's Lake (Halifax County). This is a pre-contact settlement site. Flakes were found, but the date of the settlement is unknown.

It should be noted that there are numerous pre-contact sites surrounding the Wright's Lake area (Halifax County), and similar conditions exist in the Indian Point (Sandy Cove), St Margaret's Bay area. A "burial complex" at Indian Point was recorded by H. Piers, and remnants of shell midden were found. There were two burial sites found: one at Indian Point (BdCx -2 as recorded by H. Piers) and the other at Glen Haven (BdCx -5). Due to favourable habitation conditions, the Mi'kmaq may have more burial sites in the area.

From Wright's Lake to Indian Point (Halifax County) is a short distance (approximately 20 kilometers) either by water and possibly some portages; the proposed project will be running between the two areas where archaeological evidence records a Mi'kmaq occupation of the area.

In the area closer to Hubbards, prehistoric artifacts were found that dated back to 3000 years plus. The site is referred to as an "isolated find." The site is approximately 5 kilometers north of existing Highway 103 and on the north section of Sawlor Lake.

There were several shell midden sites found in the area: Indian Point (BdCx – 1 and BdCx – 5), and Glen Haven (BdCx – 3). A more detailed description of what can be found in a shell midden is offered by W. J. Wintemberg. He worked on an archaeological excavation called the Eisenhauer Shell-Heap site in the Mahone Bay area (Lunenburg County). The archaeological site shares a similar terrain as the proposed project site, and the shell heap is located approximately 35 kilometers southwest.

W.J. Wintemberg began his work on the Eisenhauer Shell-Heap in 1913. The excavation site is located between the village of Mahone Bay and Indian Point. The archaeological artifacts that Wintemberg found are listed in his report. The items Wintemberg found were shell, fish, animal bone fragments, moose, Virginia deer, beaver, otter, dog, bear, harbour seal, racoon, lynx, woodland caribou, porcupine, woodchuck, muskrat, hare, wolf, and fisher. Also in his report, Wintemberg identifies bones from a loon, northern eider, and fish bones were also found. He also reported several rocks and minerals, stone tools, pottery fragments, and an ornamental fragment (Smith and Wintemberg, 1973, pp. 113 -125). Wintemberg also found a disk which may have been used in a game (Ibid 126). A possible version of the disk (Altĕstăkŭn – Mi'kmaq dice game) is described by Father Chrestien Le Clercq, as translated by William F Ganong. Ganong's footnotes describe the game (LeClercq, 1910, p. 294). Bernard G. Hoffman, also, writes about the game in detail (Hoffman, 1955, p. 693).

Besides shell midden sites as evidence of Mi'kmaq occupation, there are census records that indicate Mi'kmaq lived in the vicinity:

During the years between 1687 and 1688, Gargas took census of Mi'kmaq in LaHave area: 60 Mi'kmaq in the area.

In 1708, there is a census of Mi'kmaq families in the La Have and vicinity. At the time, there were 3 families with a total of 20 people (Whitehead, 1991, p. 80).

There was another Mi'kmaq census recorded in 1772, and Thomas Chandler Haliburton recorded that there are 865 Mi'kmaq in Nova Scotia (Whitehead, 1991, p. 39).

In 1819, Walter Bromley writes there are 32 Mi'kmaq at Gold River, and he adds that the Mi'kmaq had "made considerable improvements: six acres of their land was in the best possible state of cultivation, and contained excellent crops of potatoes, cabbages, turnips, barley and English hay…"(Bromley, 1815, p. 47).

There was another census taken in 1855, and the Mi'kmaq population in Chester and Gold River area was 10 families with a total of 33 people (Whitehead, 1991, p. 256).

5.2 Current Mi'kmaq Land and Resource Use

The study of current Mi'kmaq land and resource use is comprised of a study of current Mi'kmaq land and resource use sites, species of significance to Mi'kmaq, and Mi'kmaw communities.

5.2.1 Current Mi'kmaq Land and Resource Use Sites

Current Mi'kmaq land and resource use activities are divided into five categories:

1) kill/hunting
2) burial/birth
3) ceremonial
4) gathering food/ medicinal
5) occupation/habitation

Table 1 provides a description of activities undertaken at the sites.

Table 1: Description of Activities Undertaken in Current Mi'kmaq Land and Resource Use Sites

TYPE OF SITE	DESCRIPTION OF ACTIVITIES IN STUDY AREA
HUNTING/KILL	Deer, partridge, mackerel, salmon, trout, lobster, rabbit.
BURIAL/BIRTH	One potential burial site
CEREMONIAL	
GATHERING	Berries, decoration plant
HABITATION	Group campsite

There are no ceremonial sites identified, however there is one potential site for burial. Please see figure 2, map indicating sensitive area.

5.2.2 Species of Significance to Mi'kmaq present in study area

Species of significance to Mi'kmaq in the study area are divided into three categories:

1) Medicinal
2) Food/Beverage
3) Craft/Art

The following table describes the number of plants of significance present in the study areas during the fall and spring surveys.

Table 2: Number of Species of Significance to Mi'kmaq Present in the Study Areas Spring 2010

TYPE OF USE	NUMBER OF SPECIES PRESENT SPRING 2010
MEDICINAL	32
FOOD/BEVERAGE	12
CRAFT/ART	9

Table 3: Number of Species of Significance to Mi'kmaq Present in the Study Areas Fall 2010

TYPE OF USE	NUMBER OF SPECIES PRESENT FALL 2010
MEDICINAL	45
FOOD/BEVERAGE	23
CRAFT/ART	11

5.2.3 *Mi'kmaw Communities*

There are several Mi'kmaw reserves located nearby the study area. Indian Reserves (IR) being defined as those lands that had been set-aside for the use and benefit of Indians under Federal Legislation of the Indian Act. There are no Indian Reserves located within the current use study area, however, there are six reserves located in within approximately 50 kilometers of the project area.

Shubenacadie IR 13, established in 1820 in Halifax County, is 30 kilometers northeast of the project.

New Ross IR 20, established in 1820 in Lunenburg County, is approximately 35 kilometers northwest of the project.

Gold River IR 21, established in 1820 in Lunenburg County, is approximately 28 kilometers southwest of the project.

St Croix IR 34, established in 1851 in Queens County, is approximately 25 kilometers north of the project.

Pennal IR 19, established in 1858 in Lunenburg County, is approximately 30 kilometers northwest of the project.

Cole Harbour IR 30, established in 1880 in Halifax County, is approximately 30 kilometers southeast of the project.

The following is a list of Mi'kmaq place names:

St. Margaret's Bay……………..Nalikipuleuk
Ingram River Reserve…………L'nu Maqamikew
Pennant Point…………………...Skaqanek
Sambro Reserve………………...L'nu Maqamikek

Prospect…………………………Paspek or Naspataqn
Pockwock Lake…………………Paakwaak…canoe is hindered
Mi'kmaq territory……………….Megămaage
Halifax…………………………..Chebutookt
Dartmouth……………………….Punamkuatjik…salmon place

6.0 POTENTIAL PROJECT IMPACTS ON MI'KMAQ LAND AND RESOURCE USE

The following table presents potential project impacts on historic and current Mi'kmaq land and resource use.

Table 3: Potential Project Impacts on Mi'kmaq Land and Resource Use

POTENTIAL IMPACTS ON MI'KMAQ LAND AND RESOURCE USE	
6.01	The historic review of Mi'kmaq use and occupation documents historic Mi'kmaq use and occupation in the study area, and potentially the project area. A potential impact of the project is the disturbance of archaeological resources.
6.02	Several species of significance to Mi'kmaq have been identified in the study area. Permanent loss of some specimens is a potential impact of the project.
6.03	A Specific Land Claim has been identified within the study area. A potential impact of the project is the disturbance of the area.
6.04	A potential burial site has been identified within the study area. Permanent loss of site is a potential impact of the project.

7.0 SIGNIFICANCE OF POTENTIAL PROJECT IMPACTS ON MI'KMAQ LAND AND RESOURCE USE

The concept of significance in the Mi'kmaq Knowledge Study is distinct from the concept of significance under the *Canadian Environmental Assessment Act* or the *Nova Scotia Environmental Assessment Regulations*. Significance to Mi'kmaq is evaluated only in accordance with the criteria listed below. The MEKS evaluation of the significance of the potential project impacts on Mi'kmaq should be used by regulators to inform their determination of the significance of the environmental effects of the Project.

7.1 Significance Criteria

The following criteria are used to analyze the significance of the potential project impacts on Mi'kmaq use:

1) Uniqueness of land or resource
2) Culture or spiritual meaning of land or resource
3) Nature of Mi'kmaq use of land or resource
4) Mi'kmaq constitutionally protected rights in relation to land or resource

7.2 Evaluation of Significance

Table 4: Significance of Potential Project Impacts on Mi'kmaq Land and Resource Use

POTENTIAL IMPACT	EVALUATION OF SIGNIFICANCE
6.01 The historic review of Mi'kmaq use and occupation documents Mi'kmaq use and occupation in the study area, and potentially the project area. A potential impact of the project is the disturbance of archaeological resources.	7.2.01 Mi'kmaq archaeological resources are extremely important to Mi'kmaq as a method of determining Mi'kmaq use and occupation of Mi'kma'ki and as an enduring record of the Mi'kmaq nation and culture across the centuries. Archaeological resources are irreplaceable. Any disturbance of Mi'kmaq archaeological resources is significant.
6.02 Several species of significance to Mi'kmaq have been identified in the study area. Permanent loss of some species is a potential impact of the Project.	7.2.02 The plant species of significance to Mi'kmaq identified within the study area exist within the surrounding area. The destruction of some specimens within the study area does not pose a threat to Mi'kmaq use of the species. The impact of the permanent loss of some specimens of plants species of significance to Mi'kmaq is evaluated as not a threat.
6.03 A Specific Land Claim has been identified within the study area. Disturbance of this area is a potential impact of the Project.	7.2.03 Specific Land Claims are extremely important to Mi'kmaq of Nova Scotia. Any disturbance of these areas is evaluated as significant.

6.04 A potential burial site has been identified within the study area. Disturbance of this area is a potential impact of the project.	7.2.04 Burial sites are extremely important to Mi'kmaq of Nova Scotia. Any disturbance of these areas is evaluated as significant.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.01 In the event that Mi'kmaw archaeological deposits are encountered during construction or operation of the Project, all work should be halted and immediate contact should be made with David Christianson at the Nova Scotia Museum and with Dr. Donald M. Julien at The Confederacy of Mainland Mi'kmaq.

8.01 There is one land claim registered with the Specific Claims branch of Indian and Northern Affairs Canada in Ottawa for Mi'kmaq communities in Nova Scotia, within the project area. However, that does not suggest that any other Mi'kmaw claimants for this area may not submit land claims in the future. For more information, on the specific land claim, Please contact Mary Jane Stevens, the Confederacy of Mainland Mi'kmaq Specific Land Claims Research manager.

8.02 The information regarding the potential burial site marked in figure 2 is limited. Should this sensitive area need to be disturbed during project construction or operation, further research regarding this site is recommended.

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Figure 2 Hwy 103 Exit 5 to Exit 6 Current Mi'kmaq Land & Resource Use Study Area

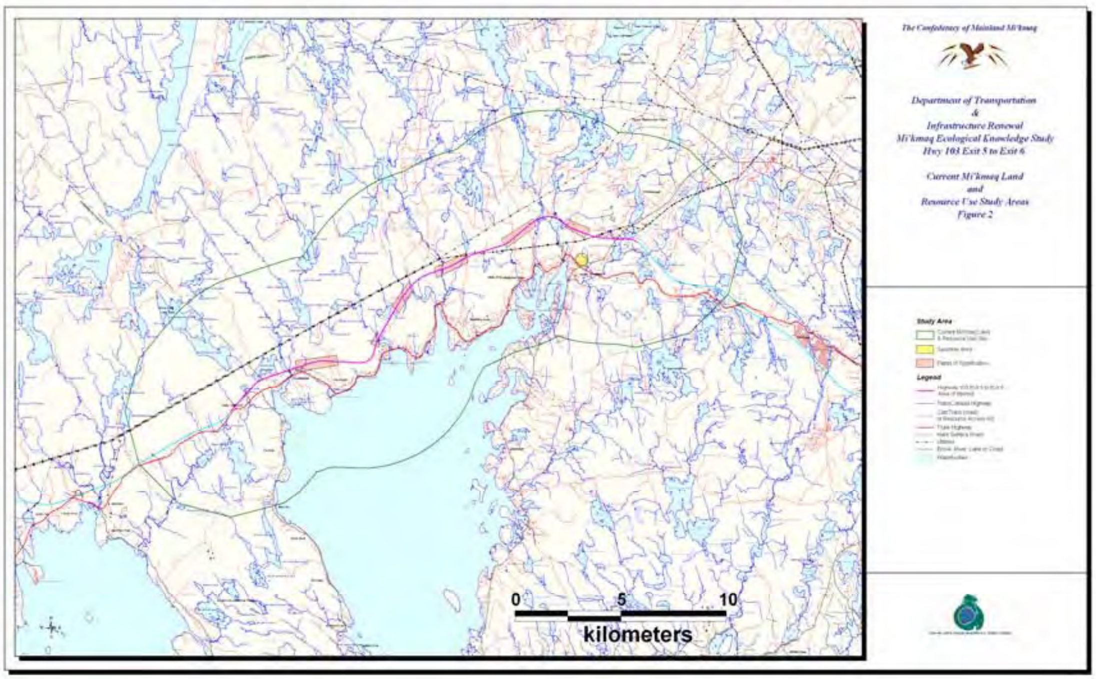
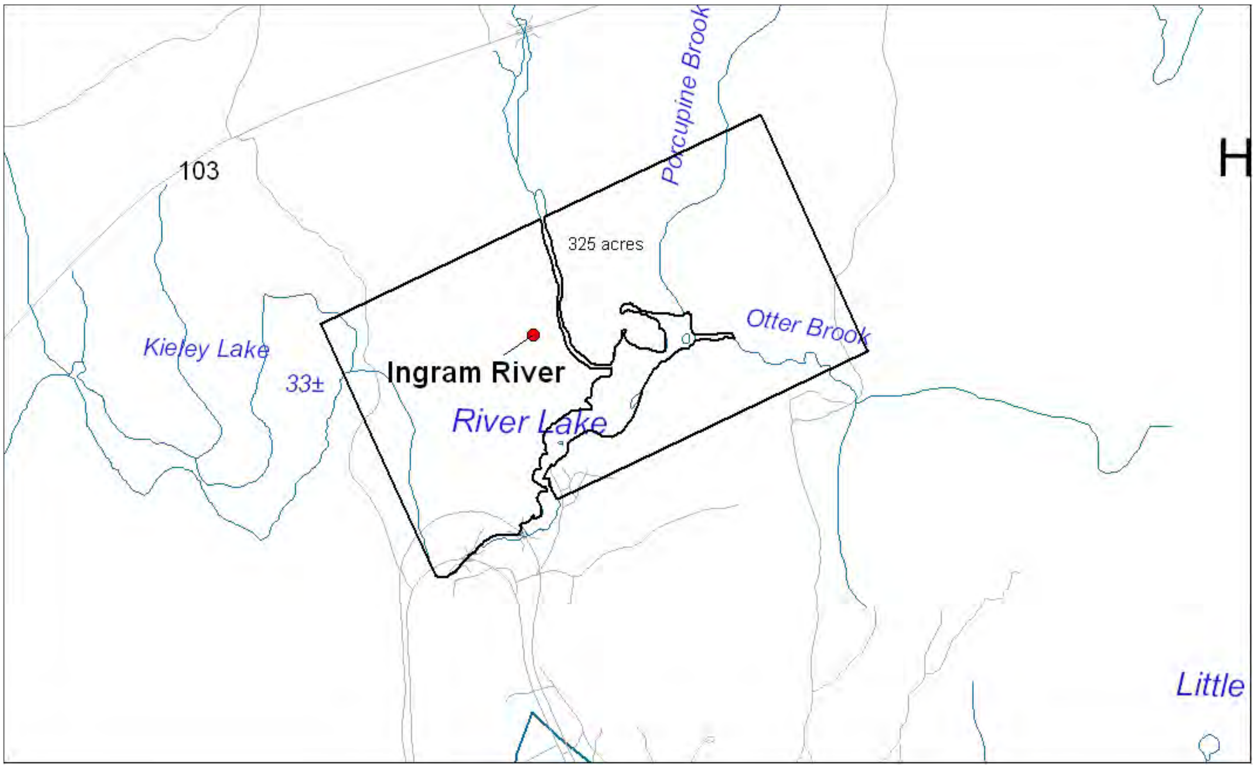


Figure 3 Map of Ingram River Specific Land Claim Area



APPENDIX E

BASELINE NOISE MONITORING RESULTS

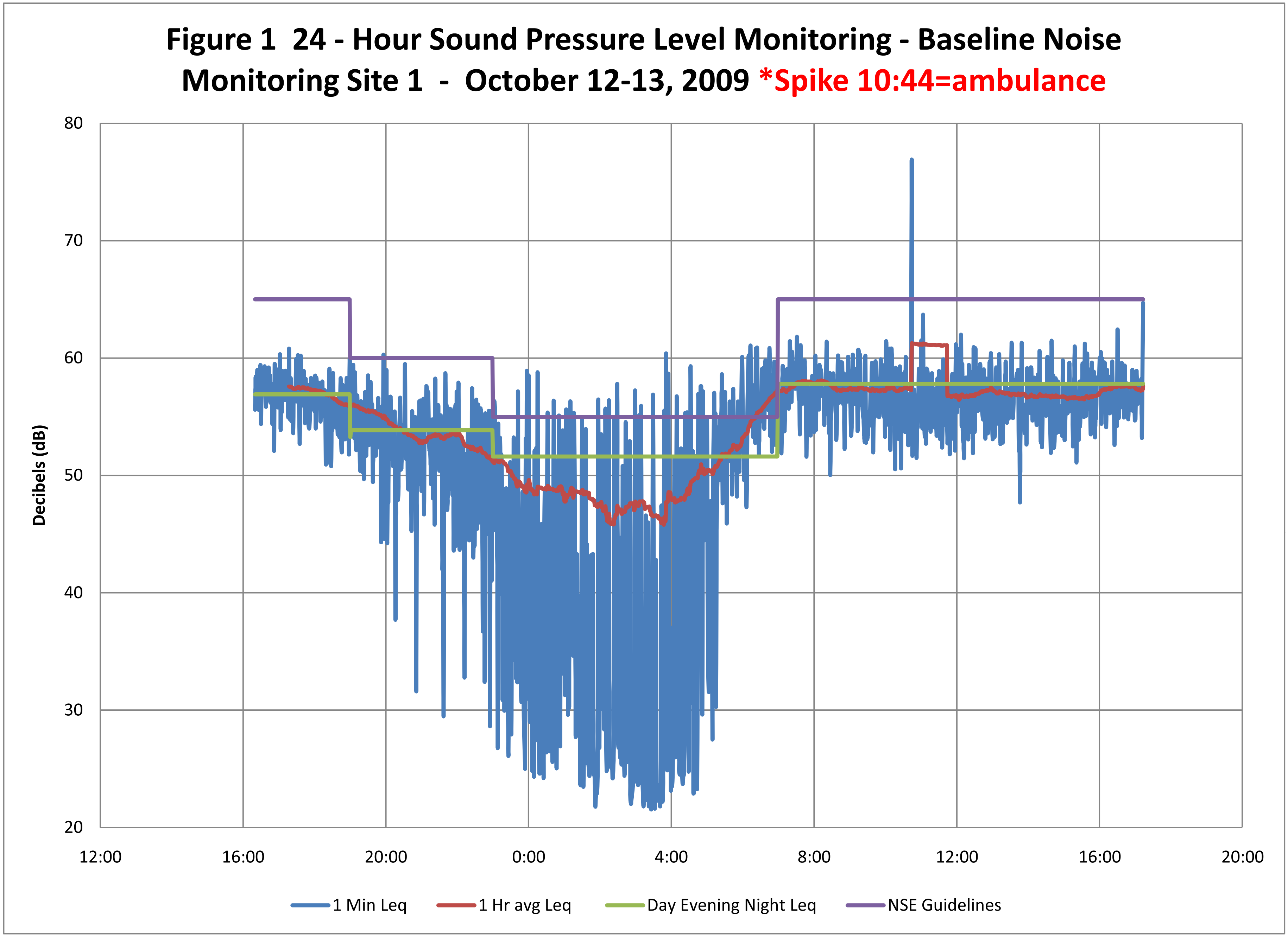


Figure 1 24 - Hour Sound Pressure Level Monitoring - Baseline Noise Monitoring Site 1 - October 12-13, 2009 *Spike 10:44=ambulance
Decibels (dB)
80
70
60
50
40
30
20
12:00
16:00
20:00
0:00
4:00
8:00
12:00
16:00
20:00
1 Min Leq
1 Hr avg Leq
Day Evening Night Leq
NSE Guidelines

Figure 2 24 - Hour Sound Pressure Level Monitoring - Baseline Noise Monitoring Site 2 - October 14-15, 2009

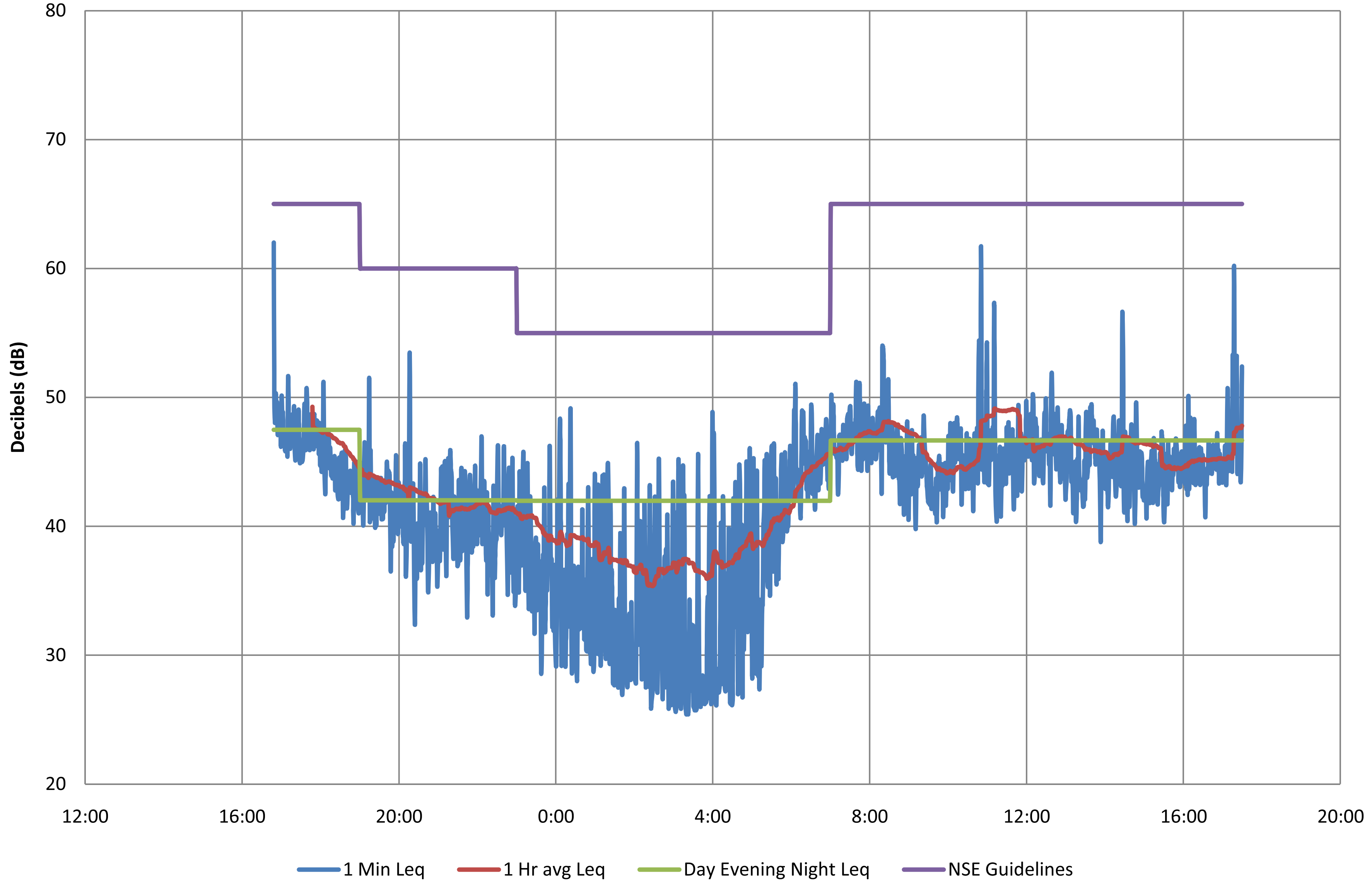
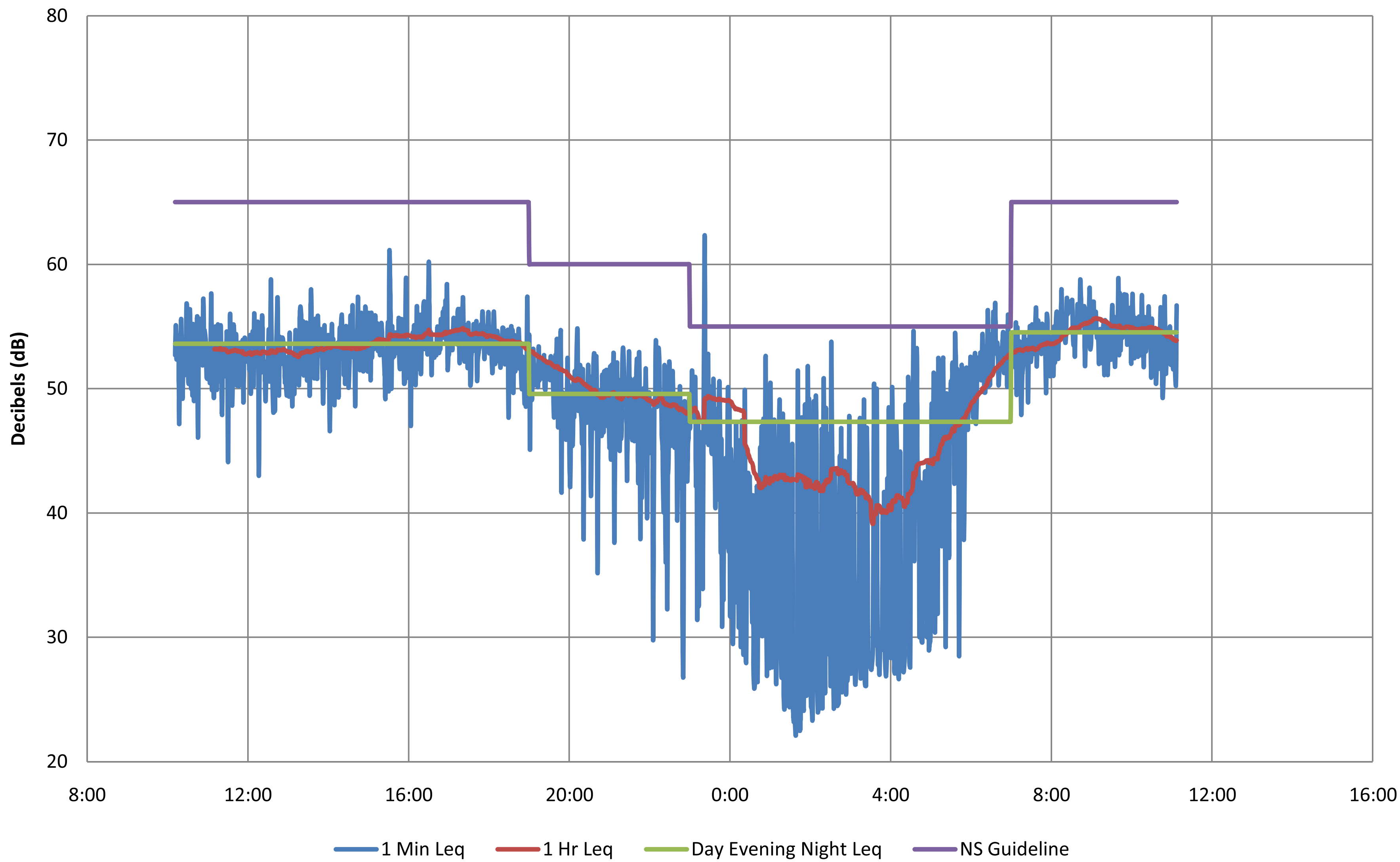


Figure 3 24 - Hour Sound Pressure Level Monitoring - Baseline Noise Monitoring Site 3 - October 20-21, 2009*Note spike at 23:22 is due to ambulance



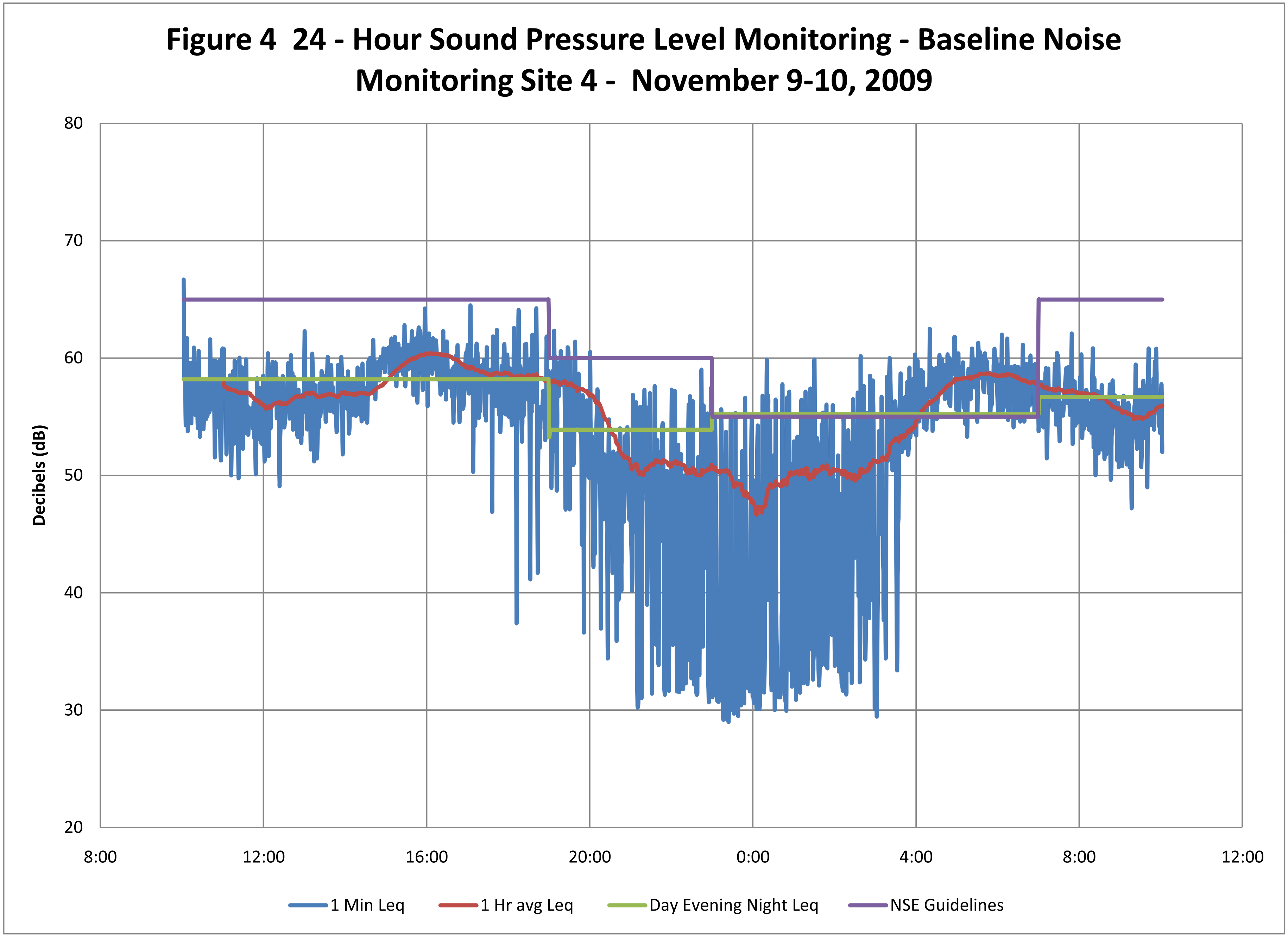


Figure 4 24 - Hour Sound Pressure Level Monitoring - Baseline Noise
Monitoring Site 4 - November 9-10, 2009
80
70
60
50
40
30
20
Decibels (dB)
8:00
12:00
16:00
20:00
0:00
4:00
8:00
12:00
1 Min Leq
1 Hr avg Leq
Day Evening Night Leq
NSE Guidelines

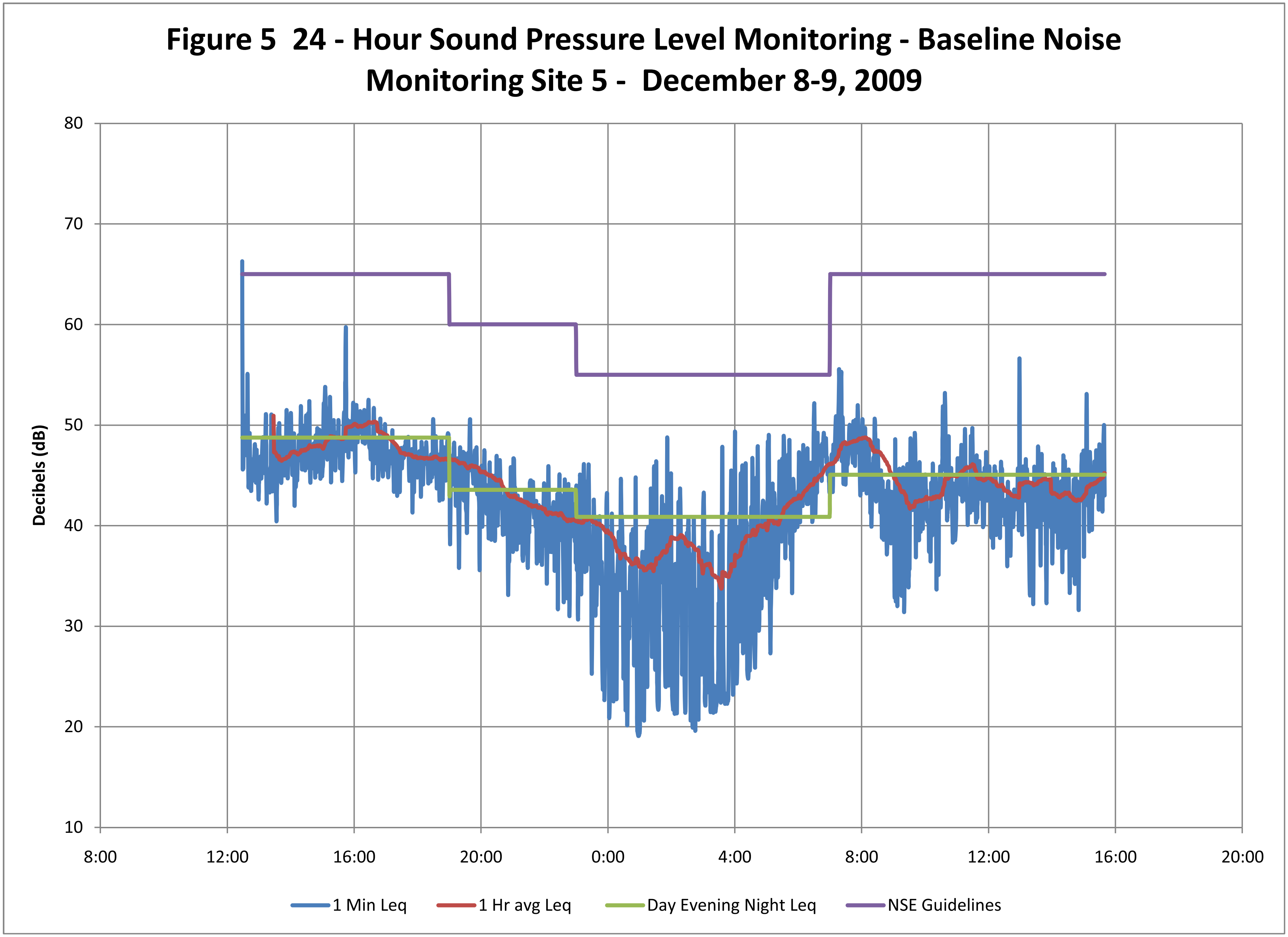
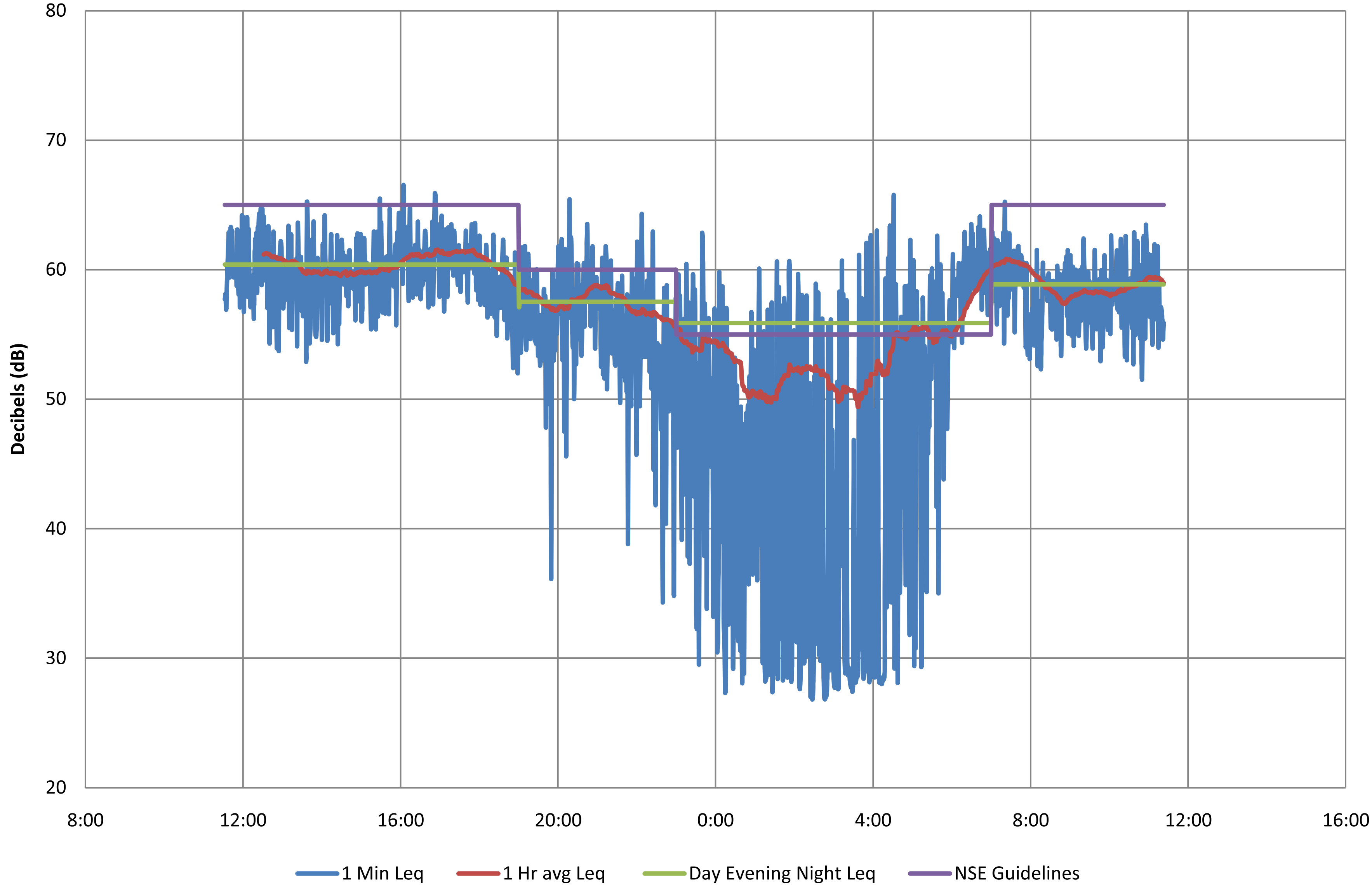


Figure 5 24 - Hour Sound Pressure Level Monitoring - Baseline Noise
Monitoring Site 5 - December 8-9, 2009
Decibels (dB)
80
70
60
50
40
30
20
10
8:00
12:00
16:00
20:00
0:00
4:00
8:00
12:00
16:00
20:00
1 Min Leq
1 Hr avg Leq
Day Evening Night Leq
NSE Guidelines

Figure 6 24 - Hour Sound Pressure Level Monitoring - Baseline Noise Monitoring Site 6 - October 21-22, 2009



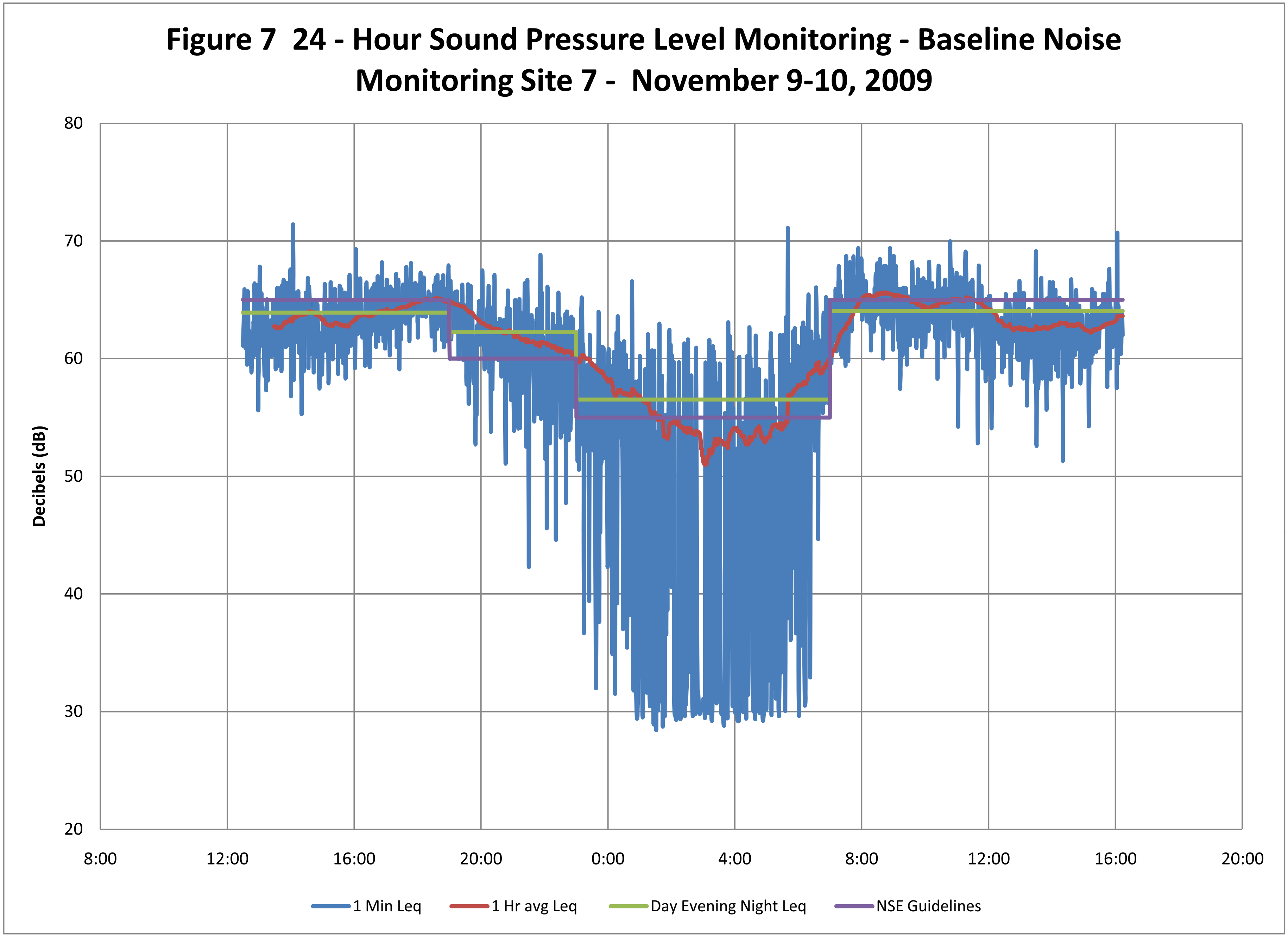


Figure 7 24 - Hour Sound Pressure Level Monitoring - Baseline Noise
Monitoring Site 7 - November 9-10, 2009
Decibels (dB)
80
70
60
50
40
30
20
8:00
12:00
16:00
20:00
0:00
4:00
8:00
12:00
16:00
20:00
1 Min Leq
1 Hr avg Leq
Day Evening Night Leq
NSE Guidelines

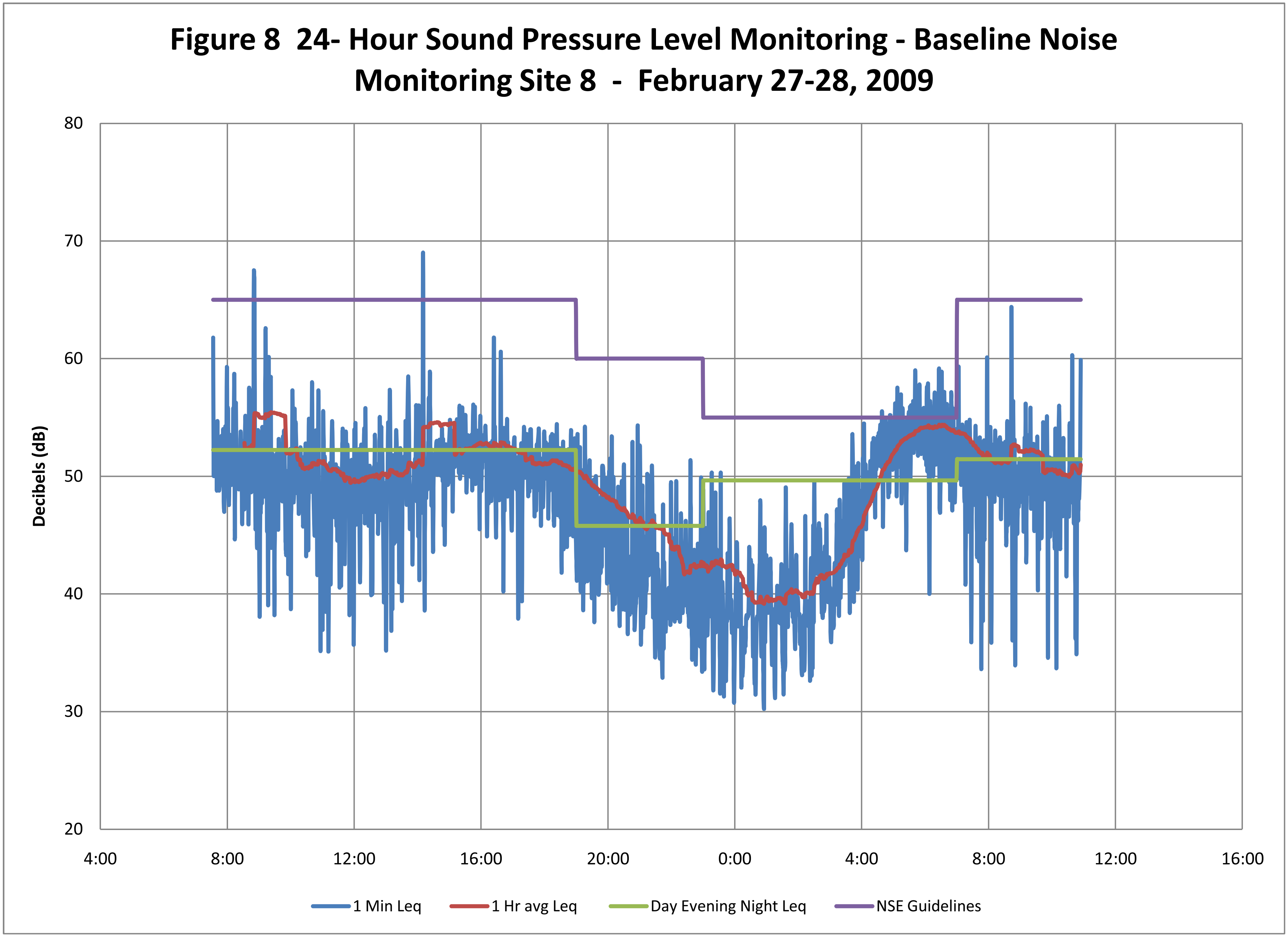
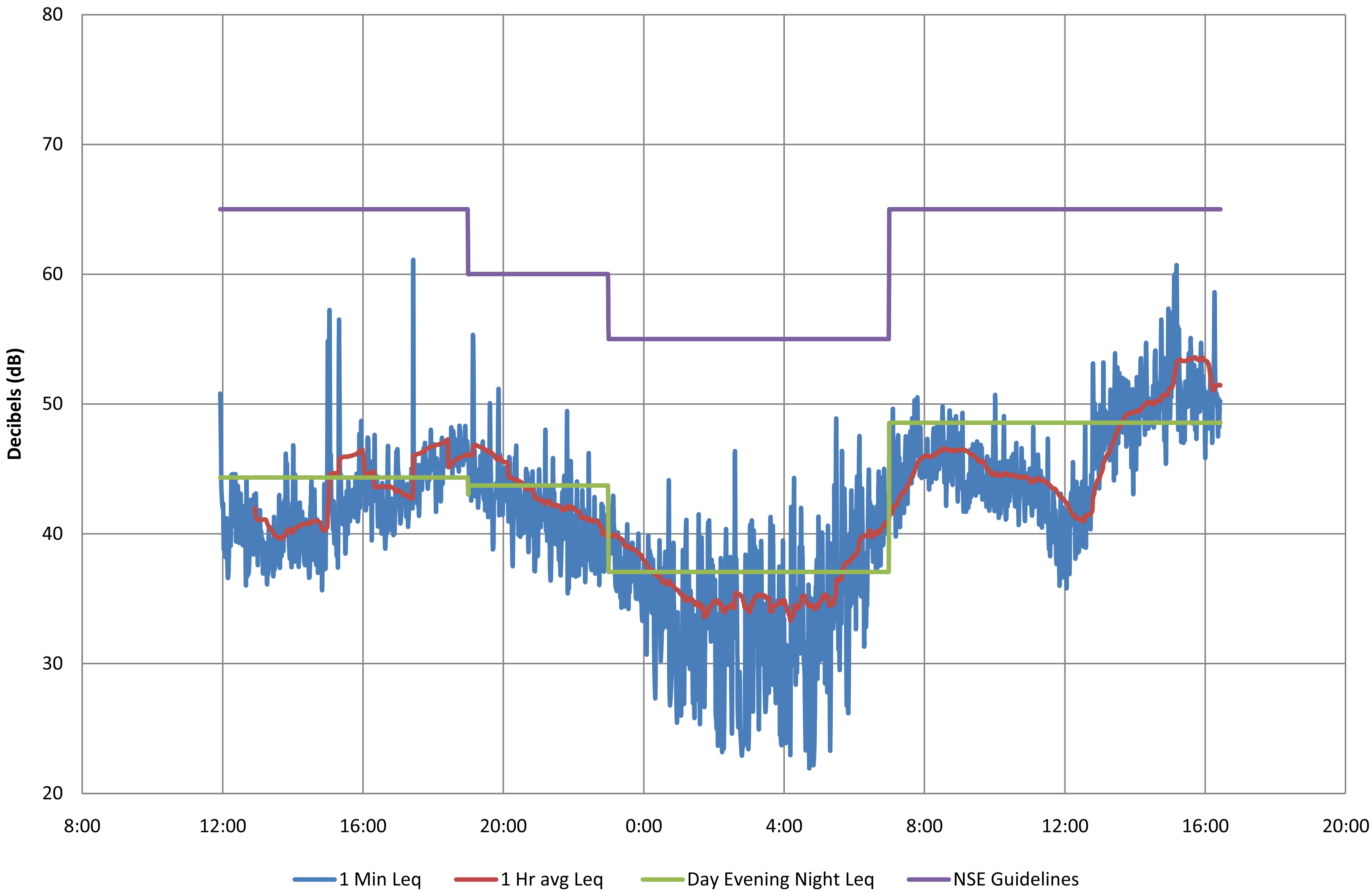


Figure 8 24- Hour Sound Pressure Level Monitoring - Baseline Noise
Monitoring Site 8 - February 27-28, 2009
Decibels (dB)
80
70
60
50
40
30
20
4:00
8:00
12:00
16:00
20:00
0:00
4:00
8:00
12:00
16:00
1 Min Leq
1 Hr avg Leq
Day Evening Night Leq
NSE Guidelines

Figure 9 24 - Hour Sound Pressure Level Monitoring - Baseline Noise Monitoring Site 9 - November 9-10, 2009



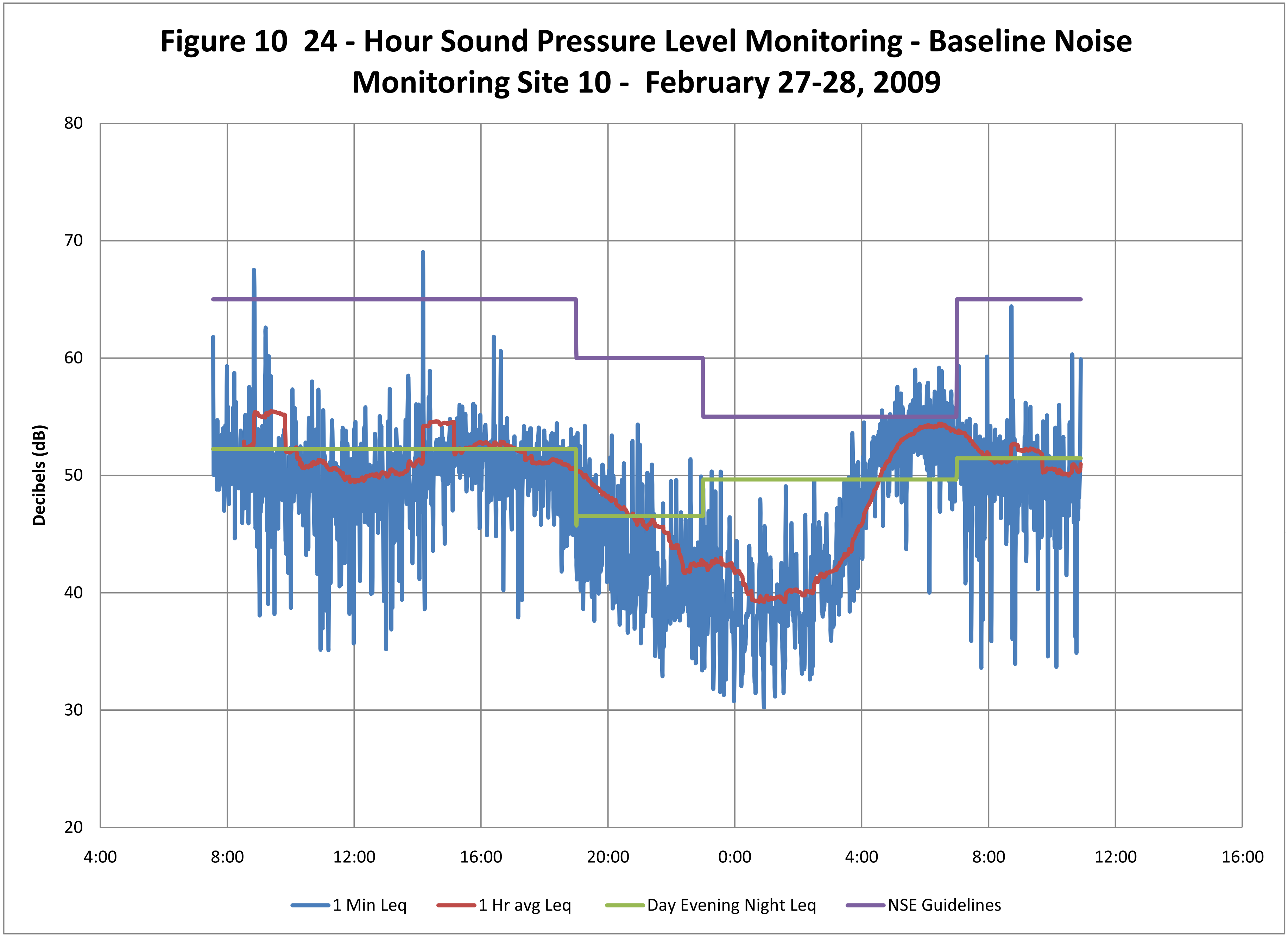


Figure 10 24 - Hour Sound Pressure Level Monitoring - Baseline Noise
Monitoring Site 10 - February 27-28, 2009
Decibels (dB)
80
70
60
50
40
30
20
4:00
8:00
12:00
16:00
20:00
0:00
4:00
8:00
12:00
16:00
1 Min Leq
1 Hr avg Leq
Day Evening Night Leq
NSE Guidelines

APPENDIX F

AQUATIC FIELD SURVEY RESULTS

Table 1 Fish Habitat Assessment Highway 103 Twinning Tantallon to Hubbards

Project	Watercourse			Watercourse Coordinates[1] (NAD 83)		Watercourse on 1:10000 SNB or DNR maps	Nature of Watercourse	Watercourse Crossing Structure	Fish Present Within RoW	Rationale for Fish Habitat Determination	Estimated Length of Watercourse in RoW (m)	Average Bank Channel Width (m)	Slope		Stability		Are There Known Fish Passage Obstructions in Assessment Area[2]?	Fish Passage Recommended?
	ID	Chainage	Name	Easting	Northing								Left (°)	Right (°)	Left	Right		
Highway 103 Twinning	WC-1	1+700	Unnamed stream	430777	4950310	No	Isolated, spring fed perennial stream	Not Applicable (N/Ap)	No	The watercourse has no connection to fish-bearing waters.	2	2	0	6			N/Ap	No
Highway 103 Twinning	WC-2	2+100	Unnamed stream	430406	4950409	No	Isolated perennial stream	Culvert	No	The watercourse has no connection to fish-bearing waters.	93	1	4	10			N/Ap	No
Highway 103 Twinning	WC-3	2+700	Unnamed trib. to Mill Lake	429759	4950655	No	Spring fed perennial tributary to a Mill Lake tributary	Culvert	No	A steep gradient exists within the watercourse that is prohibitive to fish passage.	65	1.5	Not Available (N/Av)	N/Av			Yes	No
Highway 103 Twinning	WC-4	2+600	Unnamed trib. to Mill Lake	429537	4950818	Yes	Perennial tributary to Mill Lake	Culvert	Yes	Fish Presence	297	2	4 (east reach) 10 (west reach)	14 (east reach) 28 (west reach)			No	Yes
Highway 103 Twinning	WC-5	3+300	Mill Lake Backwater Pond	429338	4950971	Yes	Shallow, flooded wetland	N/Ap	No	No surface water connection to Mill Lake; pond substrate not suitable fish habitat.	N/Ap	-	0	0			No	No
Highway 103 Twinning	WC-6	3+500	Mill Lake	429051	4951135	Yes	Mill Lake	Causeway	Yes	Fish Presence	N/Ap	-	24	24			No	Yes
Highway 103 Twinning	WC-7	4+200	Little Indian Lake	428396	4951154	Yes	Little Indian Lake	Causeway	Yes	Lake connects directly to Little Indian River where fish presence was confirmed.	N/Ap	-	-2	2			No	Yes
Highway 103 Twinning	WC-8	4+600	Little Indian River	428157	4950975	Yes	Little Indian River	N/Ap	Yes	Fish Presence	Not in ROW	3	0	2			No	Yes
Highway 103 Twinning	WC-9	5+400	Unnamed stream	427598	4950666	No	Spring fed perennial stream	Culvert	No	The watercourse has no connection to fish-bearing waters.	552	0.75	-2	4			N/Ap	No
Highway 103 Twinning	WC-10	7+000	Unnamed stream	426471	4949854	No	Perennial stream	Culvert	No	No fish were observed during the presence / absence electrofishing survey.	433	0.8	2	Highway			No	No
Highway 103 Twinning	WC-11	8+400	Porcupine Brook	424729	4949303	Yes	Perennial stream drining from Porcupine Lake to Saint Margaret's Bay	Culvert	Yes	Fish presence	237	4	8	4			No	Yes

Table 1 Fish Habitat Assessment Highway 103 Twinning Tantallon to Hubbards

Project	Watercourse			Watercourse Coordinates[1] (NAD 83)		Watercourse on 1:10000 SNB or DNR maps	Nature of Watercourse	Watercourse Crossing Structure	Fish Present Within RoW	Rationale for Fish Habitat Determination	Estimated Length of Watercourse in RoW (m)	Average Bank Channel Width (m)	Slope		Stability		Are There Known Fish Passage Obstructions in Assessment Area[2]?	Fish Passage Recommended?
	ID	Chainage	Name	Easting	Northing								Left (°)	Right (°)	Left	Right		
Highway 103 Twinning	WC-12	8+900	Unnamed stream	424190	4949010	No	Intermittent drainage stream between two wetlands	N/Ap	No	Intermittent drainage stream with no connection to fish-bearing waters.	271	0.85	2	2			N/Ap	No
Highway 103 Twinning	WC-13	9+200	Unnamed stream	424109	4948967	No	Perennial stream connecting wetlands	N/Ap	No	Watercourse connects two wetlands and has no connection to fish-bearing waters.	44	0.2	-4	0			N/Ap	No
Highway 103 Twinning	WC-14	9+600	Unnamed trib. to Ingram River	423677	4948797	No	Perennial tributary to Ingram River	N/Ap	No	No fish were observed during the presence / absence electrofishing survey.	115	1.35	14	0			No	No
Highway 103 Twinning	WC-15	9+700	Ingram River	423637	4948809	Yes	Ingram River	Single-span Bridge	Yes	Fish Presence	10	10	4	4			No	Yes
Highway 103 Twinning	WC-16	10+200	Unnamed trib. to Ingram River	423331	4948687	No	Perennial tributary to Ingram River	N/Ap	Yes	Fish Presence	555	0.5	12	0			No	Yes
Highway 103 Twinning	WC-17	10+000	Unnamed stream	423499	4948697	No	Spring fed perennial stream	N/Ap	No	Spring fed stream that has no connection to any fish-bearing waters.	216	0.5	0	-4			N/Ap	No
Highway 103 Twinning	WC-18	10+800	Unnamed trib. to Kieley Lake	422542	4948330	Yes	Wetland fed perennial tributary to Kieley Lake	Culvert	No	No fish were observed during the presence / absence electrofishing survey.	275	1.75	0	8			No	No
Highway 103 Twinning	WC-19	11+300	Unnamed trib. to Kieley Lake	422255	4948045	Yes	Ephemeral drainage fed tributary to Kieley Lake	N/Ap	No	Steep gradient change	21	0.7	4	12			Yes	No
Highway 103 Twinning	WC-20	11+400	Unnamed trib. to Kieley Lake	422114	4947957	Yes	Wetland fed perennial tributary to Kieley Lake	Culvert	No	No fish were observed during the presence / absence electrofishing survey.	121	1.2	0	2			No	No
Highway 103 Twinning	WC-20A	11+600	Unnamed trib. to Kieley Lake	422089	4947921	No	Ephemeral drainage fed tributary to Kieley Lake	N/Ap	No	Ephemeral drainage ditch	133	0.5	N/Av	N/Av			No	No
Highway 103 Twinning	WC-21	11+900	Mud Lake Brook	421793	4947571	Yes	Mud Lake Brook	Culvert	Yes	Fish Presence	130	3	4	4			No	Yes
Highway 103 Twinning	WC-22	14+100	Unnamed trib. to The Puddle	420683	4945660	No	Wetland fed perennial tributary to The Puddle	N/Av	No	Wetland fed roadside drainage channel, braided and subterranean at confluence with WC-23.	239	0.5	3	0			Yes	No

Table 1 Fish Habitat Assessment Highway 103 Twinning Tantallon to Hubbards

Project	Watercourse			Watercourse Coordinates[1] (NAD 83)		Watercourse on 1:10000 SNB or DNR maps	Nature of Watercourse	Watercourse Crossing Structure	Fish Present Within RoW	Rationale for Fish Habitat Determination	Estimated Length of Watercourse in RoW (m)	Average Bank Channel Width (m)	Slope		Stability		Are There Known Fish Passage Obstructions in Assessment Area[2]?	Fish Passage Recommended?
	ID	Chainage	Name	Easting	Northing								Left (°)	Right (°)	Left	Right		
Highway 103 Twinning	WC-23	14+000	Unnamed trib. to The Puddle	420627	4945641	No	Wetland fed perennial tributary to The Puddle (estuarine influence)	Culvert	Yes	Fish Presence	320	0.87	8	2			No	Yes
Highway 103 Twinning	WC-24	14+400	Stillwater Brook	420560	4945501	Yes	Stillwater Brook	Bridge	Yes	Fish Presence	72	4	2	10			No	Yes
Highway 103 Twinning	WC-25	15+200	Unnamed trib. to Stillwater Brook	420495	4945353	No	Wetland fed perennial tributary to Stillwater Brook	N/Ap	No	A steep cascade section is present at the downstream end of the stream preventing fish passage into the watercourse.	912	0.75	8	0			Yes	No
Highway 103 Twinning	WC-26	17+000	Unnamed Stream	418498	4944504	Yes	Wetland fed perennial stream	Culvert	Yes	Fish Presence	60	1	6	2			No	Yes
Highway 103 Twinning	WC-27	18+400	Unnamed Watercourse	417145	4944392	Yes	Perennial stream in wetland	N/Ap	Yes	Fish Presence	15	~1	N/Av	N/Av	N/Av	N/Av	No	Yes
Highway 103 Twinning	WC-28	19+200	Unnamed trib to Hubbards River	416366	4944123	Yes	Perennial tributary to Hubbards River	N/Ap	No	The steep slope and high velocity of the stream serve as barriers to fish passage.	35	3	9	20			Yes	No
Highway 103 Twinning	WC-29	19+300	Hubbards River	416360	4944119	Yes	Hubbards River	Culvert	Yes	Fish Presence	104	15	14	14			No	Yes
Highway 103 Twinning	WC-30	19+100	Unnamed trib to Hubbards River	416400	4944126	No	Wetland fed perennial tributary to Hubbards River	N/Ap	No	Steep gradient at confluence with Hubbards River	157	0.6	0	2			Yes	No
Highway 103 Twinning	WC-31	19+400	Dorey Lake	416242	4944077	Yes	Dorey Lake	N/Ap	Yes	Fish Presence	N/Ap	-	2	10			No	Yes
Highway 103 Twinning	WC-32	20+000, 20+800	Sawler Lake	414883	4943630	Yes	Sawler Lake	N/Ap	Yes	Fish Presence	N/Ap	-	10	10			No	Yes
Highway 103 Twinning	WC-33	20+100	Unnamed Watercourse (Associated with Sawler Lake)	415554	4943860	No	Spring fed perennial stream	Culvert	No	Spring-fed stream that has no connection to any fish-bearing waters.	70	1	6	0			No	No
Highway 103 Twinning	WC-34	21+600	Maple Lake	414254	4943098	Yes	Maple Lake	N/Ap	Yes	Fish Presence	N/Ap	-	12	12			No	Yes

Table 1 Fish Habitat Assessment Highway 103 Twinning Tantallon to Hubbards

Project	Watercourse			Watercourse Coordinates[1] (NAD 83)		Watercourse on 1:10000 SNB or DNR maps	Nature of Watercourse	Watercourse Crossing Structure	Fish Present Within RoW	Rationale for Fish Habitat Determination	Estimated Length of Watercourse in RoW (m)	Average Bank Channel Width (m)	Slope		Stability		Are There Known Fish Passage Obstructions in Assessment Area[2]?	Fish Passage Recommended?
	ID	Chainage	Name	Easting	Northing								Left (°)	Right (°)	Left	Right		
Highway 103 Twinning	WC-35	22+500	Unnamed trib. to Hubbards Cove	413723	4942390	Yes	Perennial tributary to Hubbards Cove	Culvert	Yes	Fish Presence	96	1.5	2	2			No	Yes
Highway 103 Twinning	WC-36	22+200	Unnamed trib. to Hubbards Cove	413786	4942465	No	Ephemeral tributary to Hubbards Cove	N/Ap	Yes	Fish Presence (stranded by low flow)	374	1.1	0	10			Yes	Yes
Highway 103 Twinning	WC-37	22+800	Unnamed trib. to Hubbards Cove	413683	4942352	No	Ephemeral tributary to Hubbards Cove	N/Ap	No	Ephemeral drainage ditch	341	1	10	0			Yes	No
Highway 103 Twinning	WC-38	13+200	Puddle Lake	421128	4946504	Yes	Puddle Lake	N/Ap	Yes	Fish Presence	N/Ap	-	0	0			No	Yes
Highway 103 Twinning	WC-39	12+900	Lily Lake	421154	4946506	Yes	Lily Lake	Culvert (at outlet)	Yes	Fish Presence	282	-	0	0			No	Yes
Highway 103 Twinning	WC-40	14+400	The Puddle	420598	4945487	Yes	The Puddle Estuarine	N/Ap	Yes	Fish Presence	N/Ap	-	0	10			No	Yes
Highway 103 Twinning	WC-41	22+900	Unnamed stream	413407	4942033	Yes	Perennial stream	Culvert	Yes	Fish Presence	199	1.2	4	2			No	Yes
Highway 103 Twinning	WC-42	23+400	Unnamed stream	413078	4941719	Yes	Perennial stream	Culvert	No	Large boulder field (subterranean flow) and gradient change prohibitive to fish passage	107	1	2	10			Yes	No
Highway 103 Twinning	WC-43	Access Road	Unnamed stream	417361	4944059	Yes	Perennial stream	Culvert	Yes	Fish Presence	55	1	5	5			No	Yes

[1] Coordinates taken within 10 m north of existing crossing of Highway 103 or at most easterly point of watercourse within the RoW when existing Highway is not crossed.

[2] 100 m upstream and 250 m downstream of existing Highway 103 roadbed.

Stable and vegetated
Bare Stable
Eroding

Table 2 Fish Summary Table - 2009 and 2010 Fish Surveys

Site Description	Date (DMY)	Area Fished	Gear Type	Frequency (Hz)	Volts (V)	Duty Cycle (%)	Fishing Effort (sec)	Water Temp (ºC)	Specific Conductivity (µS/cm)	Fish Results: Scientific Name	Fish Results: Common Name	Number Caught	Size Range (cm)
WC-4 (Unnamed stream)	22/09/09	80 m US of existing Hwy	LR-24 [1]	30	550	12	740	10.68	135	*Salvelinus fontinalis*	Brook trout	4	6.4 - 16.3
WC-5 (Mill Lake Backwater Pond)	8/7/10	Littoral zone	Minnow Traps (x2)[2]	-	-	-	overnight			None	-	0	-
WC-6 (Mill Lake)	29/09/09	Littoral zone	LR-24	30 - 85	590	12	688	16.18	47	*Pungitius pungitius*	Ninespine stickleback	3	5.2 - 5.7
										Fundulus diaphanus	Banded killifish	4	2.8 - 9.9
			Minnow Traps (x2)	-	-	-	overnight	16.18	47	*Pungitius pungitius*	Ninespine stickleback	3	6.0 - 6.2
										Perca flavescens	Yellow perch	8	6.4 - 9.5
WC-8 (Indian River)	29/09/09	DS of existing Hwy	LR-24	N/A	N/A	N/A	N/A	13.16	168	*Salvelinus fontinalis*	Brook trout	7	7.9 - 17.6
										Pungitius pungitius	Ninespine stickleback	5	4.4-4.7
										Anguilla rostrata	American eel	5	20 - 32
WC-10 (Unnamed stream)	2/10/09	15 m US of existing Hwy to where stream too narrow to fish 80 m DS of existing Hwy where accessible	LR-24	80	500	12	179	12.18	52	None	-	0	-
WC-11 (Porcupine Brook)	22/09/09	100 m US of existing Hwy	LR-24	30	780	15	2083	15.53	41	*Salvelinus fontinalis*	Brook trout	4	4.8 - 19.8
										Anguilla rostrata	American eel	9	10 - 30
										-	Salmonid [3]	4	N/A
WC-14 (Unnamed Tributary to Ingram River)	6/10/09	~100 m US where accessible	LR-24	80	350	12	164	11.15	264	None	-	0	-
WC-15 (Ingram River)	22/09/09	75 m US of existing Hwy 50 m DS of existing Hwy	LR-24	30	955	15	2508	16.71	31	*Salvelinus fontinalis*	Brook trout	1	18
										Catostomus commersoni	White sucker	9	5.2 - 15.6
										Anguilla rostrata	American eel	84	10 - 55
										Rhinichthys atratulus	Blacknose dace	1	4.3
										Salmo salar	Atlantic salmon	1	7.1
										Fundulus diaphanus	Banded killifish	1	7.4
WC-16 (Unnamed stream)	2/10/09	30 m N of existing Hwy	LR-24	70	300	12	52	10.53	618	*Salvelinus fontinalis*	Brook trout	4	6.6 - 10.9
WC-18 (unnamed tributary to Keiley Lake)	1/10/09	50 m US of existing Hwy (until dried up) 70 m DS of existing Hwy	LR-24	30	600	12	554	12.04	46	None	-	0	-
WC-20 (unnamed tributary to Keiley Lake)	29/09/09	50 m US of existing Hwy 75 m DS of existing Hwy	LR-24	50	690	12	515	12.00	52	None	-	0	-

Table 2 Fish Summary Table - 2009 and 2010 Fish Surveys

Site Description	Date (DMY)	Area Fished	Gear Type	Frequency (Hz)	Volts (V)	Duty Cycle (%)	Fishing Effort (sec)	Water Temp (°C)	Specific Conductivity (µS/cm)	Fish Results: Scientific Name	Fish Results: Common Name	Number Caught	Size Range (cm)
WC-21 (Mud Lake Brook)	25/09/09	100 m US of existing Hwy 60 m DS of existing Hwy	LR-24	30	675	12	853	11.91	50	*Anguilla rostrata*	American eel	2	10 - 15
WC-23 (Estuarine)	30/09/09	DS of existing Hwy, at inlet of The Puddle (~25m)	LR-24	90	110	12	138	12.47	688	-	Unidentified (tidal influence; fish would not stun)	2	N/A
WC-23 (Freshwater)	8/7/2010	80 DS of existing Hwy	LR-24	75	165	12	886	12.70	1232	None	-	0	-
WC-24 (Stillwater Brook)	25/09/09	100 m US of existing Hwy An additional pool/run area 150m US of Hwy	LR-24	30	600	12	954	14.14	51	*Salvelinus fontinalis*	Brook trout	4	6.4 - 13.7
										Fundulus diaphanus	Banded killifish	4	3.0 - 7.8
										Anguilla rostrata	American eel	79	7.5 - 35
										Apeltes quadracus	Fourspine stickleback	14	3.5 - 4.5
										Gasterosteus aculeatus	Threespine stickleback	6	3.1 - 4.2
										Gasterosteidae	Stickleback spp.	7	N/A
WC-26 (Unnamed stream)	30/09/09	80 m US of existing Hwy 100 m DS of existing Hwy	LR-24	50	470	12	711	12.17	130	*Anguilla rostrata*	American eel	1	10
WC-27 (Unnamed stream)	30/09/09	US 60 m Littoral zone	LR-24	50	640	12	410	10.69	55	*Anguilla rostrata*	American eel	1	12
			Minnow Traps (x2)	-	-	-	overnight	10.69	55	None	-	0	-
WC-29 (Hubbards River)	25/09/09	50 m US of existing Hwy 50 m DS of existing Hwy	LR-24	30	840	12	764	16.94	31	*Anguilla rostrata*	American eel	60	10 - 51
										Catostomus commersoni	White sucker	3	12.9 - 14
										Salvelinus fontinalis	Brook trout	1	14
WC-31 (Dorey Lake)	25/09/09	Littoral zone	LR-24	60	760	12	613	7.69	36	*Anguilla rostrata*	American eel	15	10 - 25
			Minnow Traps (x4)	-	-	-	overnight	7.69	36	*Perca flavescens*	Yellow perch	1	N/A
										Notropis cornutus	Common shiner	1	N/A
WC-32 (Sawler Lake)	28/09/09	Littoral zone	LR-24	30 - 90	450 - 600	12	891	16.02	37	*Anguilla rostrata*	American eel	6	8 - 15
										Perca flavescens	Yellow perch	2	3.7 - 4.3
										Fundulus diaphanus	Banded killifish	23	3.0 - 9.0
										Catostomus commersoni	White sucker	3	4.4 - 5.5
			Minnow Traps (x2)	-	-	-	overnight	16.02	37	*Perca flavescens*	Yellow perch	1	8.0
WC-34 (Maple Lake)	5/10/09	Littoral zone	Minnow Traps (x4)	-	-	-	overnight	8.53	54	*Notemigonus crysoleucas*	Golden shiner	3	5.4 - 7.3

Table 2 Fish Summary Table - 2009 and 2010 Fish Surveys

Site Description	Date (DMY)	Area Fished	Gear Type	Frequency (Hz)	Volts (V)	Duty Cycle (%)	Fishing Effort (sec)	Water Temp (°C)	Specific Conductivity (µS/cm)	Fish Results		Number Caught	Size Range (cm)
										Scientific Name	Common Name		
WC-35 (Unnamed stream)	1/10/09	75 m US of existing Hwy (main channel) 30 m of US feeder channel	LR-24	70	600	12	509	12.71	43	*Salvelinus fontinalis*	Brook trout	2	10 - 17.9
										Anguilla rostrata	American eel	1	30
WC-36	8/7/10	25 m upstream of confluence with WC-35	LR-24	75	600	12	486	14.08	48	*Salvelinus fontinalis*	Brook trout	11	4.4 - 21.2
WC-38 (Puddle Lake)	28/09/09	Littoral zone	LR-24	30	450	12	716	15.38	190	*Anguilla rostrata*	American eel	6	12 - 31
										Perca flavescens	Yellow perch	2	5.2 - 10.6
			Minnow Traps (x3)	-	-	-	overnight	15.38	190	*Perca flavescens*	Yellow perch	2	5.2 - 6.1
WC-40 (The Puddle)	29/09/09	Littoral zone	Minnow Traps (x4)	-	-	-	overnight	16.08	2761	*Fundulus heteroclitus*	Mummichog	25	3.5 - 9.0
										Apeltes quadracus	Fourspine stickleback	2	3.2 - 3.5
										Gasterosteus aculeatus	Threespine stickleback	1	4.0
WC-39 (Lily Lake and Outlet)	25/09/09	40 m DS of existing Hwy (outlet channel) Littoral Zone	LR-24	30	270	12	659	13.80	235	*Fundulus diaphanus*	Banded killifish	2	5.2
										Anguilla rostrata	American eel	7	15 - 25
			Minnow Trap (x3)	-	-	-	overnight	13.80	235	*Fundulus diaphanus*	Banded killifish	15	3.5 - 6.5
WC-41 (Unnamed Stream)	7/7/10	10 m US of existing Hwy 30 m DS of existing Hwy (Fenced Property)	LR-24	70	600	12	245	14.14	70	*Salvelinus fontinalis*	Brook trout	18	3.0 - 6.6
WC-42 (Unnamed Stream)	7/7/10	30 m US of existing Hwy (All) 50 m DS of existing Hwy	LR-24	75	600	12	387	12.65	28	None	-	0	-
WC-43 (Unnamed Stream)	27/08/10	85 m DS of existing road	LR-24	75	425	15	397	16.13	317	*Salvelinus fontinalis*	Brook trout	5	6.7 - 7.3

[1] Smith Root Backpack Electrofishing Unit, Model LR-24

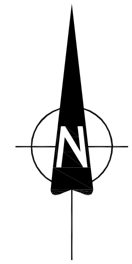
[2] Two additional minnow traps were set but were pulled onshore and opened by raccoons over the course of the night.

[3] Fish stunned but not caught; identified to family level only

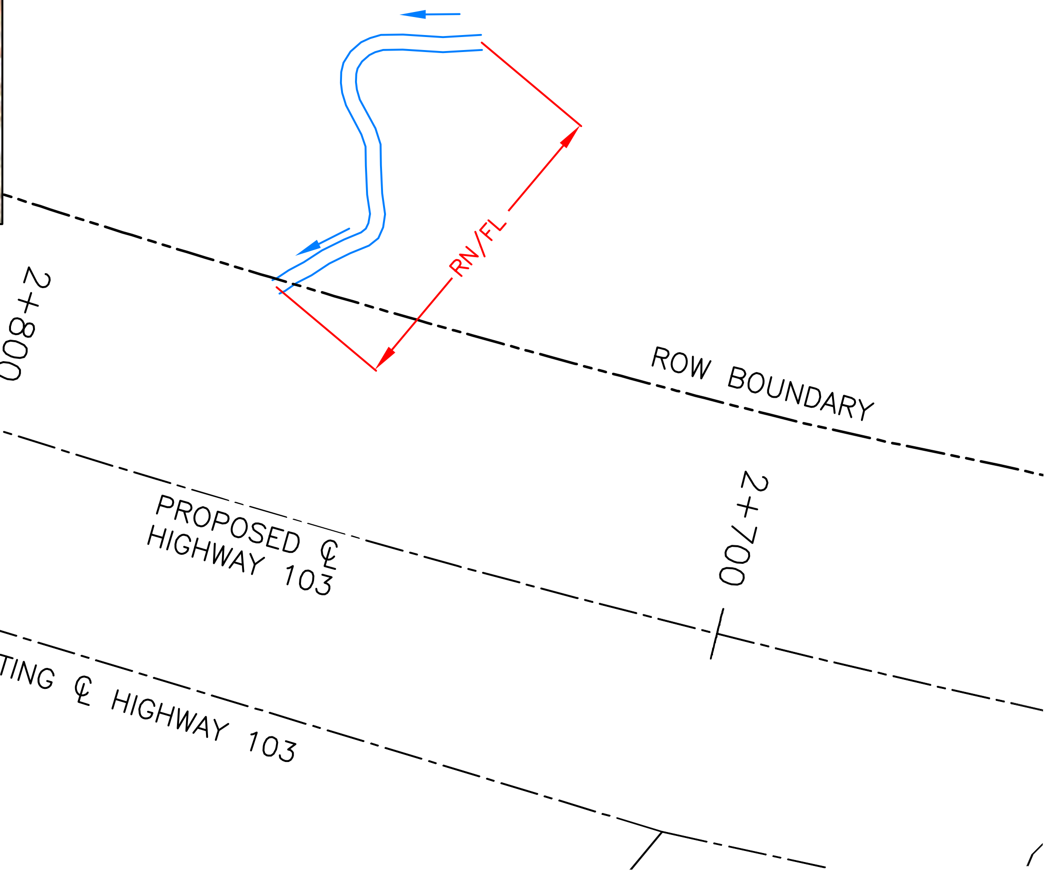
RIGHT OF WAY –
FACING DOWNSTREAM

RIGHT OF WAY –
FACING UPSTREAM

RIGHT OF WAY –
LEFT BANK AND
SUBSTRATE



RIGHT OF WAY –
RIGHT BANK



RIGHT OF WAY –
SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 1

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:1000
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	1

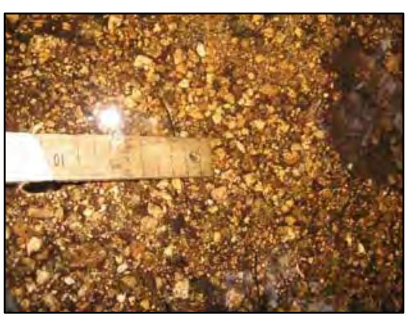
Stantec

RIGHT OF WAY – FACING DOWNSTREAM

RIGHT OF WAY – FACING UPSTREAM

RIGHT OF WAY – LEFT BANK

RIGHT OF WAY – RIGHT BANK



DOWN STREAM– SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
SUB	SUBTERRANEAN
→	FLOW DIRECTION

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

WATERCOURSE 2

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

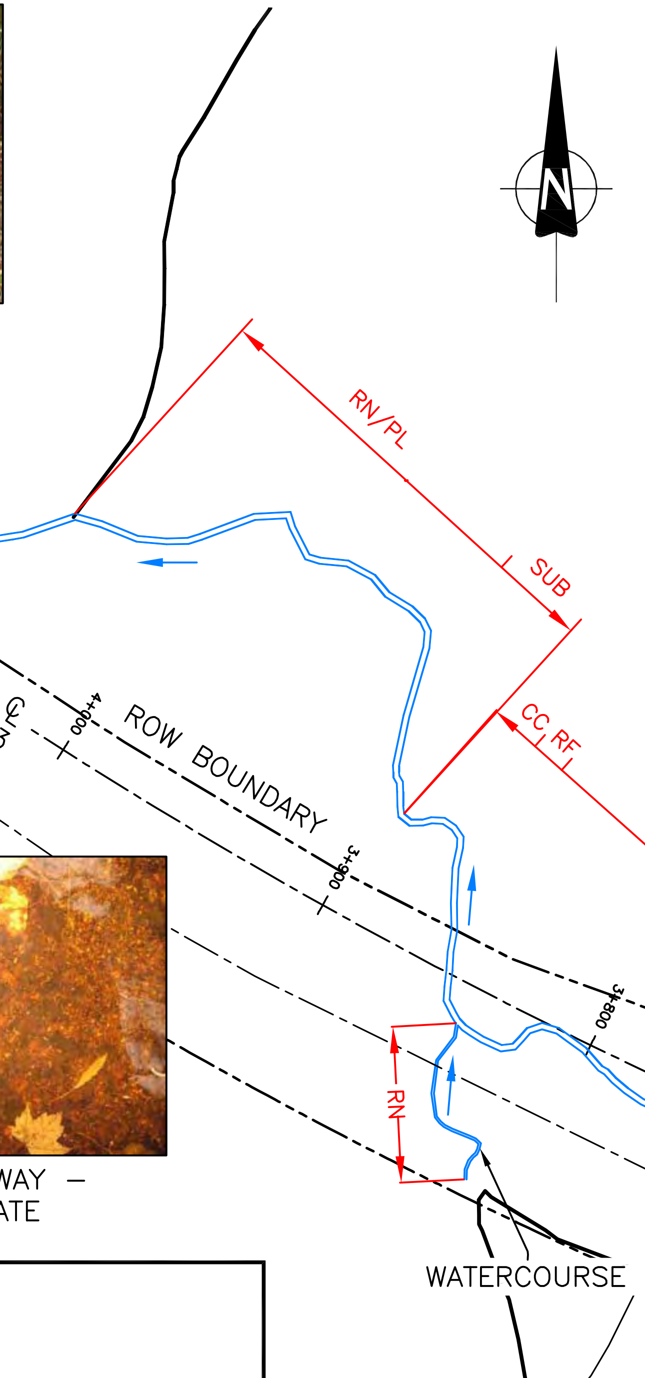
Client:	NSTIR
Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	2

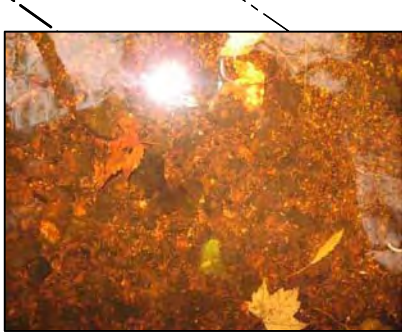
Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-1to2.dwg PRINTED: Aug 25, 2010

RIGHT OF WAY – FACING UPSTREAM

RIGHT OF WAY – FACING DOWNSTREAM





RIGHT OF WAY – SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
SUB	SUBTERRANEAN
→	FLOW DIRECTION

RIGHT OF WAY – LEFT BANK

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

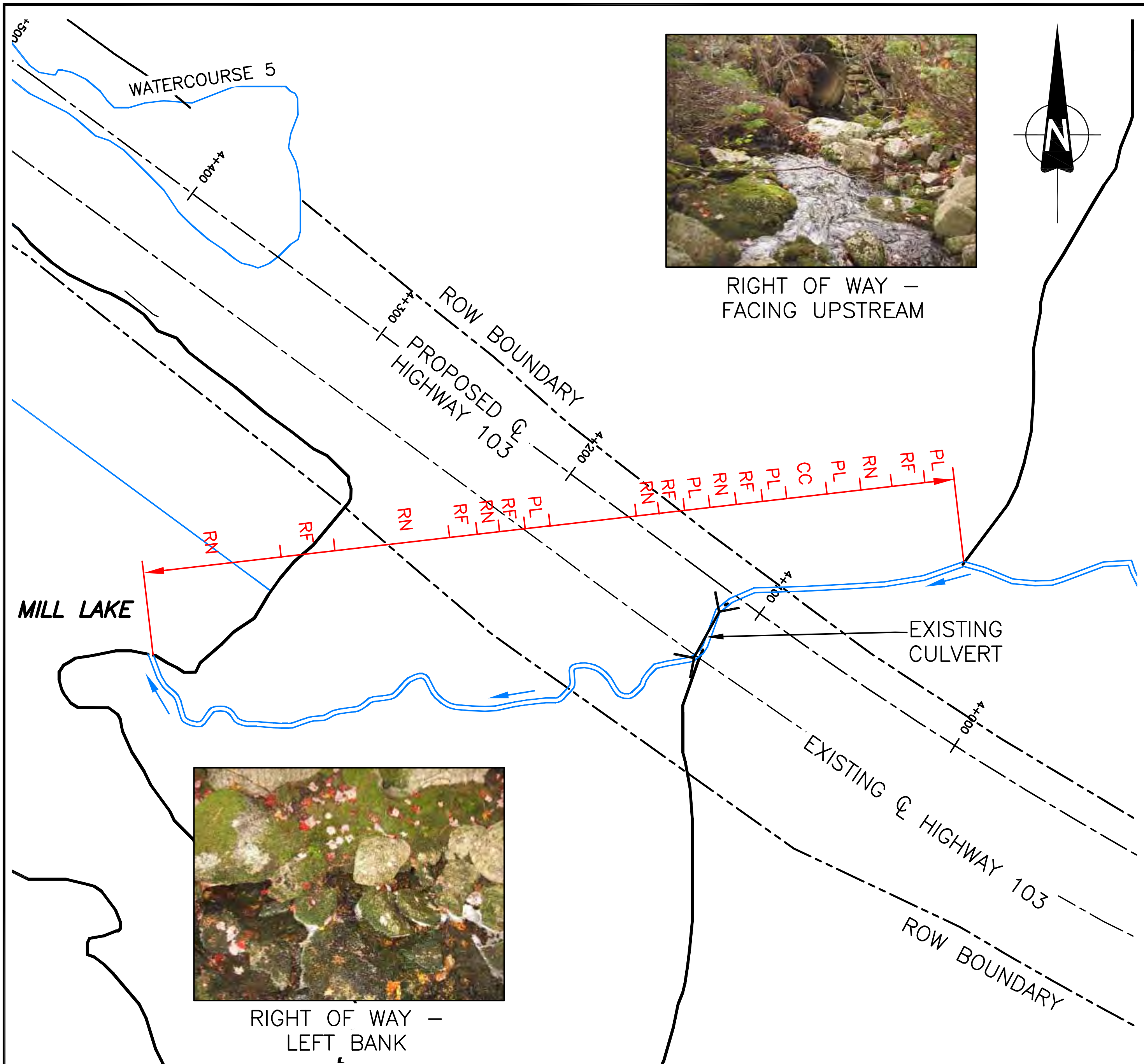
WATERCOURSE 3 & 4 (EAST BRANCH)

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257
Scale:	1:2500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	3
Client:	NSTIR

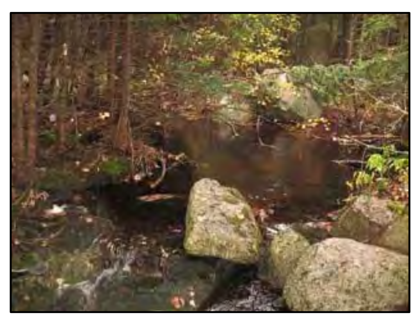
Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-3&4.dwg PRINTED: Aug 25, 2010



KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION



RIGHT OF WAY – FACING DOWNSTREAM

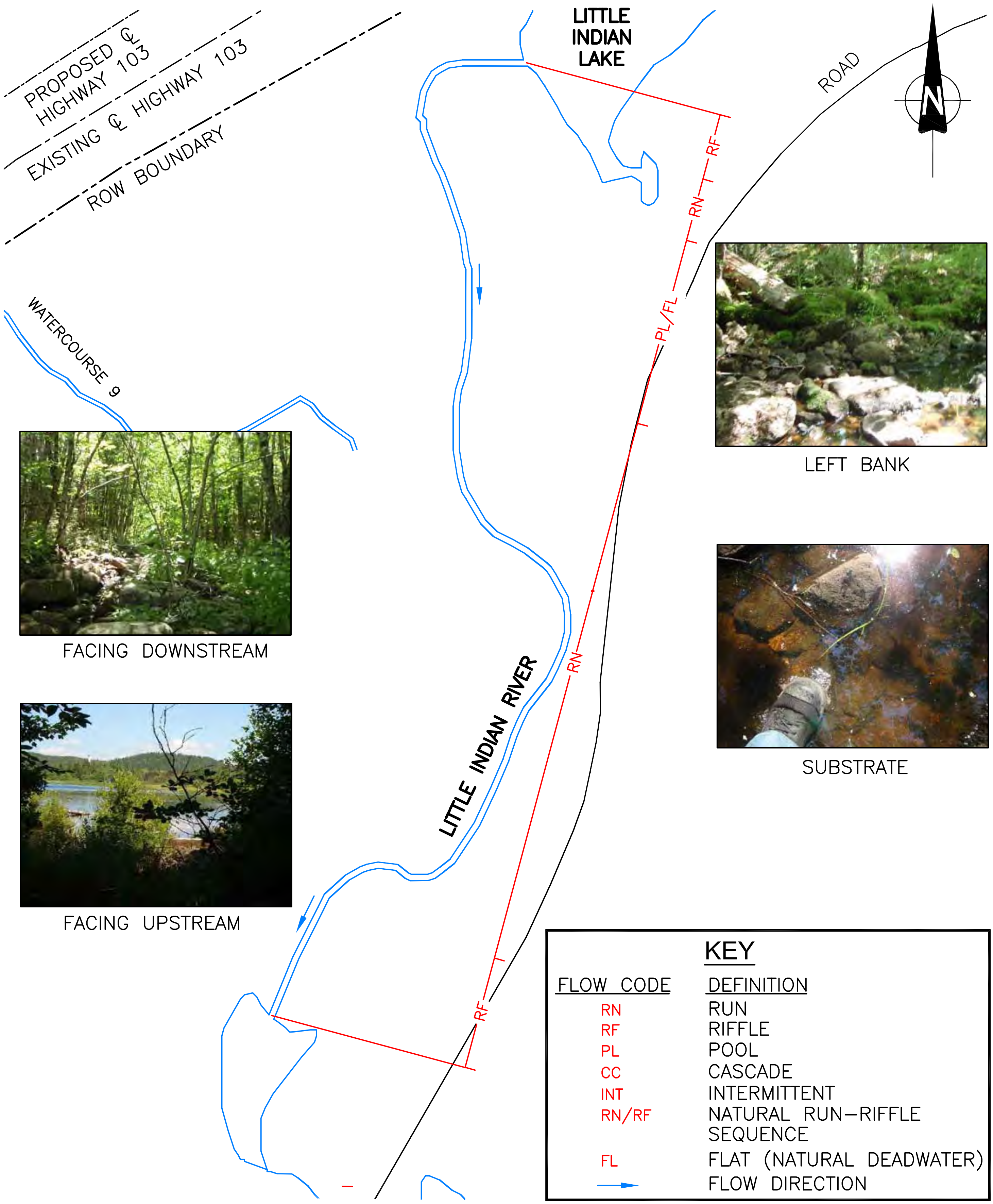
NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC LIMITED REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

WATERCOURSE 4 (WEST BRANCH)

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257
Scale:	1:2500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	4
Client:	NSTIR

Stantec



FACING DOWNSTREAM

FACING UPSTREAM

LEFT BANK

SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 8

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

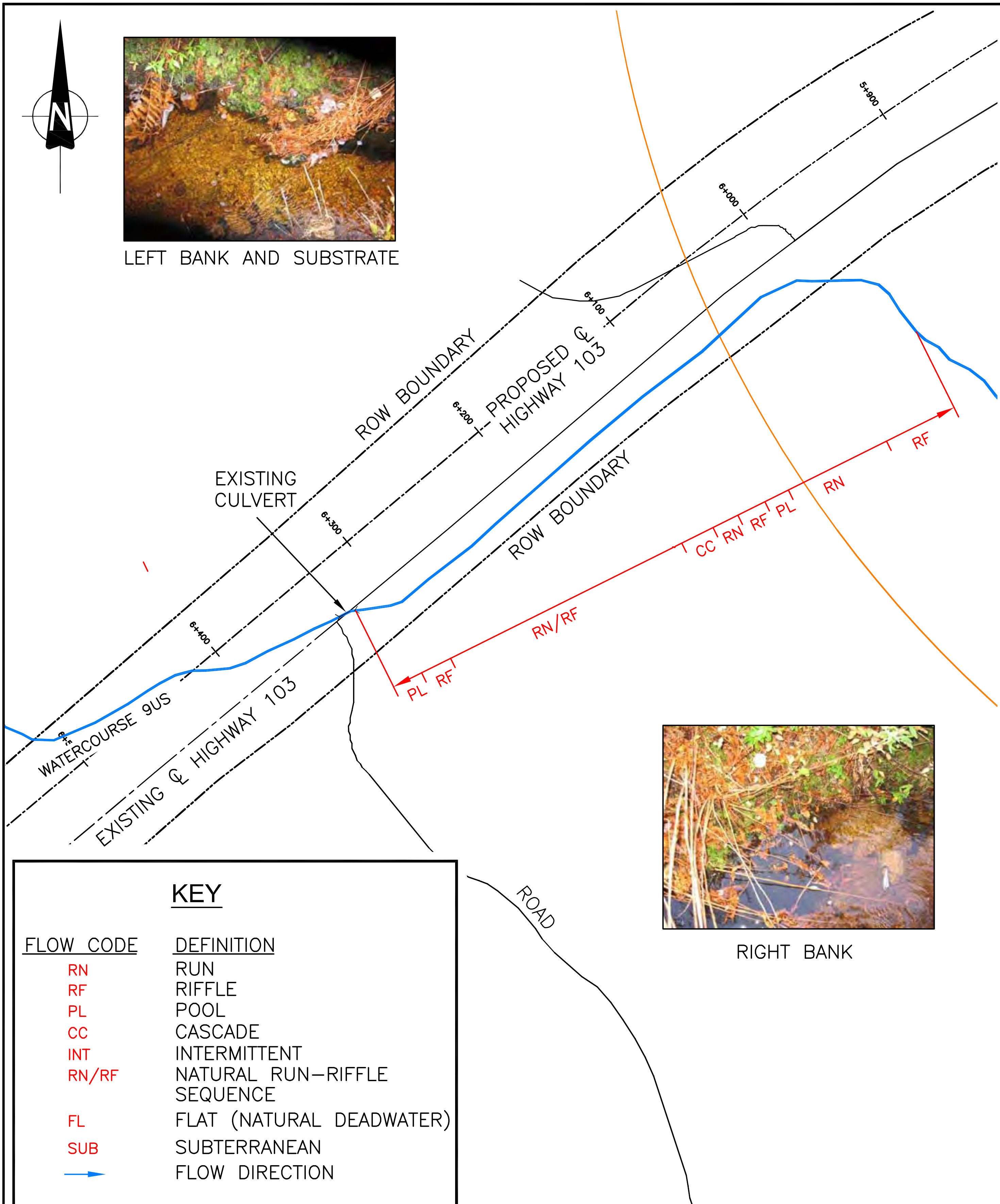
Client: NSTIR

Job No.:	121510257
Scale:	1:2500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS

Dwg. No.: 8

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-8.dwg PRINTED: Aug 25, 2010



LEFT BANK AND SUBSTRATE

RIGHT BANK

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
SUB	SUBTERRANEAN
→	FLOW DIRECTION

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

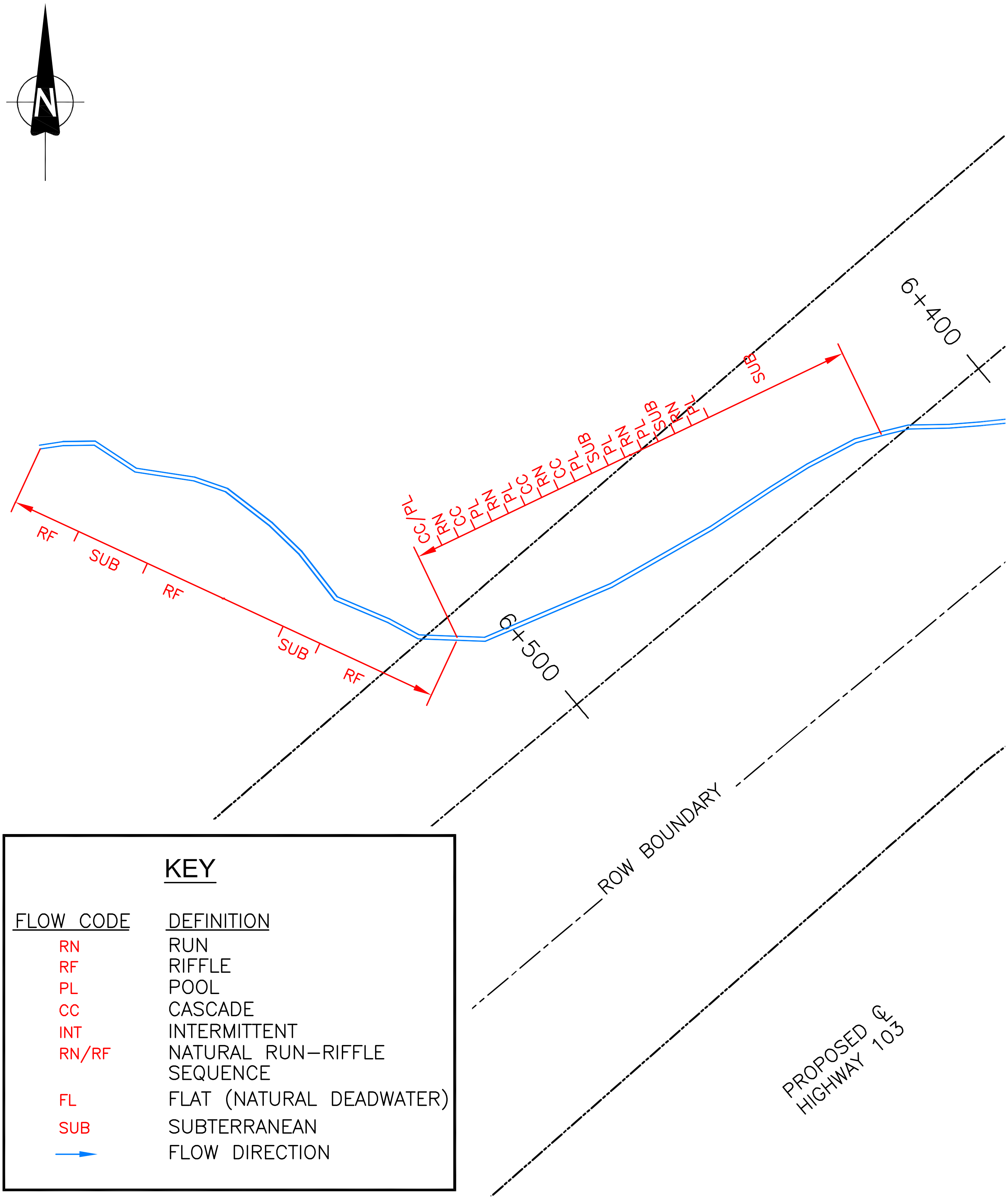
WATERCOURSE 9DS

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257
Scale:	1:3000
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	9DS
Client:	NSTIR

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-9.dwg PRINTED: Aug 25, 2010



KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
SUB	SUBTERRANEAN
→	FLOW DIRECTION

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

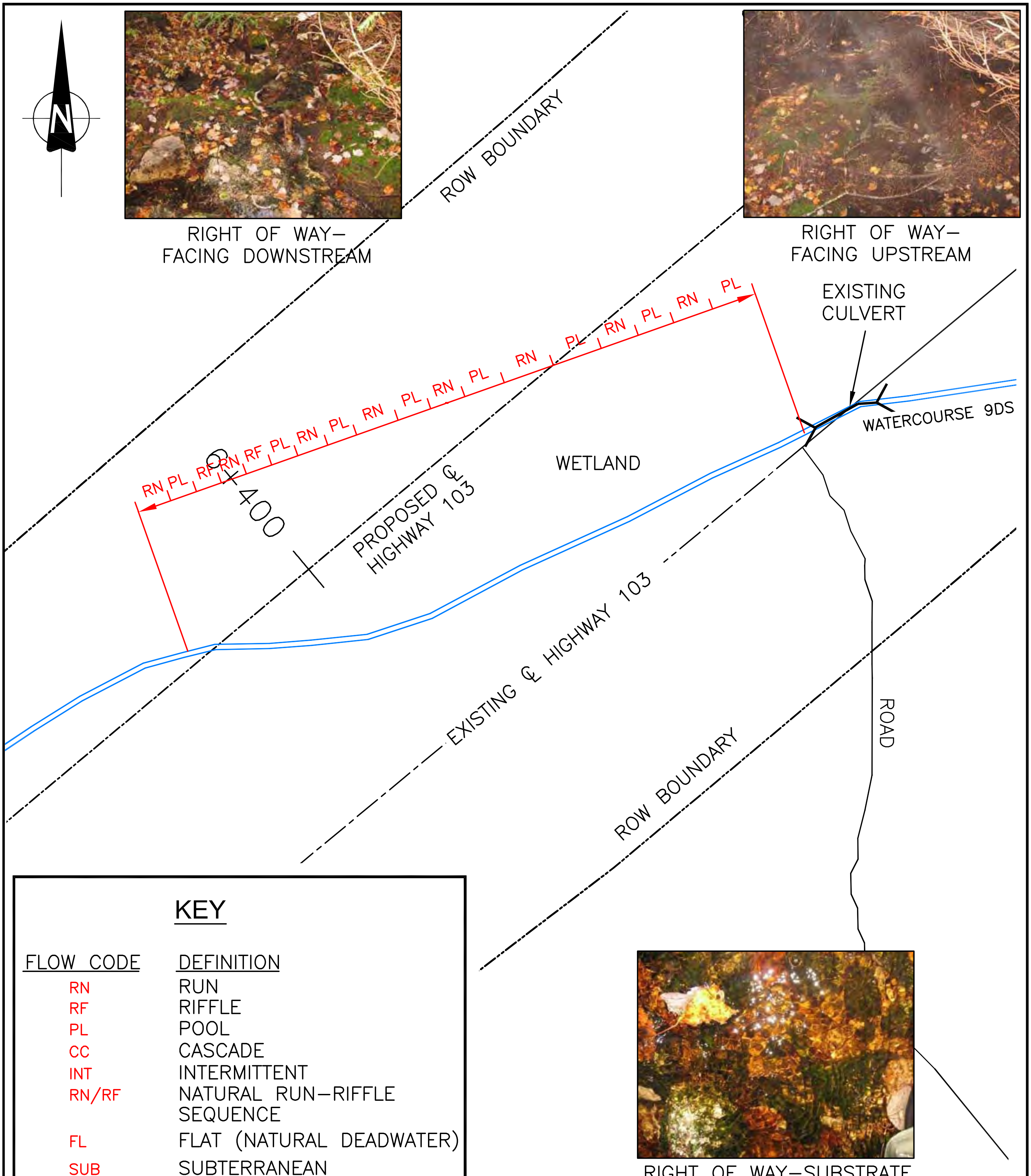
WATERCOURSE 9US-1-2

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR		
Job No.:	121510257	Dwg. No.:	9US 1-2
Scale:	1:500		
Date:	08/20/2010		
Dwn. By:	SJT		
App'd By:	JSS		

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-9.dwg PRINTED: Aug 25, 2010



RIGHT OF WAY– FACING DOWNSTREAM

RIGHT OF WAY– FACING UPSTREAM

RIGHT OF WAY–SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
SUB	SUBTERRANEAN
→	FLOW DIRECTION

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

WATERCOURSE 9US, 2-2

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:750
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	9US 2-2

Stantec

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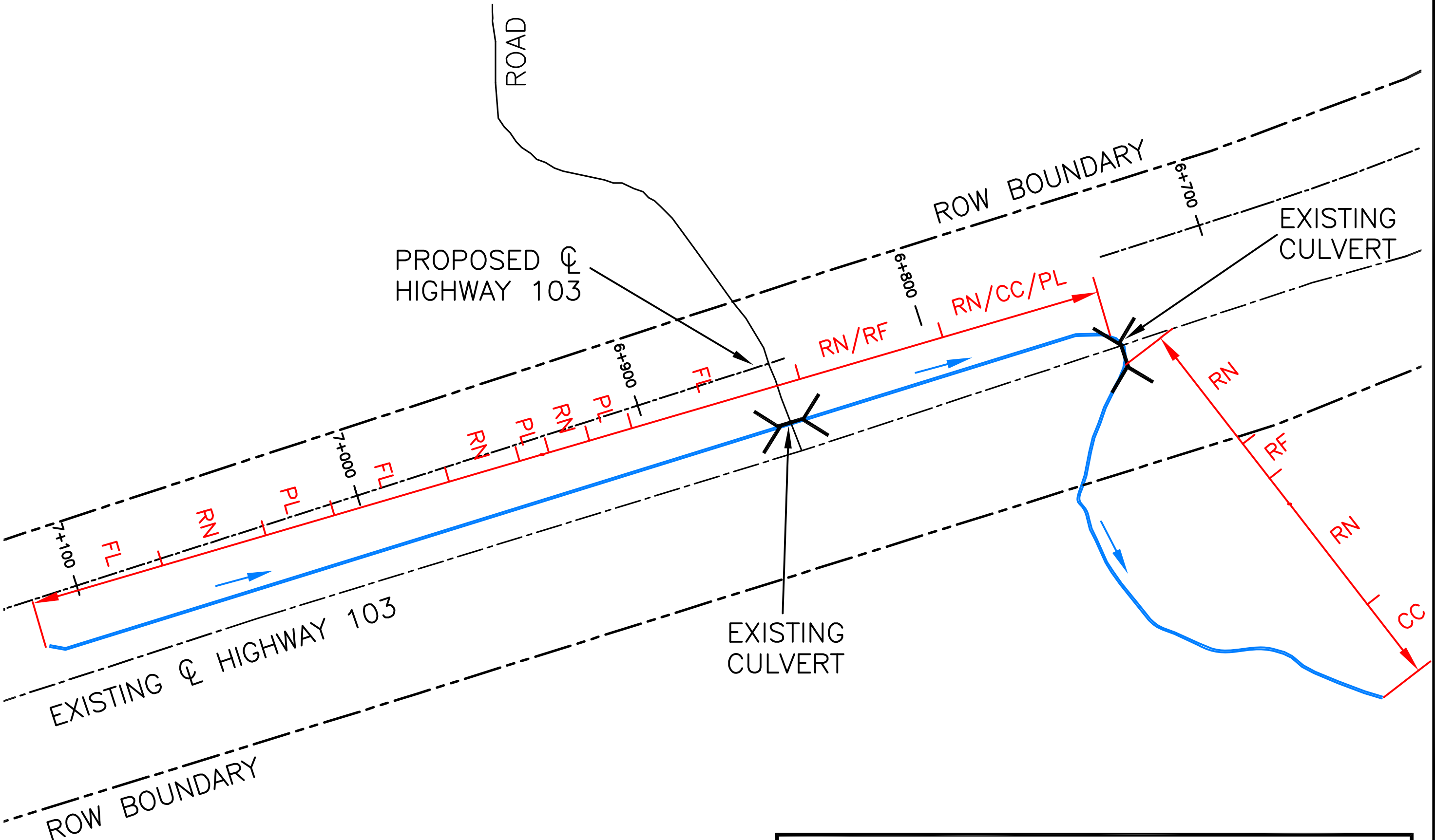
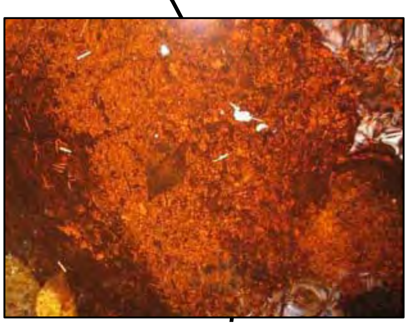
DOWNSTREAM–
FACING DOWNSTREAM

DOWNSTREAM–
FACING UPSTREAM





DOWNSTREAM–
SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
RN/CC/PL	NATURAL RUN–CASCADE–POOL REPEATING SEQUENCE
→	FLOW DIRECTION

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

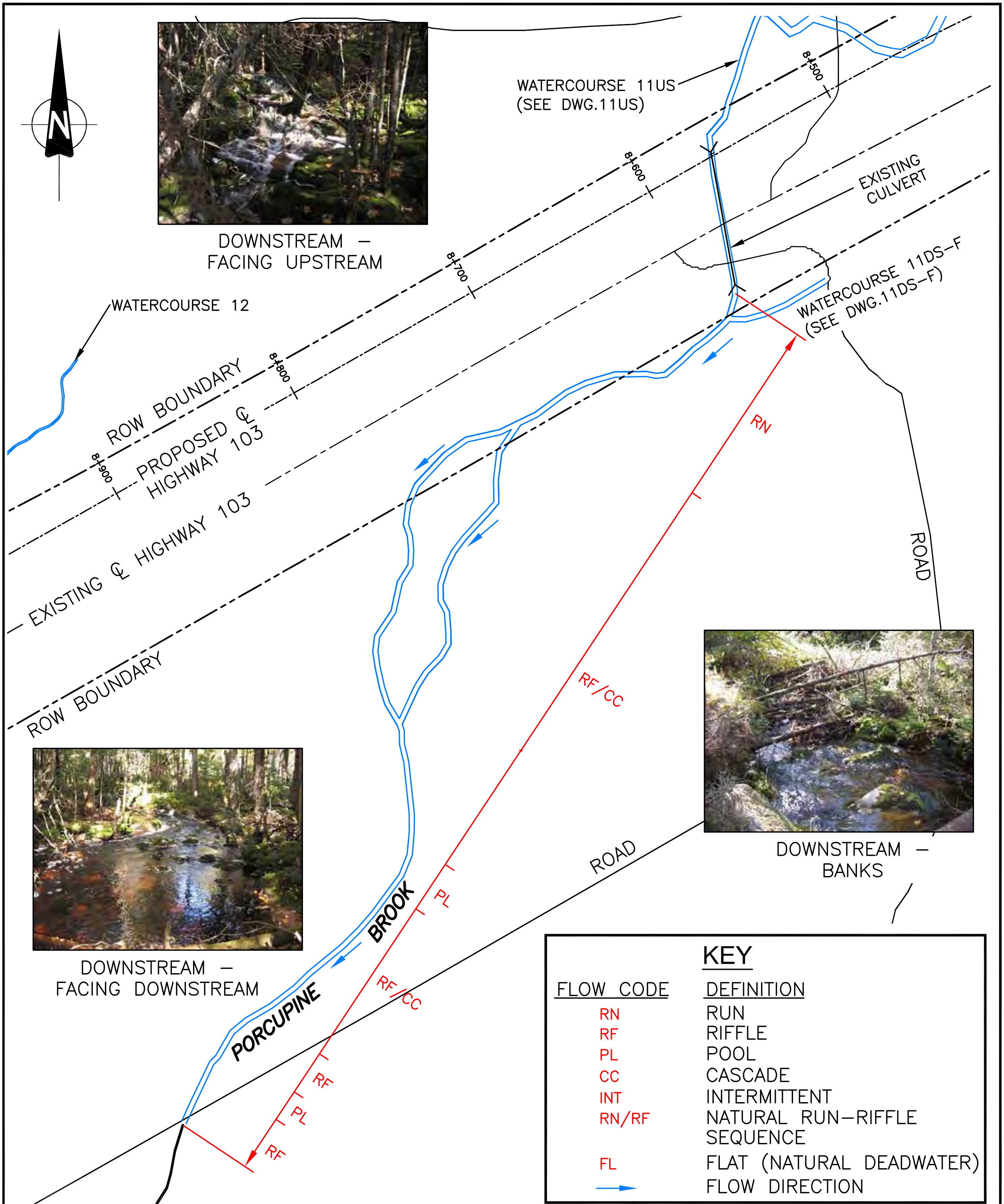
WATERCOURSE 10

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:2500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	10

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-10to11.dwg PRINTED: Aug 25, 2010



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

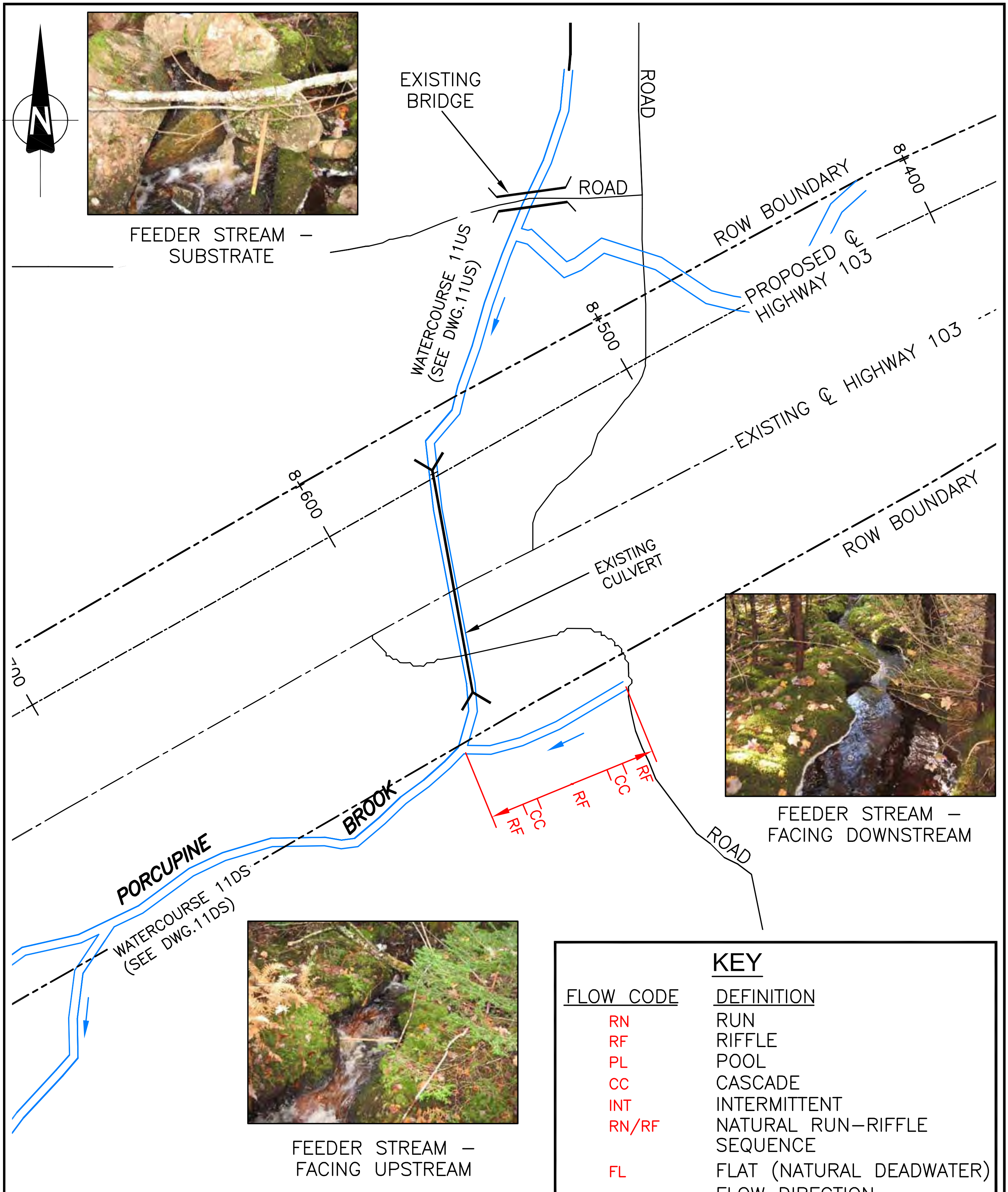
WATERCOURSE 11DS

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257
Scale:	1:2500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	11DS
Client:	NSTIR

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-10to11.dwg PRINTED: Aug 25, 2010



KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

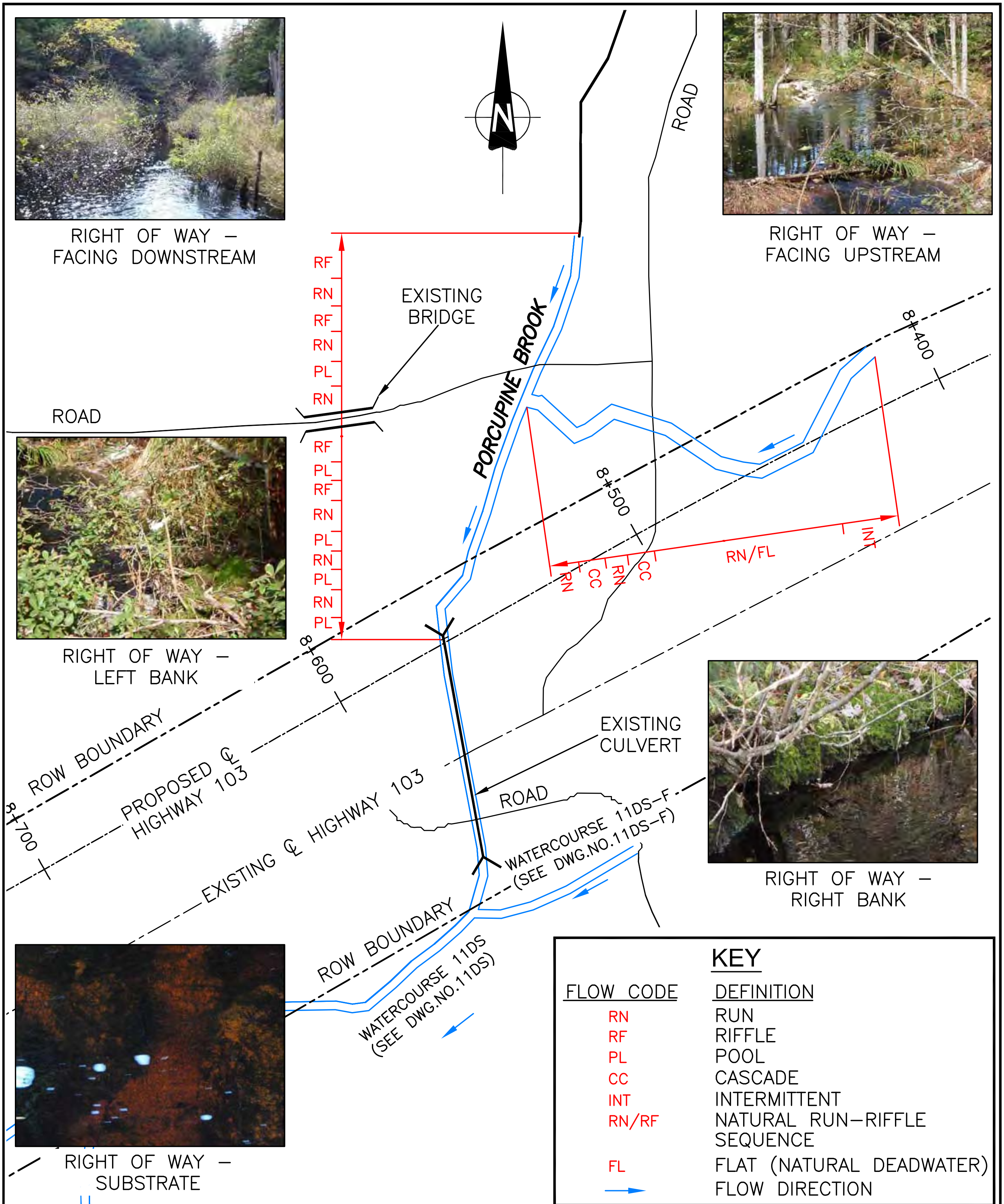
WATERCOURSE 11DS-F

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client: NSTIR

Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	11DS -F

Stantec



KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 11US

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client: NSTIR

Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS

Dwg. No.: 11US

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-10to11.dwg PRINTED: Aug 25, 2010

N
INT
RN/RF
ROW BOUNDARY
ROW BOUNDARY
PROPOSED ℄ HIGHWAY 103
EXISTING ℄ HIGHWAY 103
8+9
9+000
9+100
9+200

RIGHT OF WAY – FACING DOWNSTREAM

RIGHT OF WAY – FACING UPSTREAM

RIGHT OF WAY – RIGHT BANK

RIGHT OF WAY – LEFT BANK

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 12

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client: NSTIR

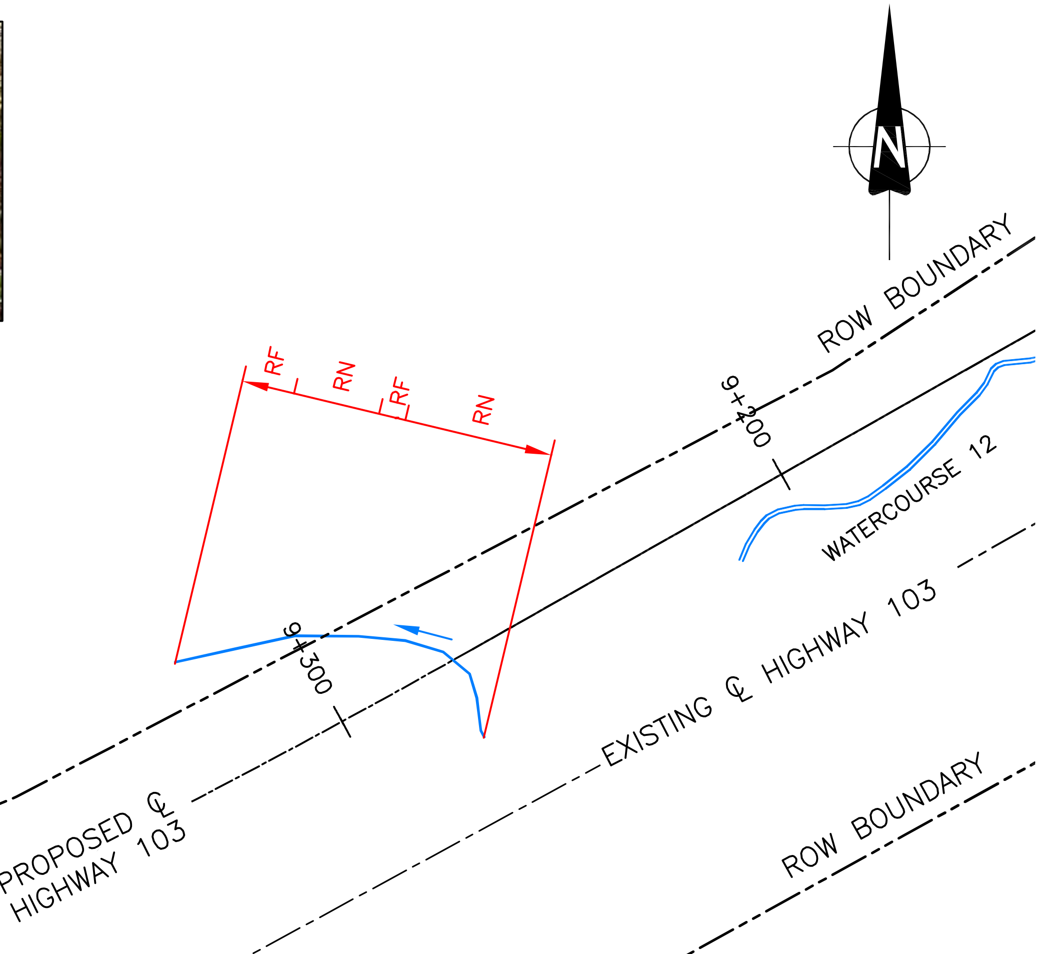
Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	12

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-12TO13.dwg PRINTED: Aug 25, 2010

RIGHT OF WAY –
FACING DOWNSTREAM

RIGHT OF WAY –
FACING UPSTREAM



RIGHT OF WAY –
SUBSTRATE

RIGHT OF WAY –
FACING LEFT BANK

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

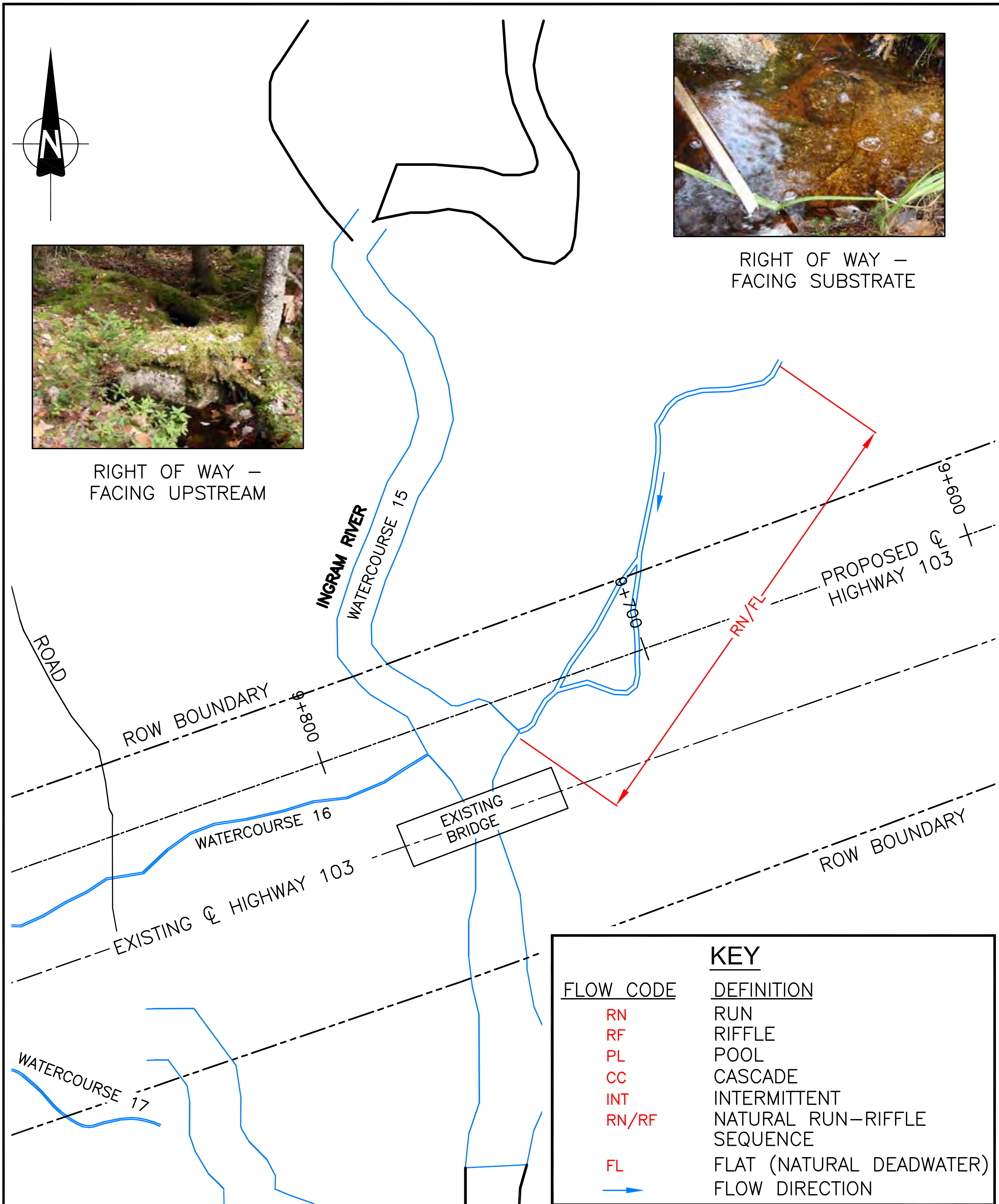
NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC LIMITED REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

WATERCOURSE 13

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR		
Job No.:	121510257	Dwg. No.:	13
Scale:	1:1500		
Date:	08/20/2010		
Dwn. By:	SJT		
App'd By:	JSS		

Stantec



RIGHT OF WAY –
FACING UPSTREAM

RIGHT OF WAY –
FACING SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

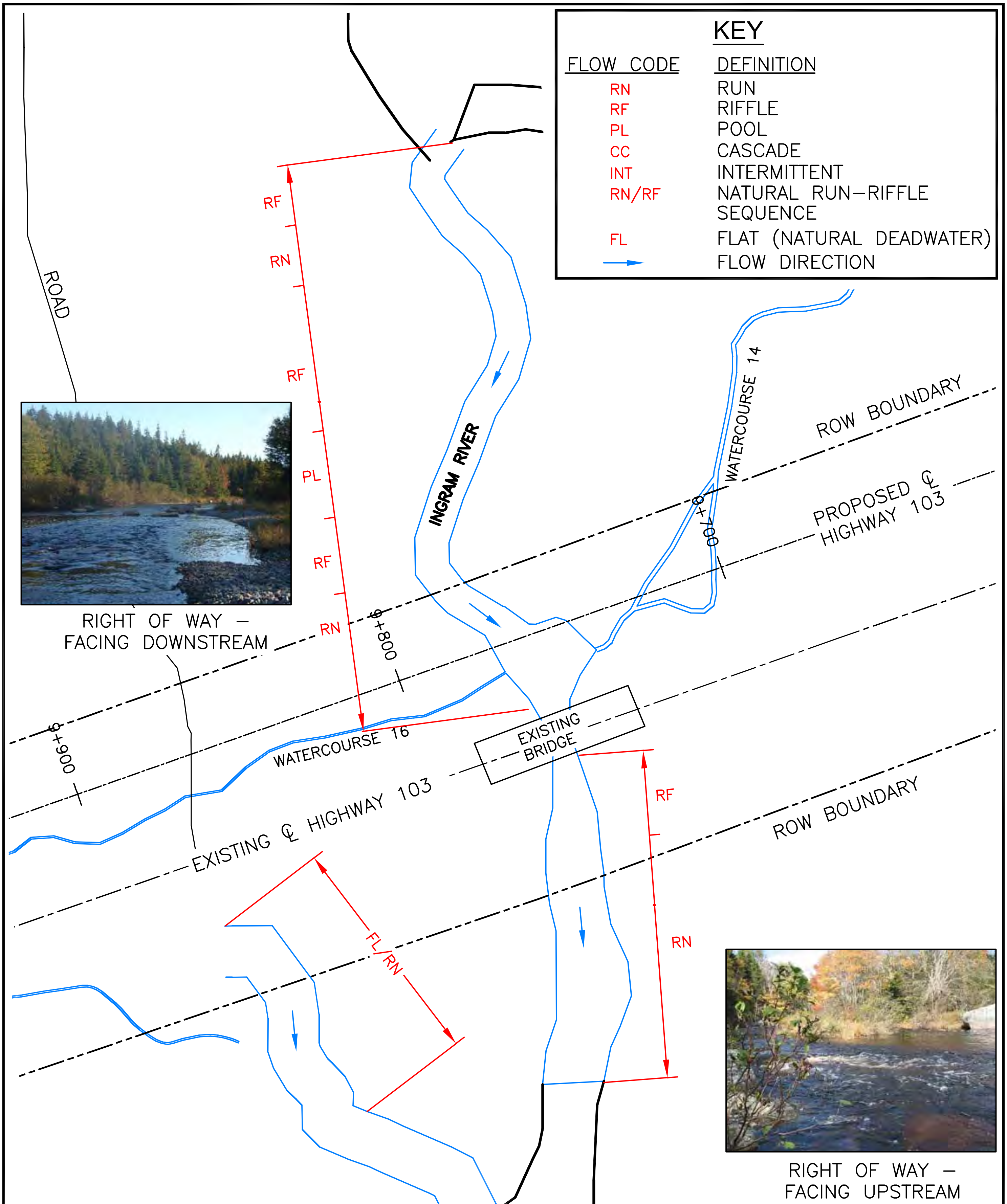
NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC LIMITED REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

WATERCOURSE 14

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	14
Client:	NSTIR

Stantec



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

WATERCOURSE 15

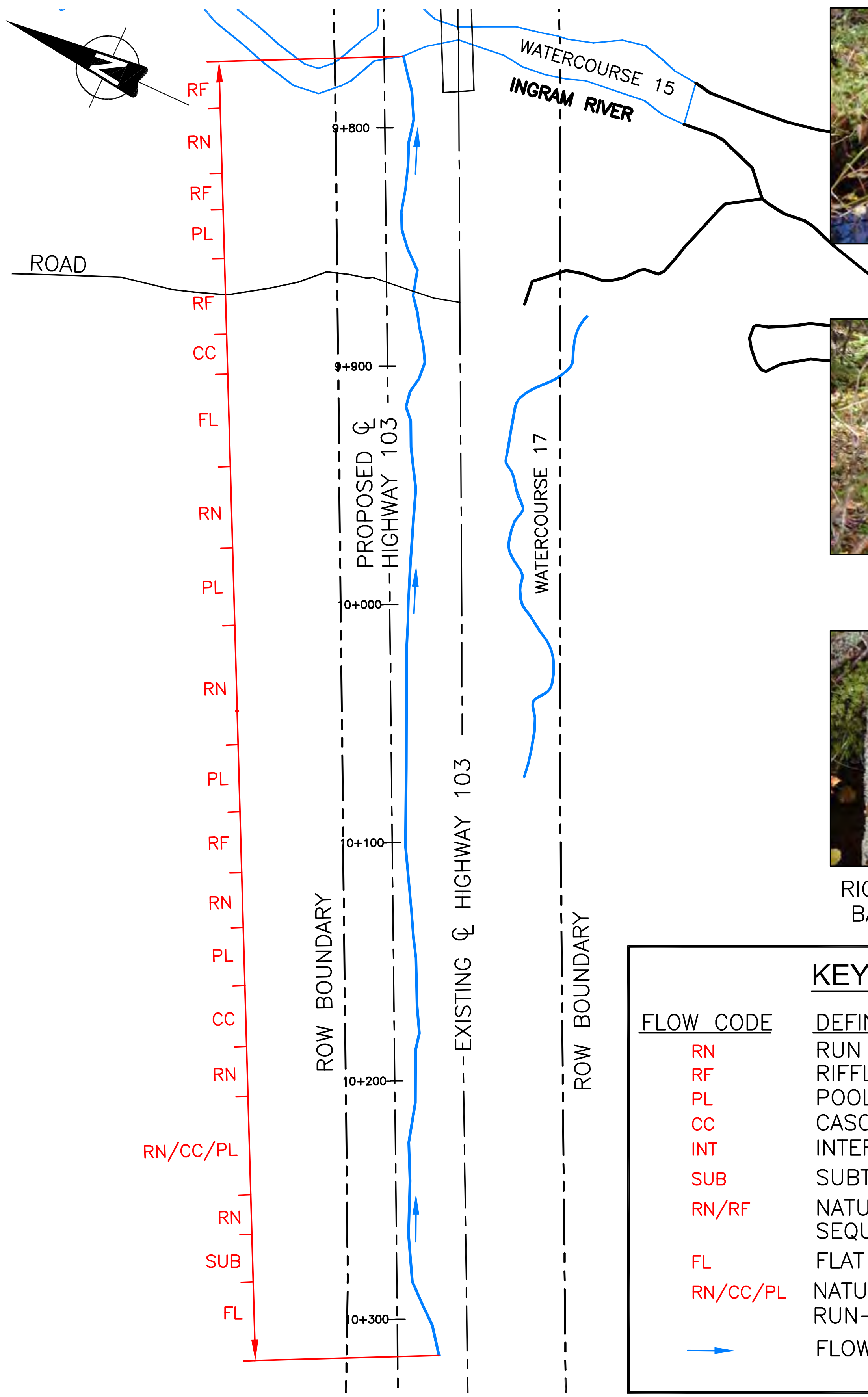
HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257	Dwg. No.:	15
Scale:	1:1500		
Date:	08/20/2010		
Dwn. By:	SJT		
App'd By:	JSS		

Client: NSTIR

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-14TO15.dwg PRINTED: Aug 25, 2010



RIGHT OF WAY – FACING DOWNSTREAM

RIGHT OF WAY – FACING UPSTREAM

RIGHT OF WAY – RIGHT BANK AND SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
SUB	SUBTERRANEAN
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
RN/CC/PL	NATURAL RUN–CASCADE–POOL
→	FLOW DIRECTION

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

WATERCOURSE 16

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client: NSTIR

Job No.:	121510257
Scale:	1:2500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	16

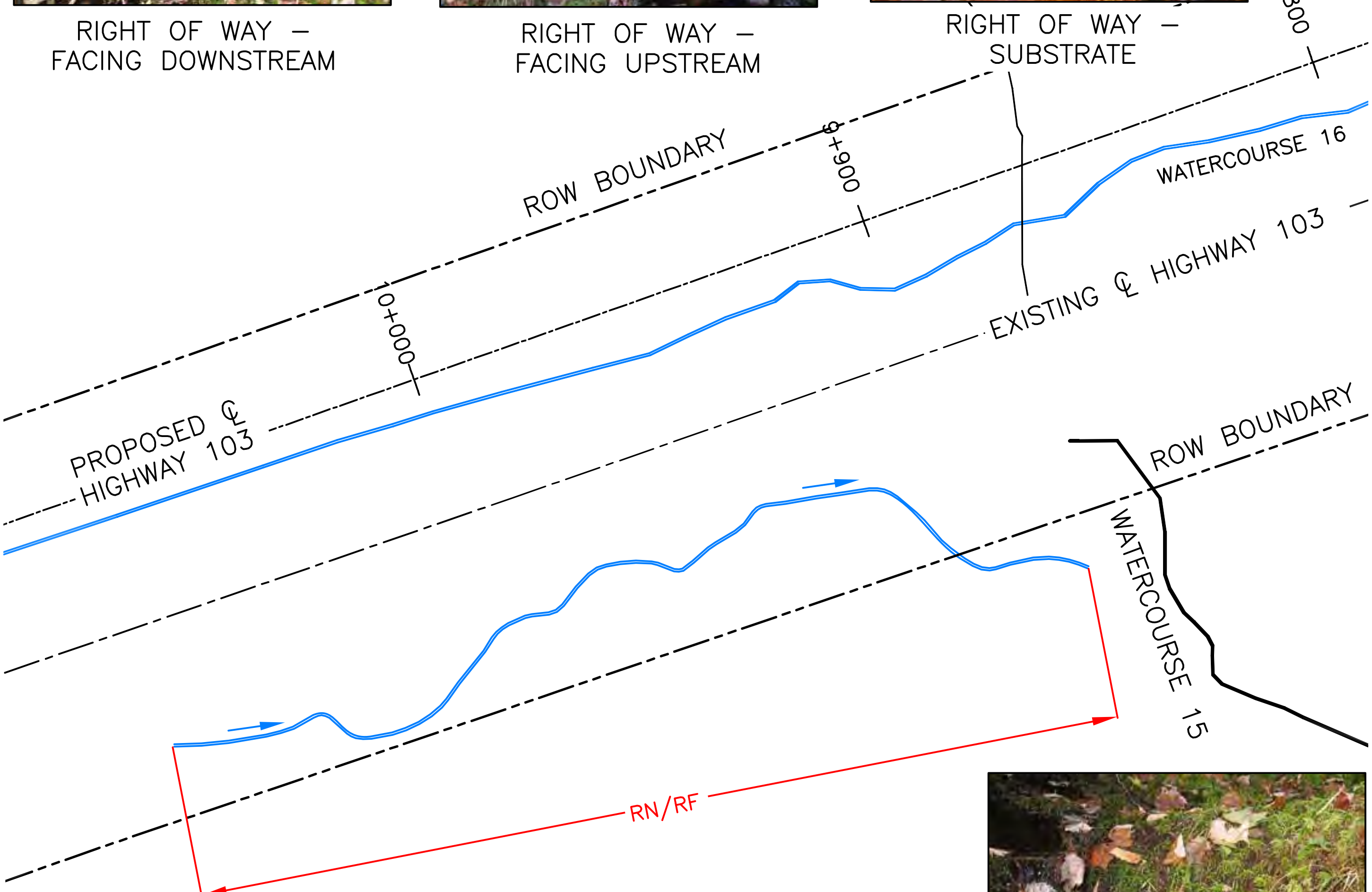
Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-16.dwg PRINTED: Aug 25, 2010

RIGHT OF WAY –
FACING DOWNSTREAM

RIGHT OF WAY –
FACING UPSTREAM

RIGHT OF WAY –
SUBSTRATE



RIGHT OF WAY –
RIGHT BANK

RIGHT OF WAY –
LEFT BANK

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 17

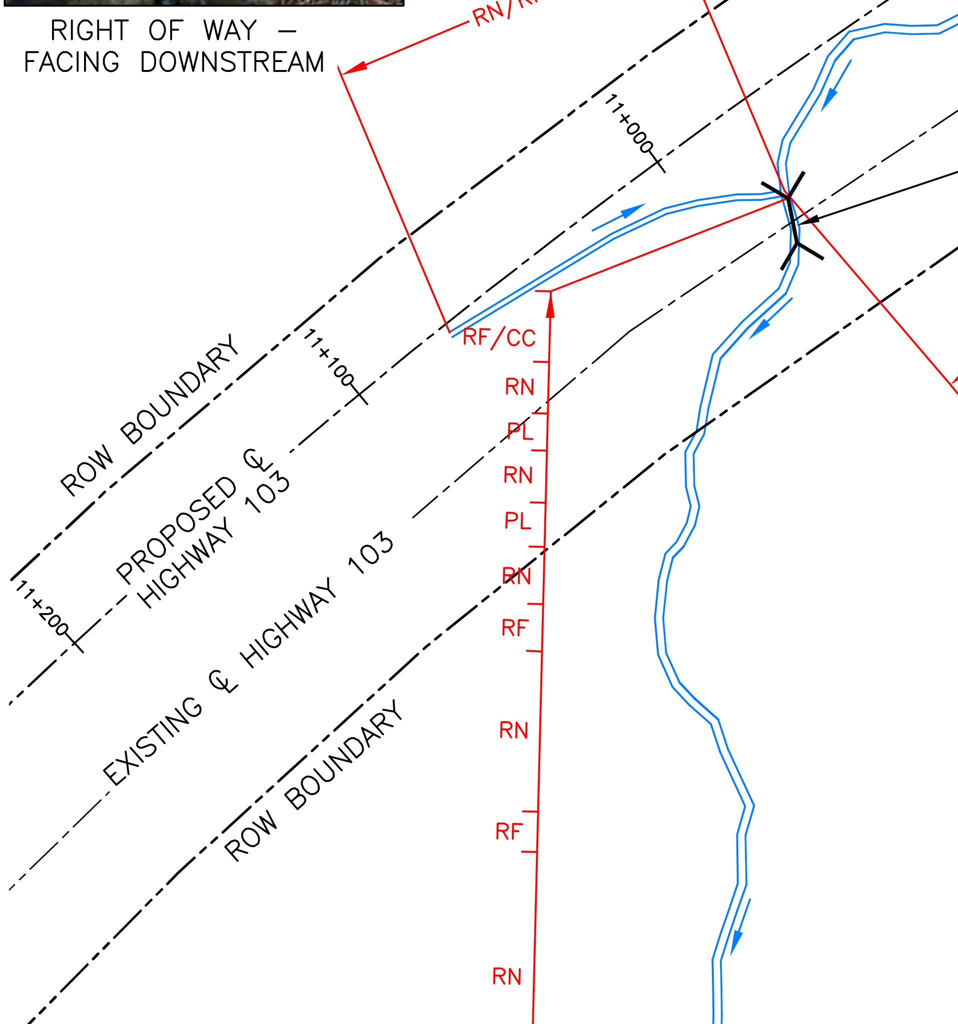
HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	17

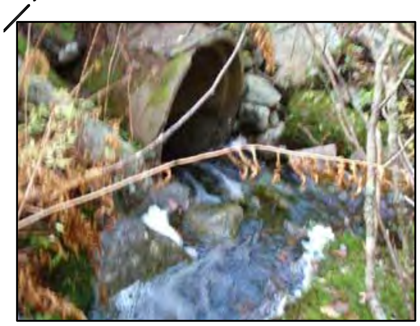
Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-17.dwg PRINTED: Aug 25, 2010

RIGHT OF WAY –
FACING DOWNSTREAM



RIGHT OF WAY –
SUBSTRATE



RIGHT OF WAY –
FACING UPSTREAM

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 18

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

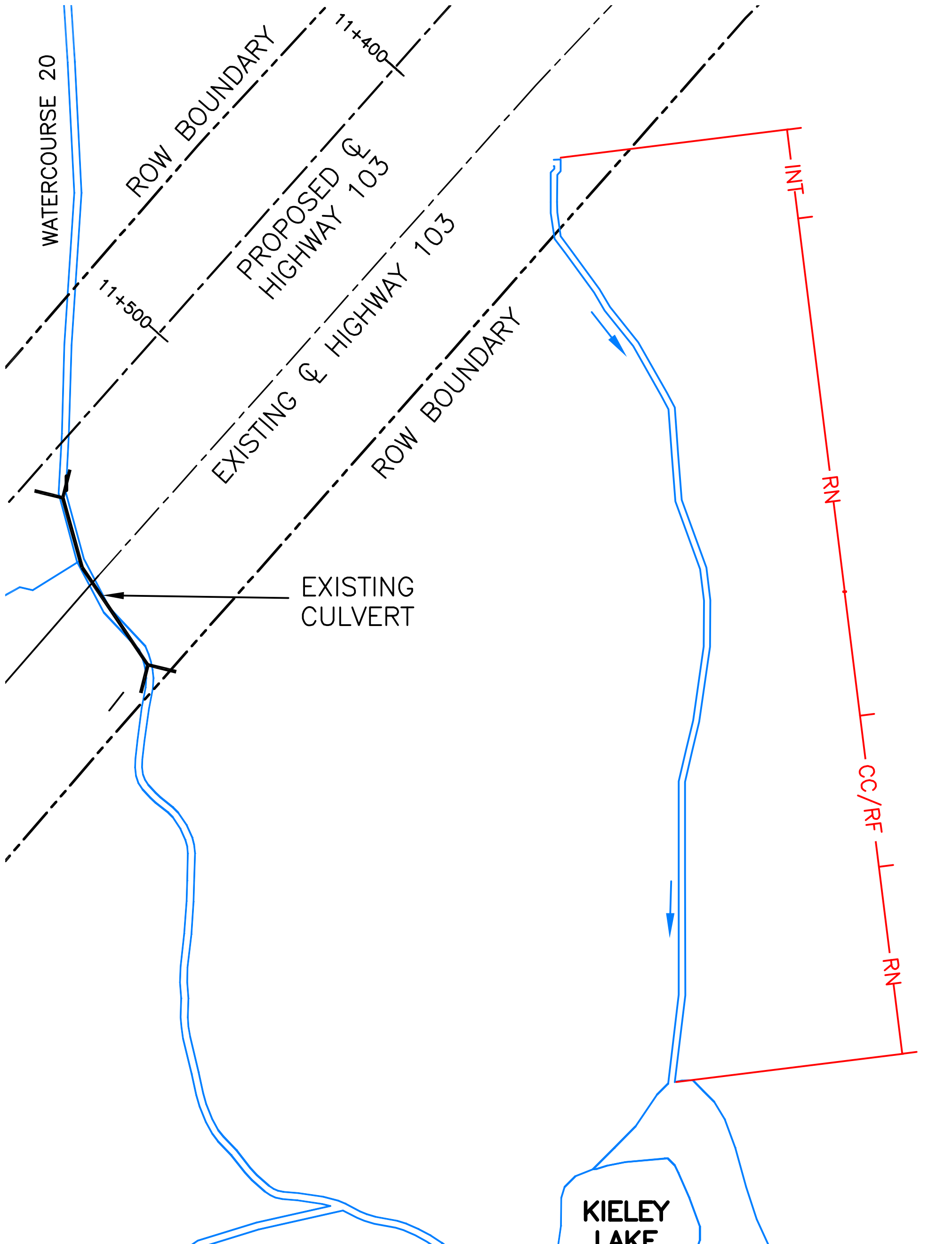
Client: NSTIR

Job No.:	121510257
Scale:	1:2000
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS

Dwg. No.: 18

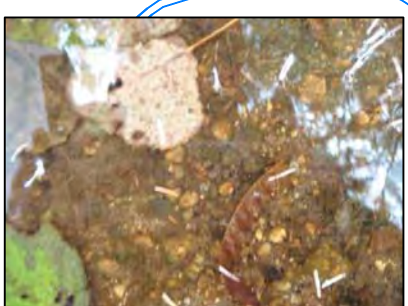
Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-18&19.dwg PRINTED: Aug 25, 2010



RIGHT OF WAY – FACING DOWNSTREAM

RIGHT OF WAY – FACING UPSTREAM



RIGHT OF WAY – SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

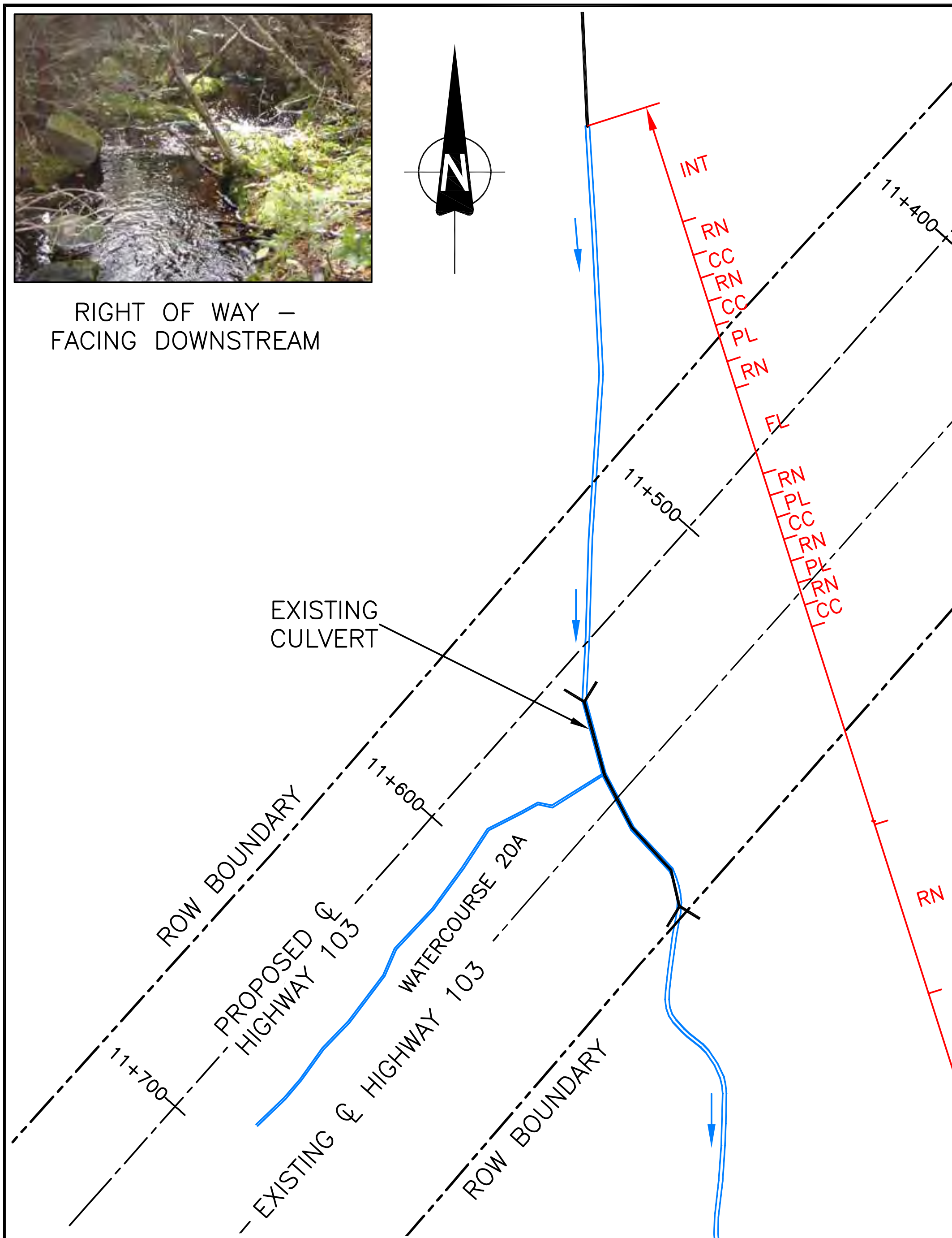
WATERCOURSE 19

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:2000
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	19

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-18&19.dwg PRINTED: Aug 25, 2010



RIGHT OF WAY – FACING DOWNSTREAM

RIGHT OF WAY – FACING UPSTREAM

RIGHT OF WAY – RIGHT BANK AND SUBSTRATE

RIGHT OF WAY – LEFT BANK

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

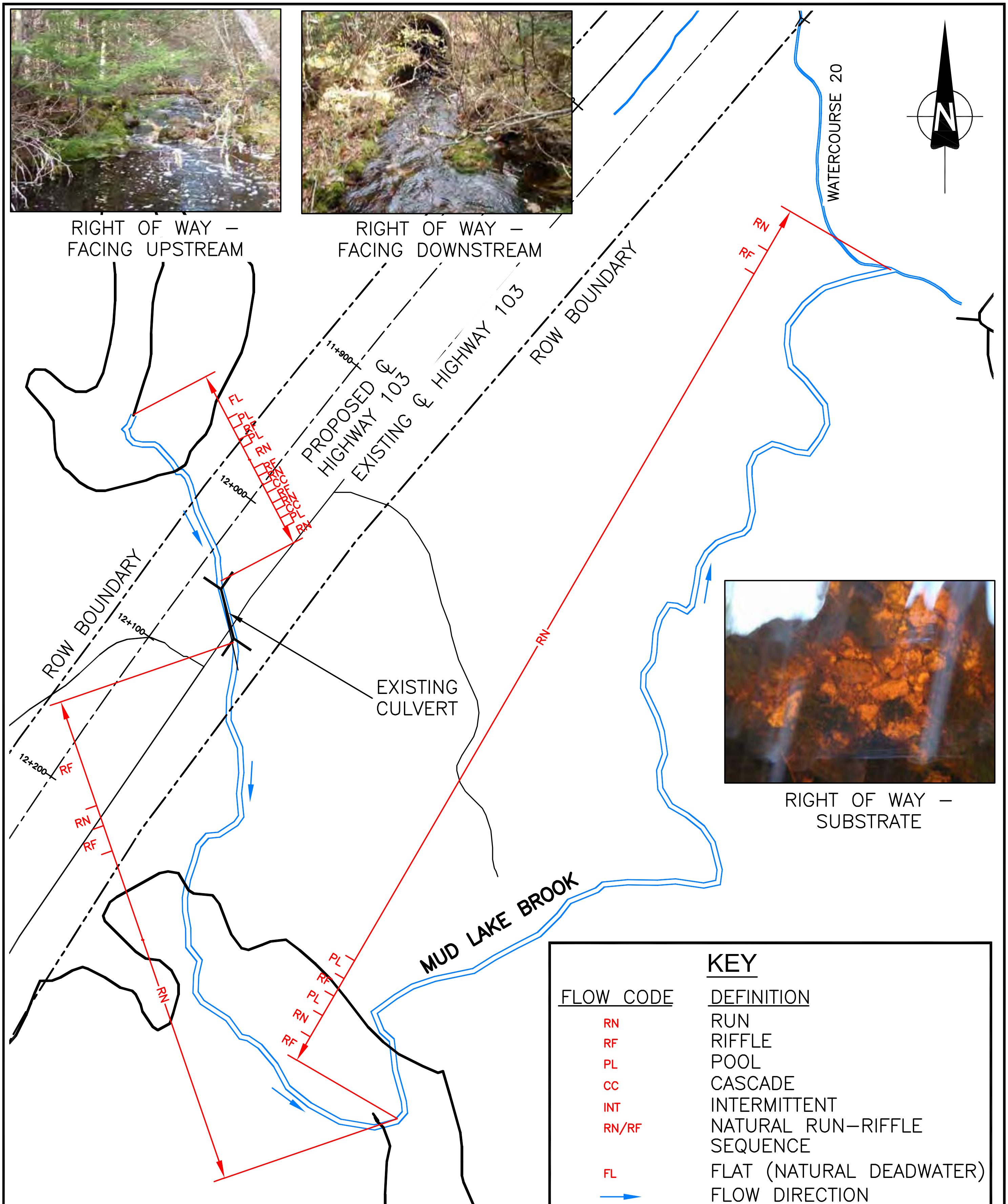
WATERCOURSE 20

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:1750
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	20

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-20TO24.dwg PRINTED: Aug 25, 2010



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

WATERCOURSE 21

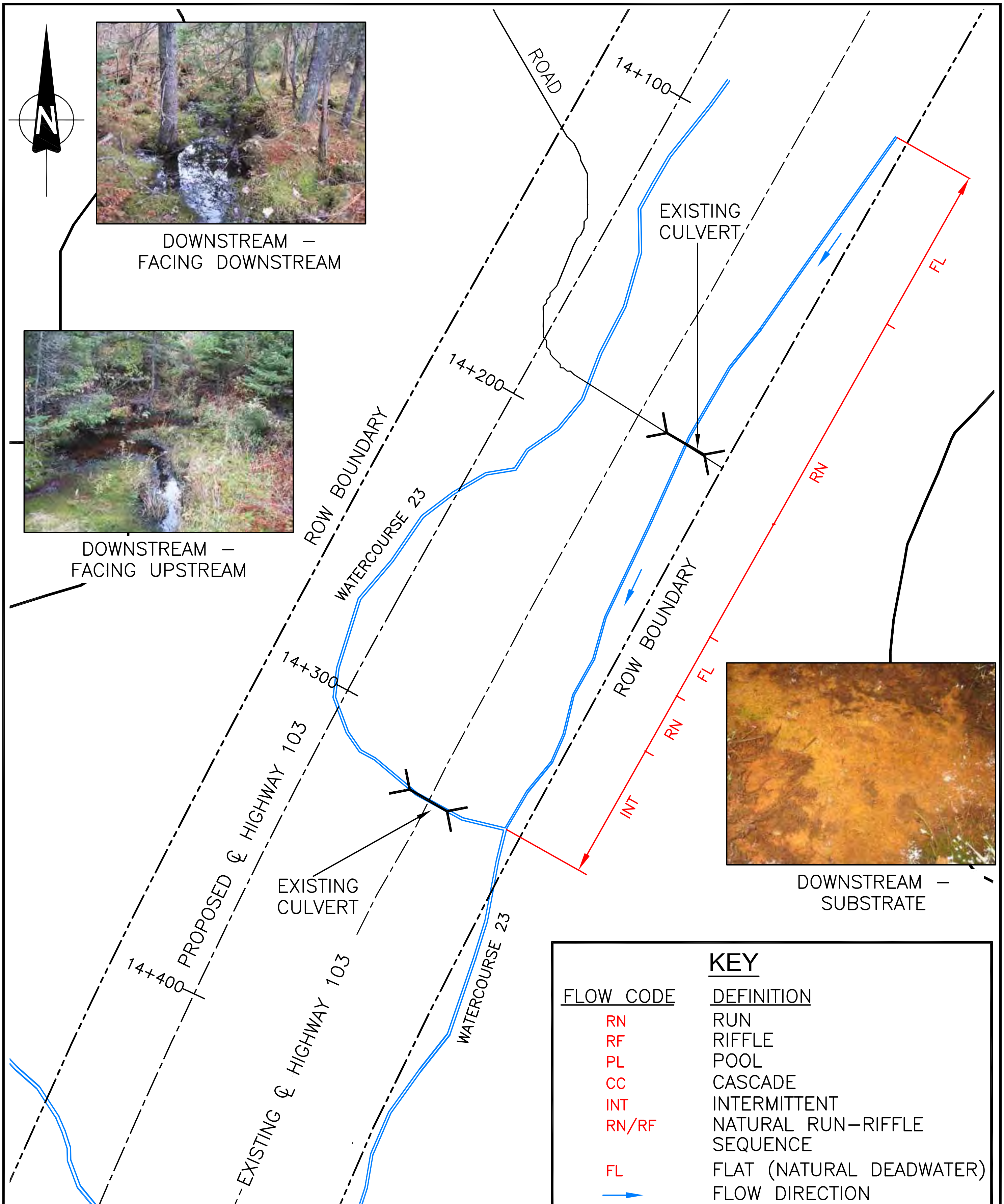
HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257	Dwg. No.:	21
Scale:	1:3000		
Date:	08/20/2010		
Dwn. By:	SJT		
App'd By:	JSS		

Client: NSTIR

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-20TO24.dwg PRINTED: Aug 25, 2010



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

WATERCOURSE 22

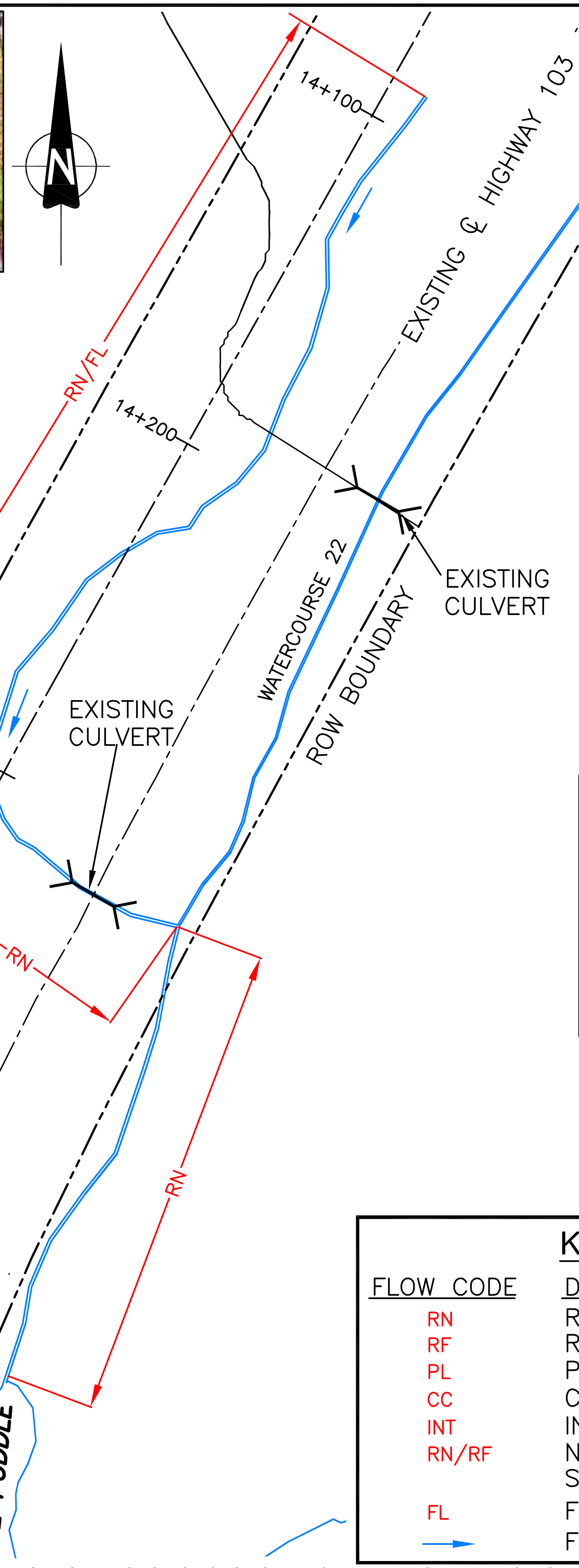
HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	22

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-20TO24.dwg PRINTED: Aug 25, 2010

RIGHT OF WAY (DS) – FACING DOWNSTREAM



RIGHT OF WAY (DS) – FACING UPSTREAM

RIGHT OF WAY (DS) – LEFT BANK

RIGHT OF WAY (DS) – RIGHT BANK

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 23

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client: NSTIR

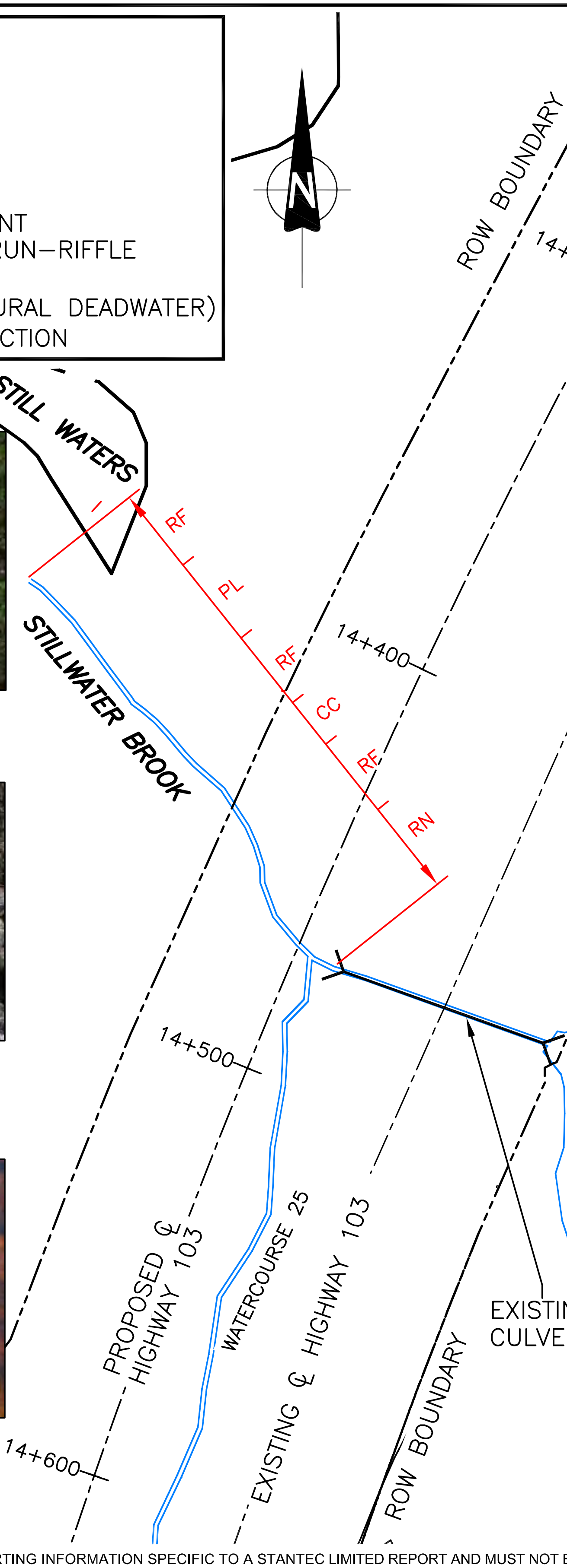
Job No.:	121510257
Scale:	1:1750
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	23

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-20TO24.dwg PRINTED: Aug 25, 2010

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION




RIGHT OF WAY – FACING DOWNSTREAM


RIGHT OF WAY – FACING UPSTREAM


RIGHT OF WAY – SUBSTRATE


RIGHT OF WAY – LEFT BANK


RIGHT OF WAY – RIGHT BANK

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

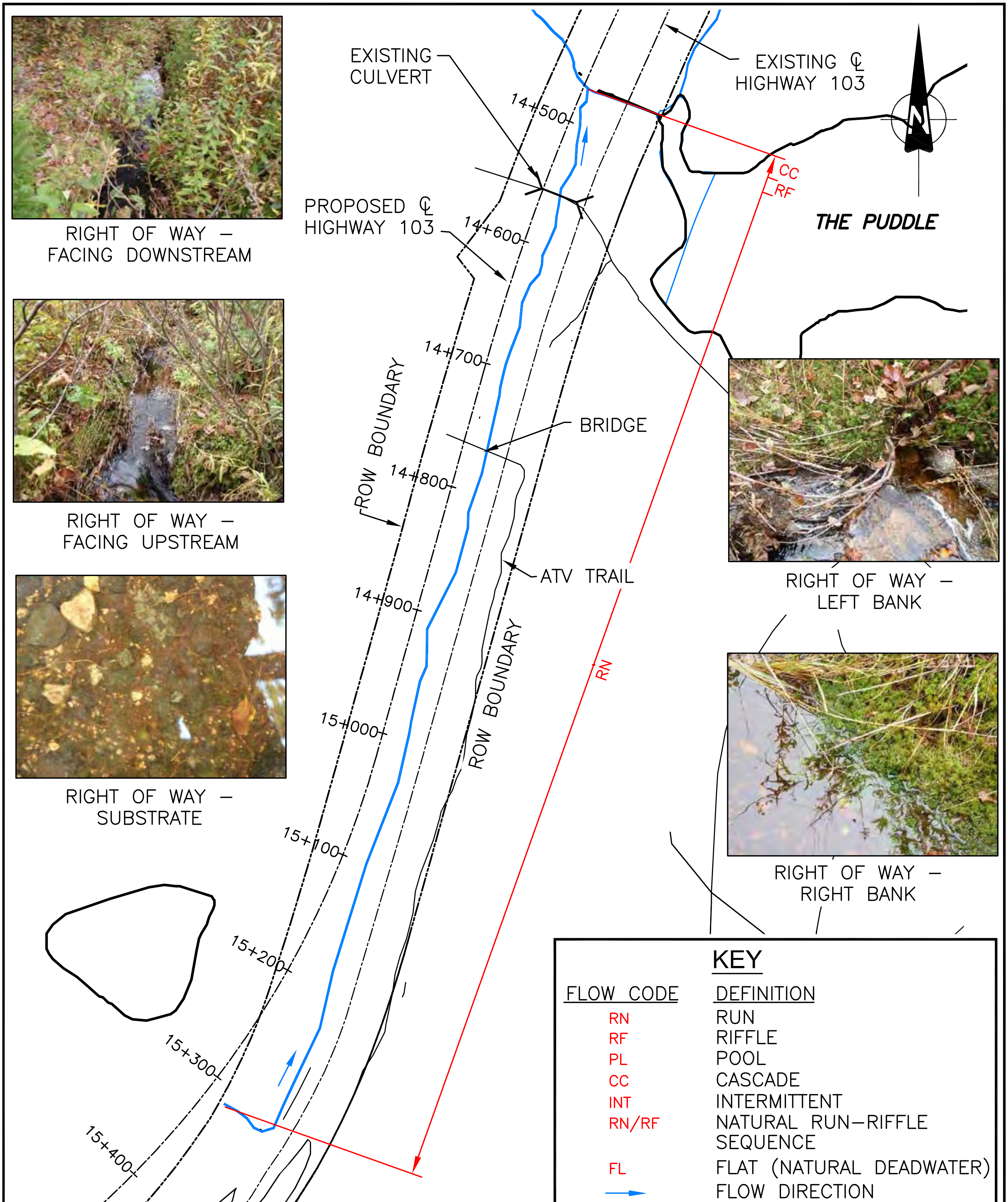
WATERCOURSE 24

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:4000
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	24

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-20TO24.dwg PRINTED: Aug 25, 2010



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

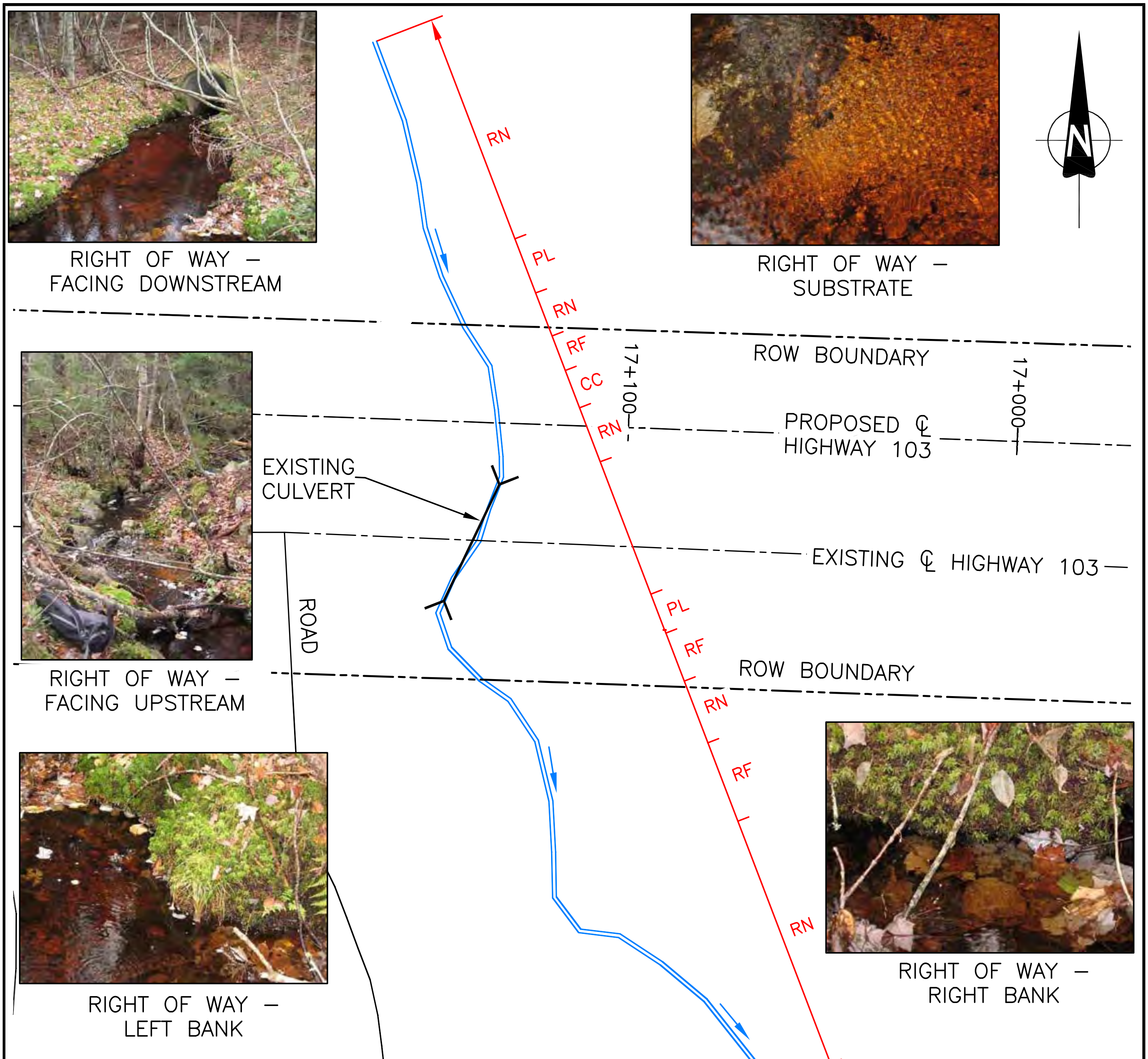
WATERCOURSE 25

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257
Scale:	1:4000
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	25
Client:	NSTIR

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-25.dwg PRINTED: Aug 25, 2010



KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 26

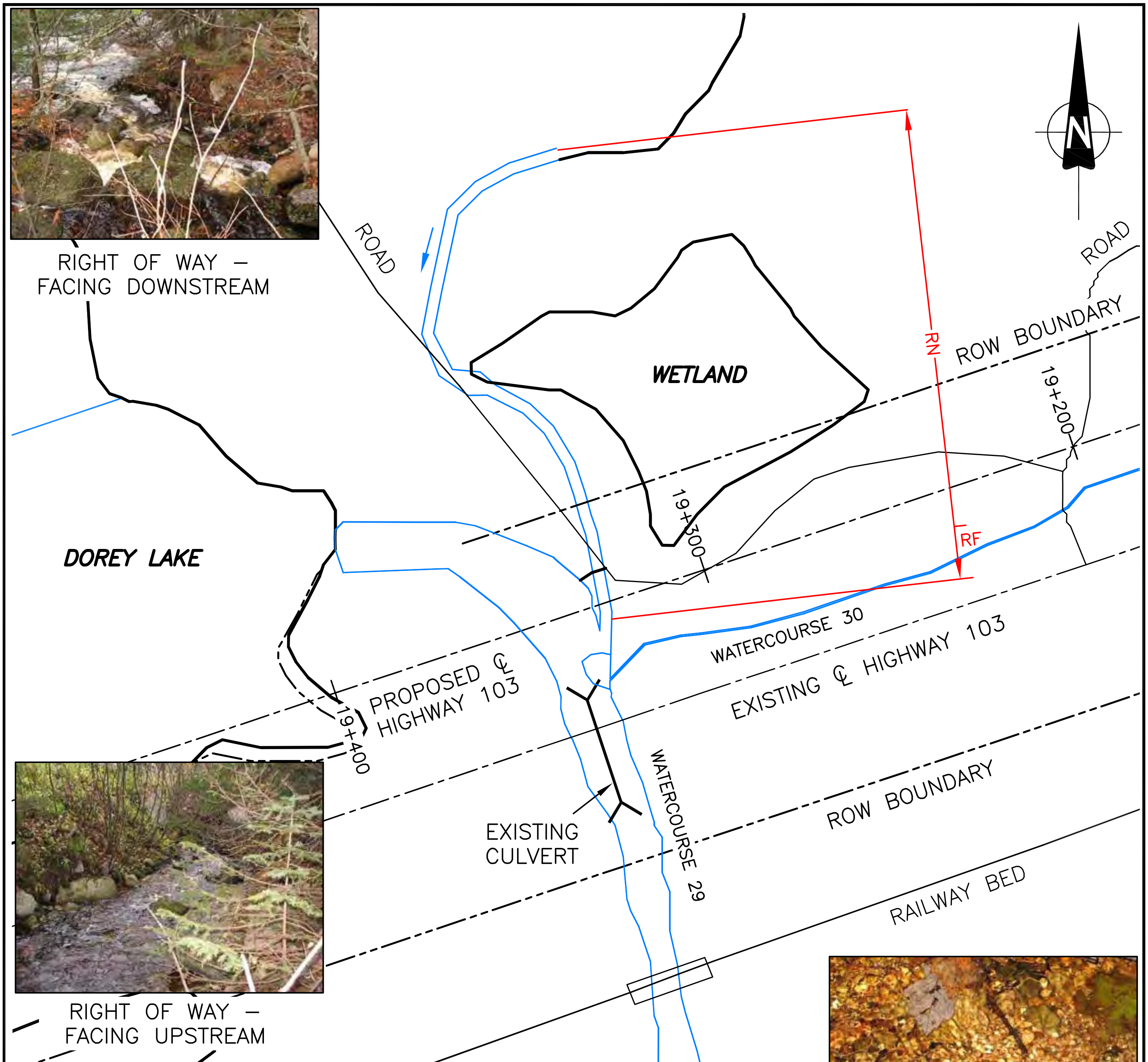
HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client: NSTIR

Job No.:	121510257
Scale:	1:4000
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	26

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-26.dwg PRINTED: Aug 25, 2010



KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 28

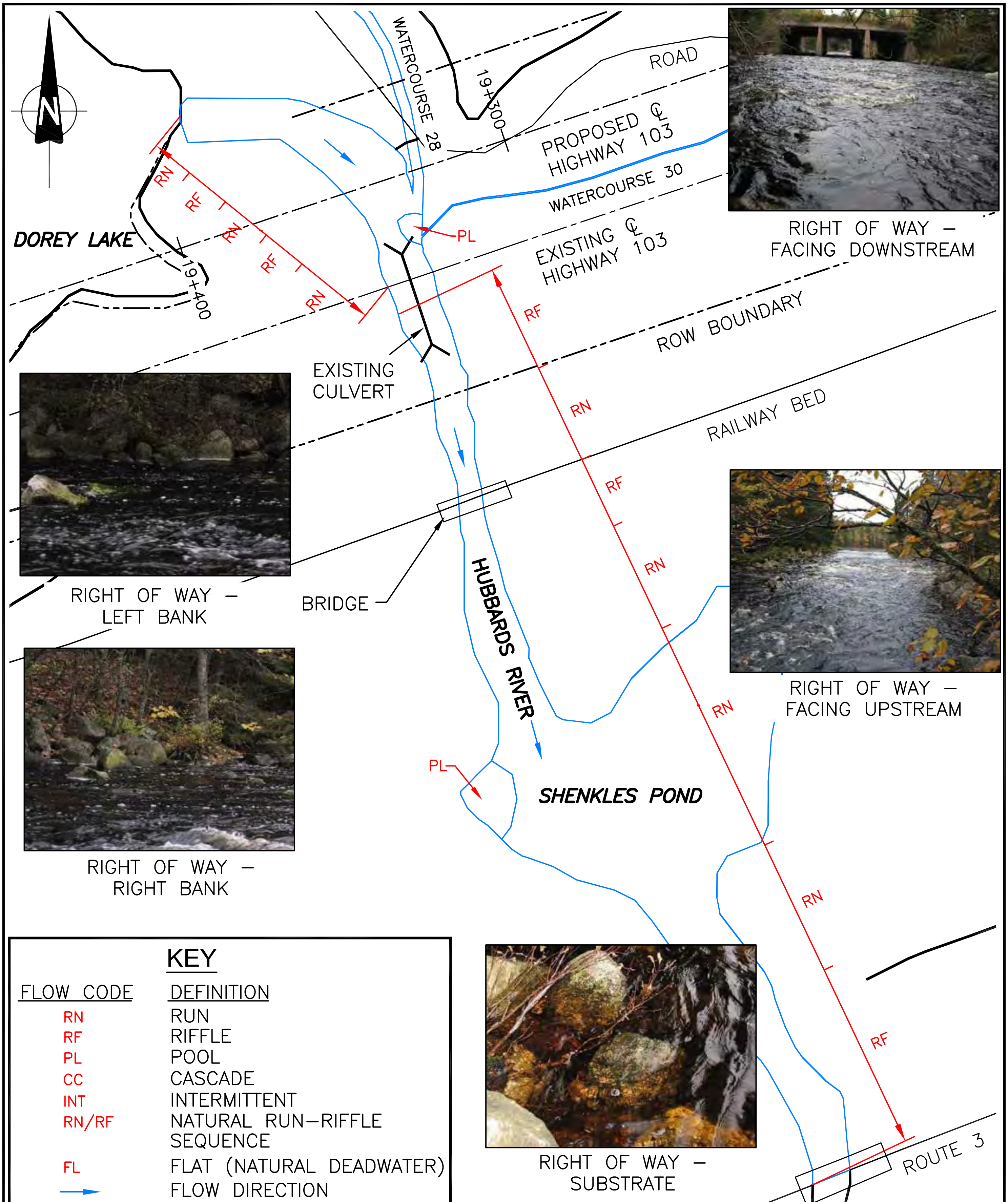
HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	28

Client: NSTIR

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-28to30.dwg PRINTED: Aug 25, 2010



KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

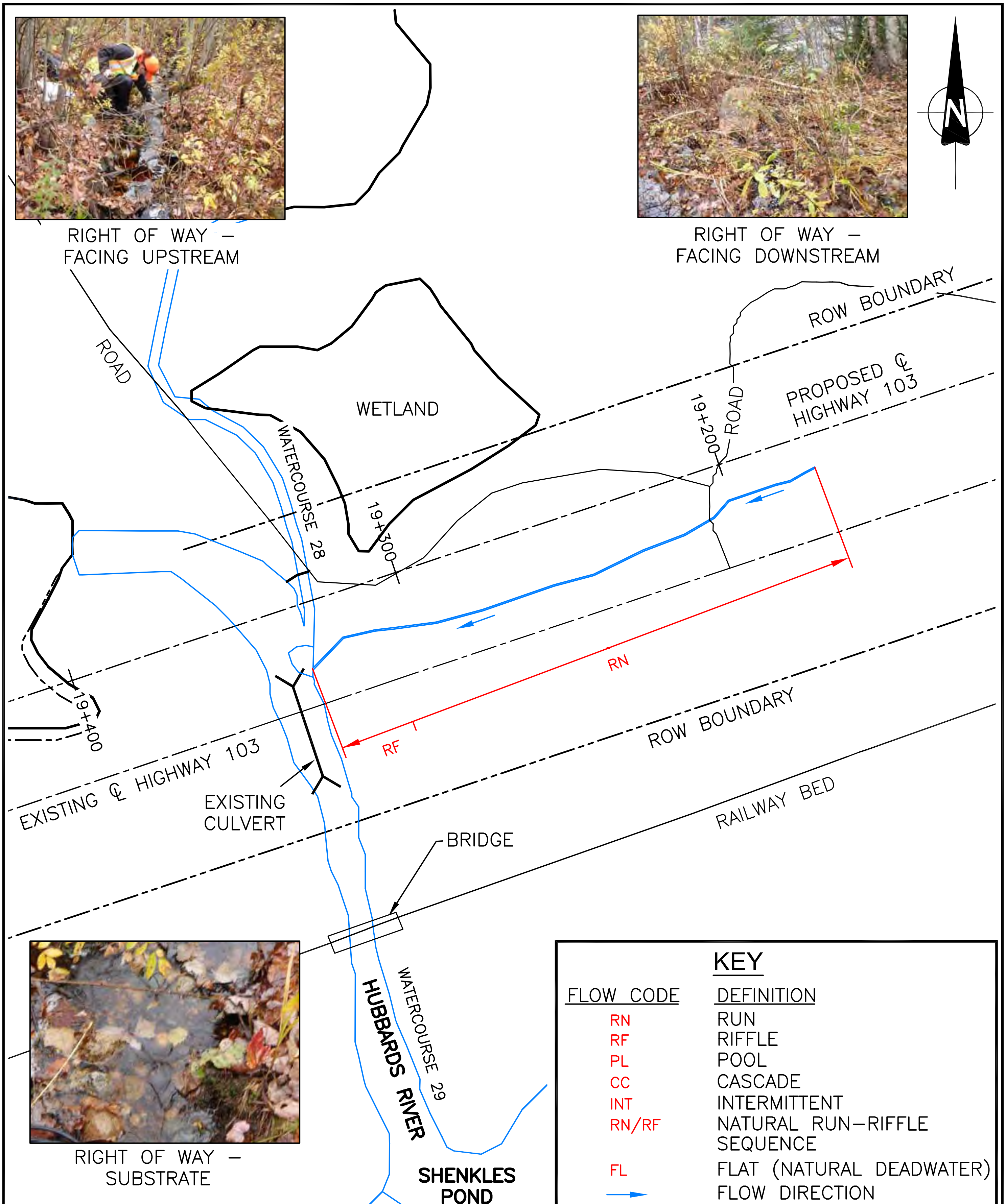
WATERCOURSE 29

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	29
Client:	NSTIR

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-28to30.dwg PRINTED: Aug 25, 2010



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

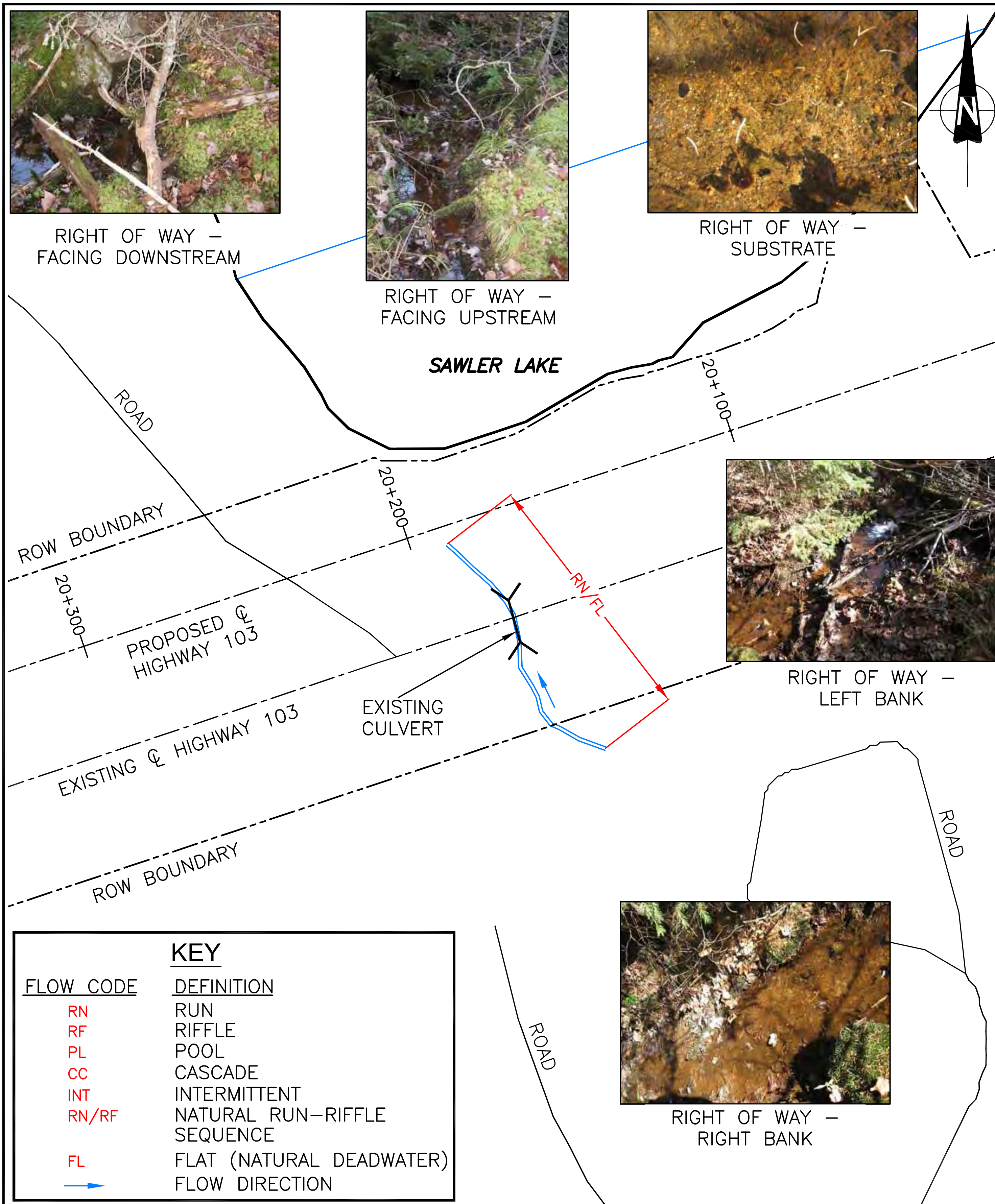
WATERCOURSE 30

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	30
Client:	NSTIR

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-28to30.dwg PRINTED: Aug 25, 2010



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

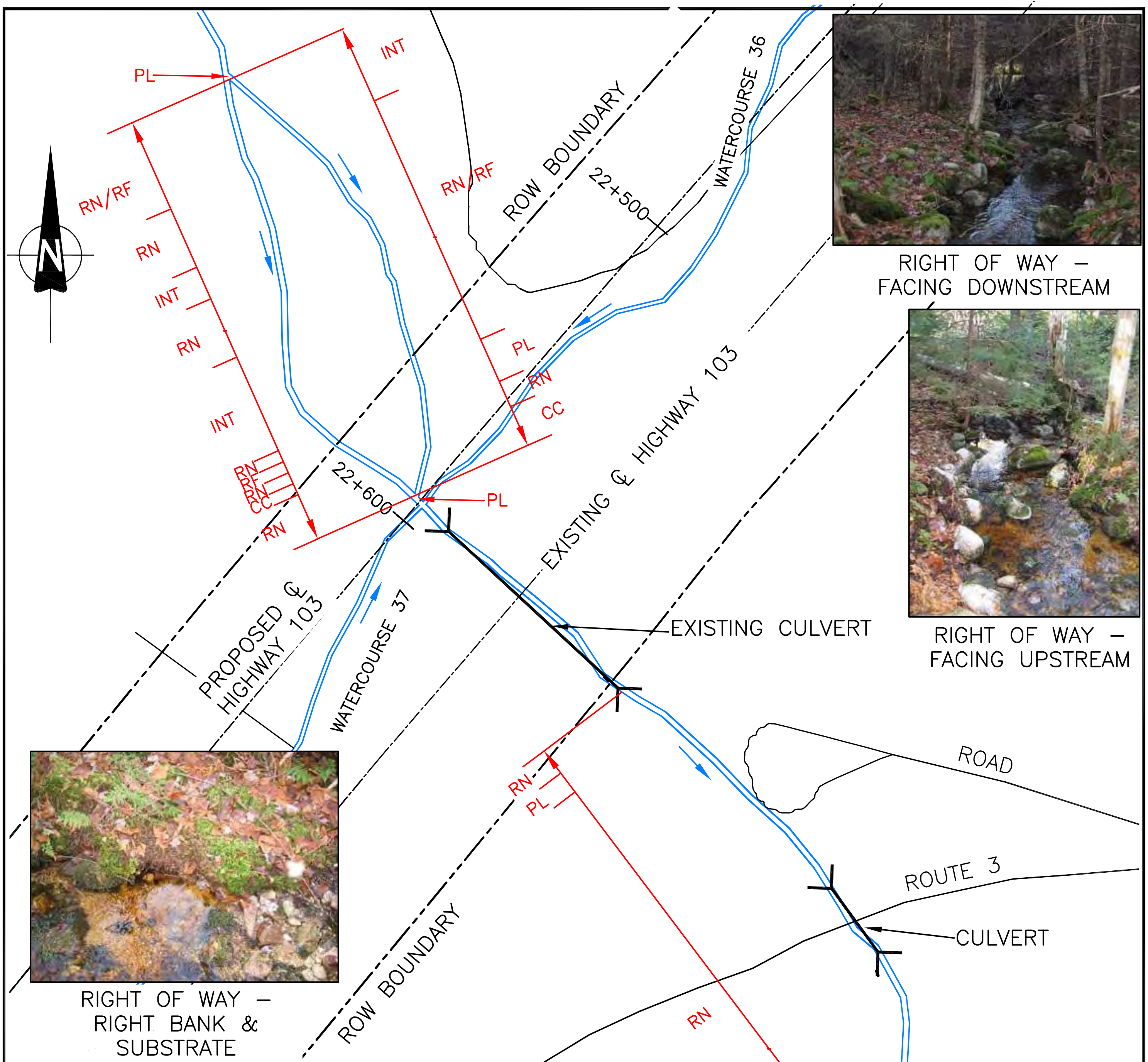
WATERCOURSE 33

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	33

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-31TO34.dwg PRINTED: Aug 25, 2010



KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

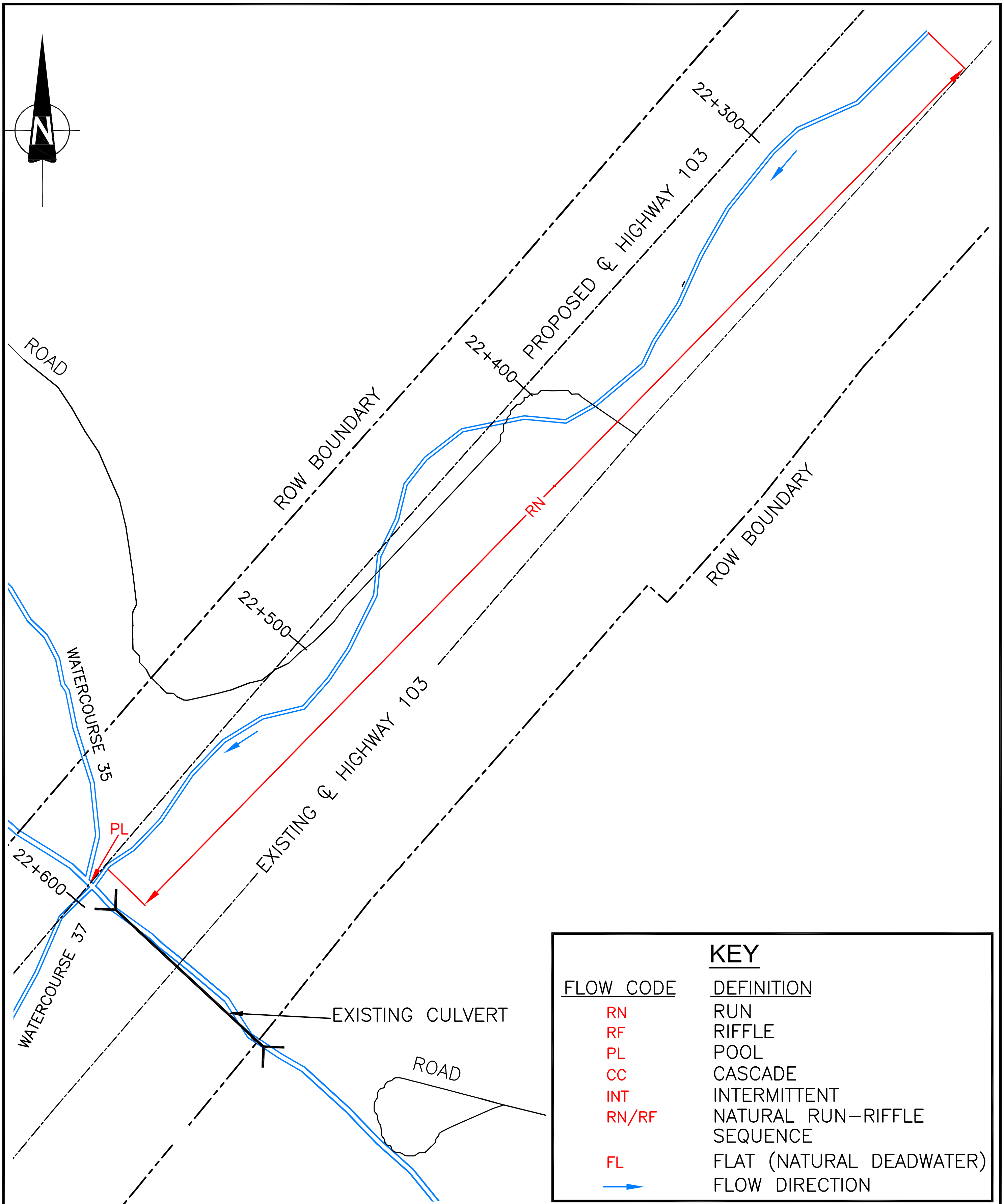
NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC LIMITED REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

WATERCOURSE 35

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	35

Stantec



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

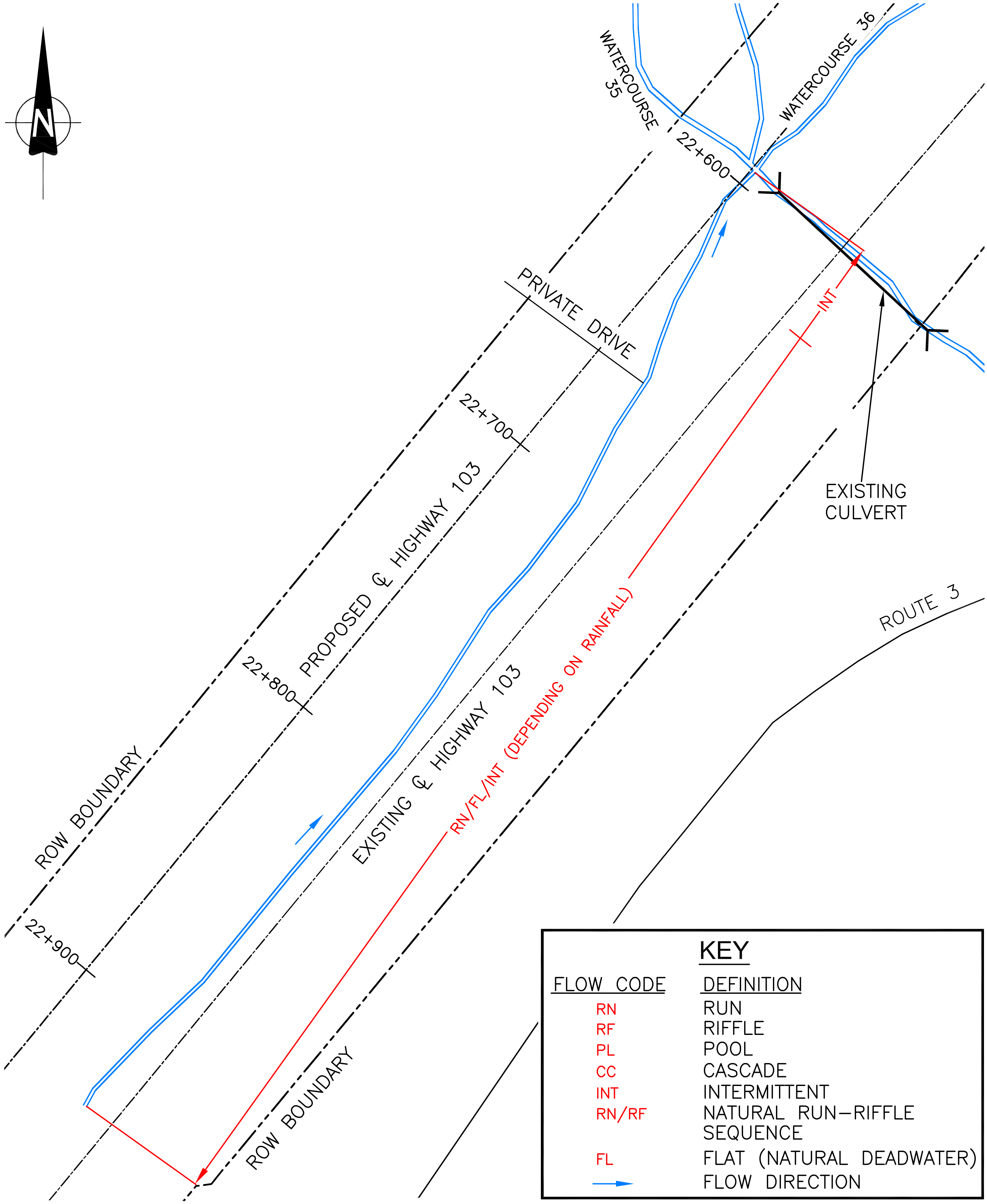
WATERCOURSE 36

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	36
Client:	NSTIR

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-35to37.dwg PRINTED: Aug 25, 2010



KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 37

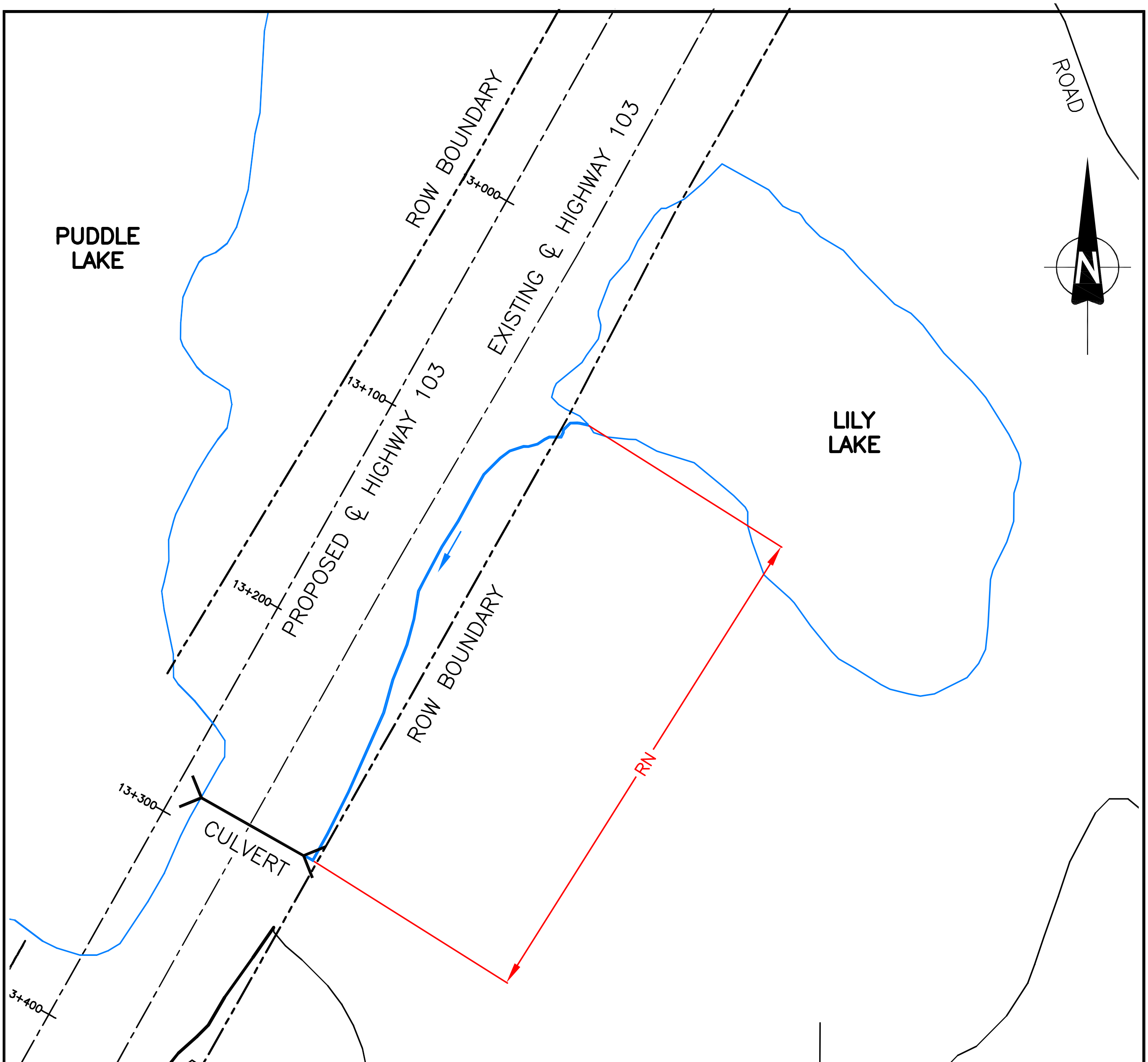
HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client: NSTIR

Job No.:	121510257
Scale:	1:1500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	37

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-35to37.dwg PRINTED: Aug 25, 2010



KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 39

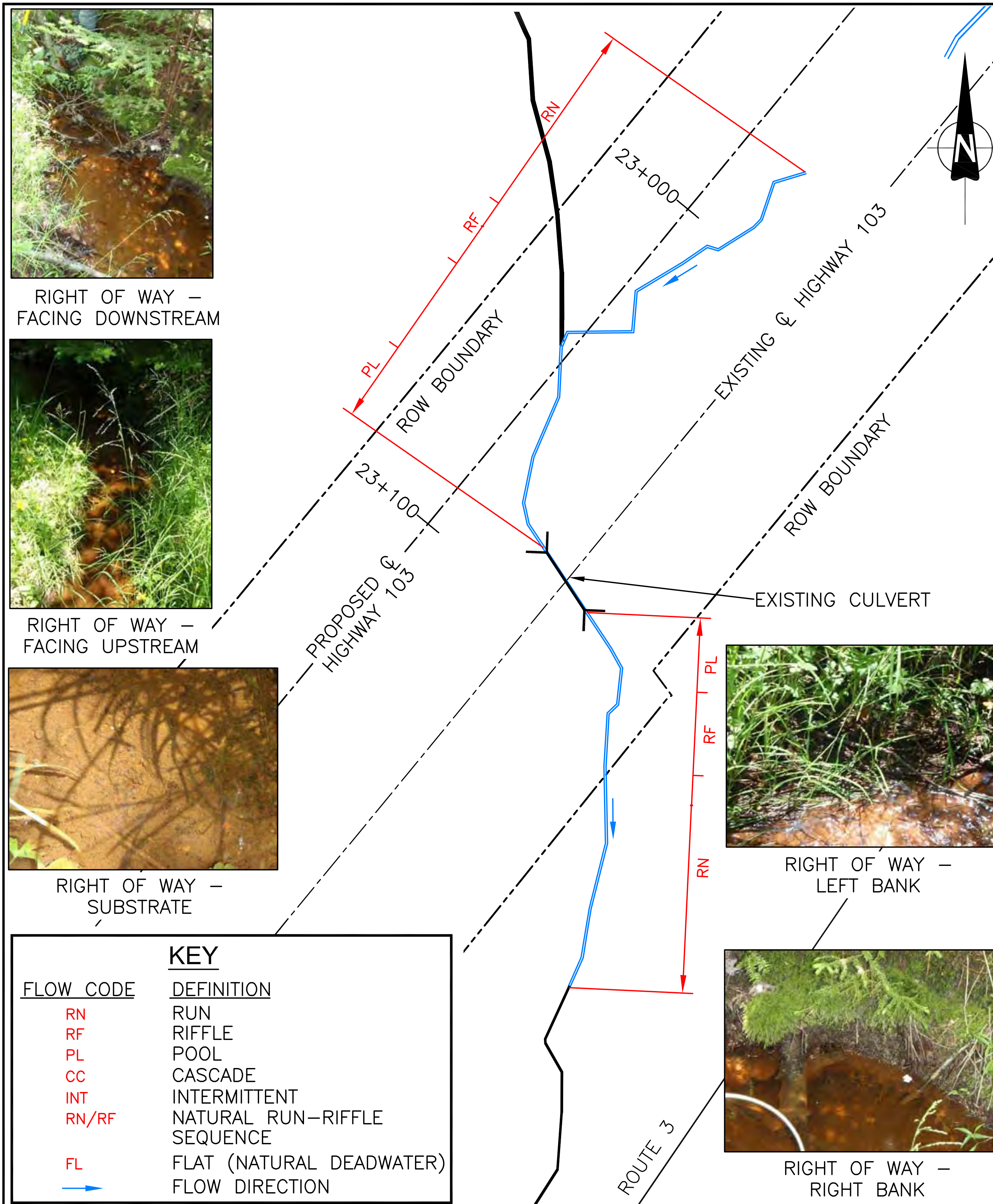
HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client: NSTIR

Job No.:	121510257
Scale:	1:2500
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	39

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-39.dwg PRINTED: Aug 25, 2010



RIGHT OF WAY – FACING DOWNSTREAM

RIGHT OF WAY – FACING UPSTREAM

RIGHT OF WAY – SUBSTRATE

RIGHT OF WAY – LEFT BANK

RIGHT OF WAY – RIGHT BANK

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

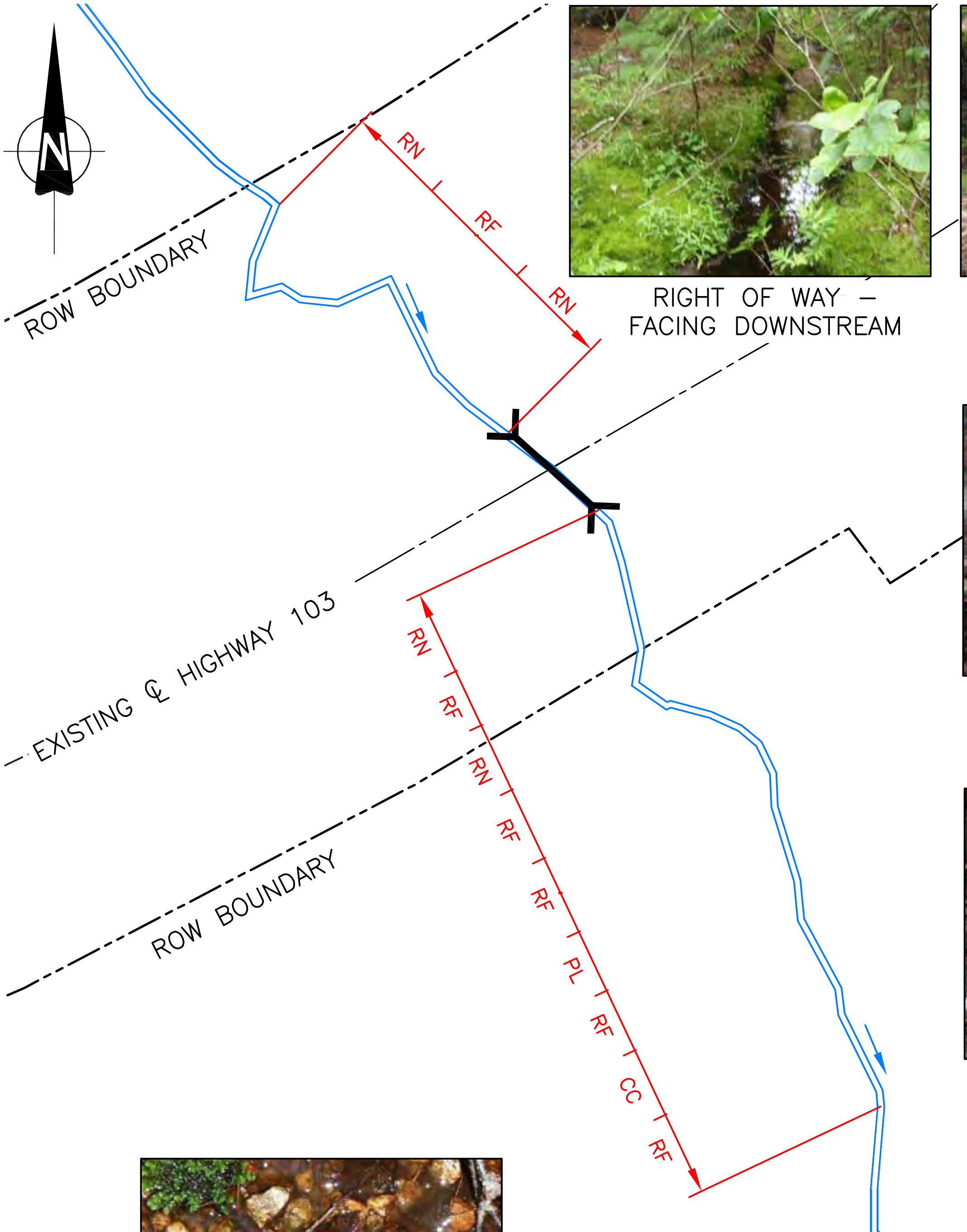
WATERCOURSE 41

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:1250
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	41

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-41&42.dwg PRINTED: Aug 25, 2010



RIGHT OF WAY – FACING DOWNSTREAM

RIGHT OF WAY – FACING UPSTREAM

RIGHT OF WAY – LEFT BANK AND SUBSTRATE

RIGHT OF WAY – RIGHT BANK

RIGHT OF WAY – SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 42

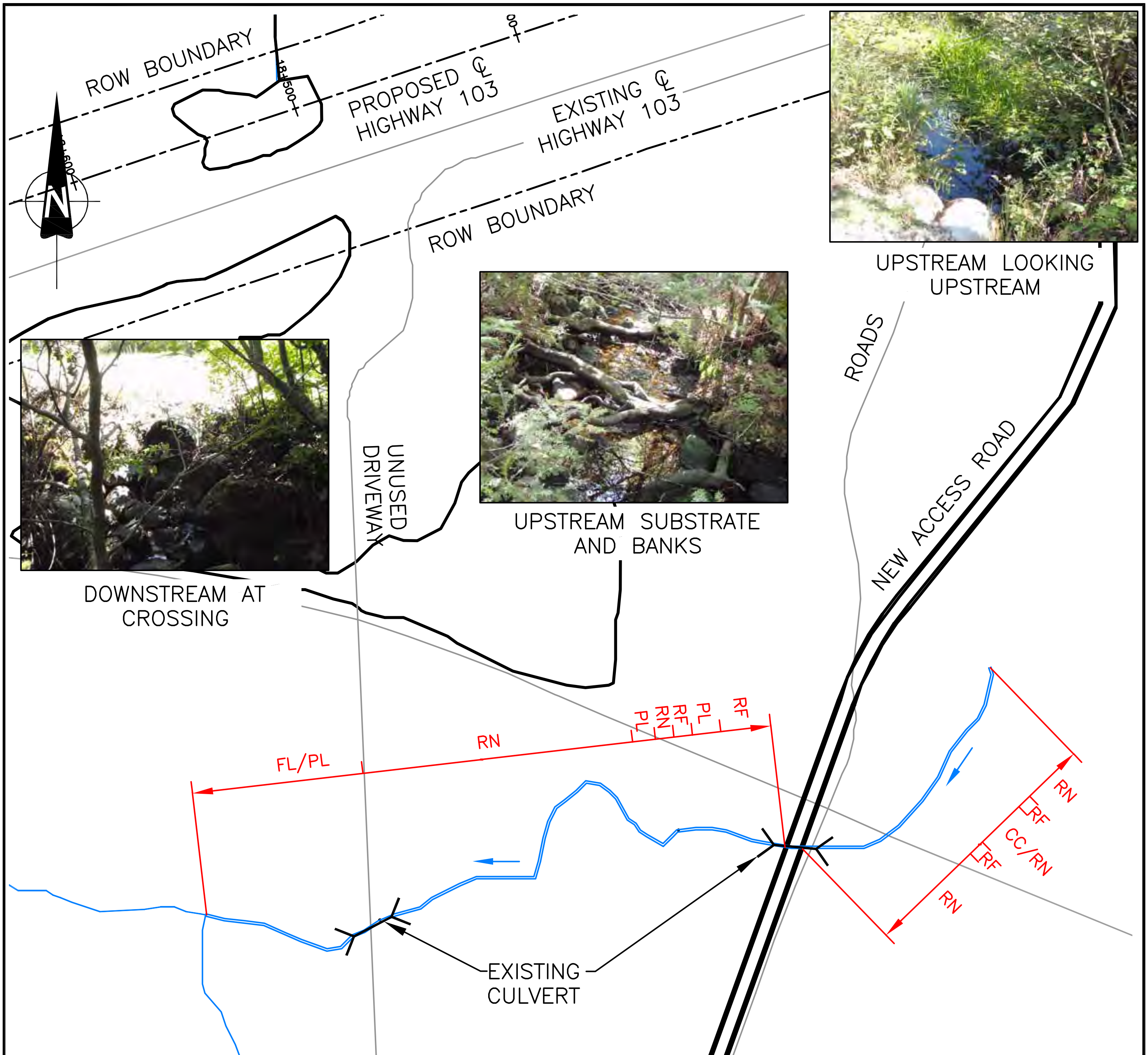
HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client: NSTIR

Job No.:	121510257
Scale:	1:1000
Date:	08/20/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	42

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-41&42.dwg PRINTED: Aug 25, 2010



DOWNSTREAM LOOKING DOWNSTREAM

SUBSTRATE

KEY

FLOW CODE	DEFINITION
RN	RUN
RF	RIFFLE
PL	POOL
CC	CASCADE
INT	INTERMITTENT
RN/RF	NATURAL RUN–RIFFLE SEQUENCE
FL	FLAT (NATURAL DEADWATER)
→	FLOW DIRECTION

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

WATERCOURSE 43

HIGHWAY 103 TWINNING PROJECT
UPPER TANTALLON TO HUBBARDS, N.S.

Client:	NSTIR
Job No.:	121510257
Scale:	1:5000
Date:	09/09/2010
Dwn. By:	SJT
App'd By:	JSS
Dwg. No.:	43

Stantec

T:\1215XXX\121510257 Hwy 103 Crossings\121510257-43.dwg PRINTED: Sep 09, 2010

Highway 103 – Lake Photo Appendix – 121510257

Watercourse 5: Mill Lake Backwater Pond – East Shoreline Watercourse 5: Mill Lake Backwater Pond – North Shoreline

Watercourse 5: Mill Lake Backwater Pond – West Shoreline Watercourse 5: Mill Lake Backwater Pond – South Shoreline

Watercourse 6: Mill Lake – East Shoreline

Watercourse 6: Mill Lake – North Shoreline

Watercourse 6: Mill Lake – West Shoreline

Watercourse 7: Little Indian Lake – East Shoreline

Watercourse 7: Little Indian Lake – North Shoreline

Watercourse 7: Little Indian Lake – West Shoreline

Watercourse 7: Little Indian Lake – Substrate

Watercourse 31: Dorey Lake – North Shoreline

Watercourse 31: Dorey Lake – East Shoreline

Watercourse 31: Dorey Lake – West Shoreline

Watercourse 31: Dorey Lake – South Shoreline

Watercourse 31: Dorey Lake – Substrate

Watercourse 32: Sawler Lake – North Shoreline

Watercourse 32: Sawler Lake – East Shoreline

Watercourse 32: Sawler Lake – West Shoreline

Watercourse 32: Sawler Lake– South Shoreline

Watercourse 32: Sawler Lake – Substrate

Watercourse 34: Dorey Lake – North Shoreline

Watercourse 34: Dorey Lake – West Shoreline

Watercourse 34: Dorey Lake – South Shoreline

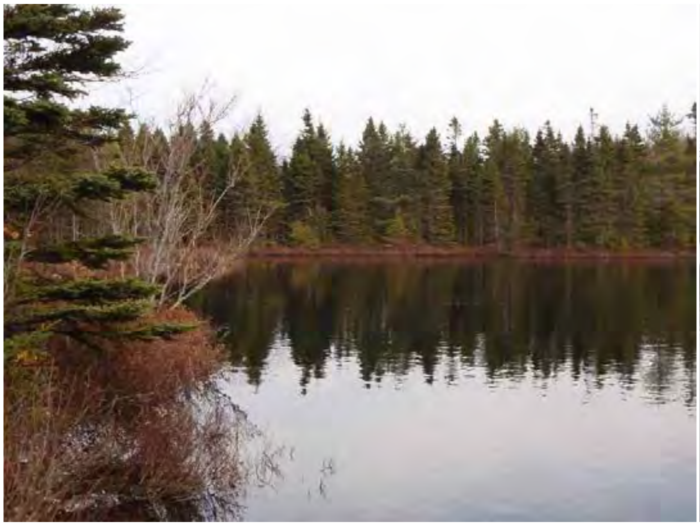
Watercourse 34: Dorey Lake – Substrate

Watercourse 38: Puddle Lake – West Shoreline

Watercourse 38: Puddle Lake – North Shoreline

Watercourse 38: Puddle Lake – East Shoreline

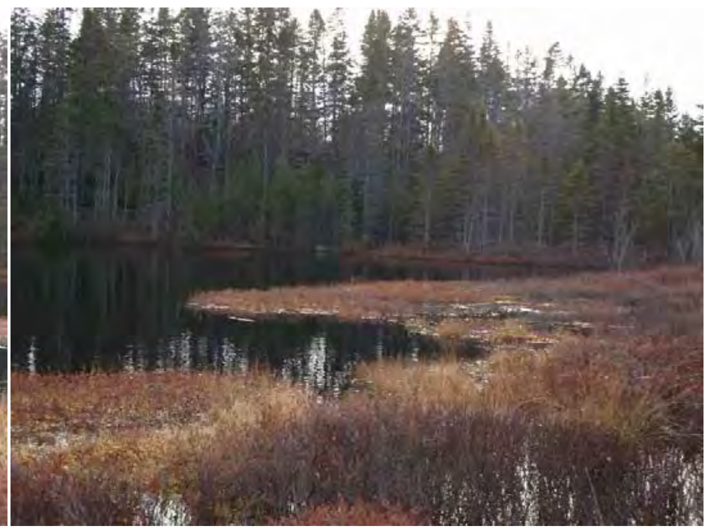
Watercourse 38: Puddle Lake – South Shoreline



Watercourse 39: Lily Lake – North Shoreline

Watercourse 39: Lily Lake – East Shoreline

Watercourse 39: Lily Lake – West Shoreline



Watercourse 39: Lily Lake – South Shoreline

Watercourse 39: Lily Lake – Substrate


Watercourse 40: The Puddle – North Shoreline


Watercourse 40: The Puddle – East Shoreline


Watercourse 40: The Puddle – West Shoreline


Watercourse 40: The Puddle – South Shoreline

APPENDIX G

TERRESTRIAL FIELD SURVEY RESULTS

Table 1 **Rare and Sensitive Plants Identified During the Modelling Exercise as Being Potentially Present in the Study Area and Information on their Habitat Preferences, Phenology, and Population Status in Nova Scotia**

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	COSEWIC Rank	NSESA Rank	Distance (km)
Small-Flower Bitter-Cress	*Cardamine parviflora var. arenicola*	Dry woods, shaded or exposed ledges, and in sandy soils.	April to August	S2	Sensitive			9 ±50.1
a Hawthorn	*Crataegus submollis*	Hedgerows, rarely in waste places.	June	S1?	Undetermined			16 ±10
Button-Bush Dodder	*Cuscuta cephalanthi*	Low-lying ground near seashore, often parasitic on Asters.	August and September	S1	May Be At Risk			7 ±0.1
Ovate Spikerush	*Eleocharis ovata*	Muddy shores and ditches.	Flowers/Fruit May to October	S2?	Sensitive			4 ±0.5
Boreal Felt Lichen	*Erioderma pedicellatum (Atlantic pop.)*	A population restricted to regions with a cool, humid, oceanic climate, highly sensitive to atmospheric pollutants such as acid precipitation. Limited observations suggest that boreal felt lichen most often occurs within 25 km of the sea coast at an elevation up to 500 m above sea level. Forest habitat is described by researchers as having low open crown closure due to natural forest dynamics. Typically found on north-facing trunks of mature and overmature balsam fir trees. Suitability of the habitat for occupation by the lichen may be increased if the forest is located on slopes with northern or northeastern exposure. In Nova Scotia, boreal felt lichen has occasionally been found living on white spruce (*Picea glauca*) and red maple (*Acer rubrum*) substrates in mixedwood stands.	Identifiable year round	S1S2	At Risk	Endangered	Endangered	13 ±5
Canada Frostweed	*Helianthemum canadense*	Sand barrens.	June to early July	S1	May Be At Risk		Endangered	13 ±1
Kalm's Hawkweed	*Hieracium kalmii*	Roadsides, rough ground, clearings and thickets.	Flowers July and August	S2?	Undetermined			17 ±5
Kalm's Hawkweed	*Hieracium kalmii var. kalmii*	Roadsides, rough ground, clearings and thickets.	July to October	S2?	Undetermined			16 ±10
Larger Canadian St. John's Wort	*Hypericum majus*	Wet or dry open soil.	July to September	S1	May Be At Risk			2 ±1
Acadian Quillwort	*Isoetes acadiensis*	Water up to 1 m deep, bordering lakes or ponds, and occasionally along rivers.	Megaspores required for identification.	S3	Sensitive			25 ±10
Dudley's Rush	*Juncus dudleyi*	Marshy ground.	June to September	S2?	Sensitive			20 ±1
Mountain Sandwort	*Minuartia groenlandica*	Granitic ledges and gravel, on coasts at higher elevations.	June to August	S2	Sensitive			18 ±0
Field Milkwort	*Polygala sanguinea*	Poor or acidic fields, damp slopes, and open woods or bush.	Late June to October.	S2S3	Sensitive			6 ±0.1
Small's Knotweed	*Polygonum buxiforme*	Sandy soils, not necessarily maritime.	Flowers July to September	S2S3	Undetermined			22 ±10

Table 1 **Rare and Sensitive Plants Identified During the Modelling Exercise as Being Potentially Present in the Study Area and Information on their Habitat Preferences, Phenology, and Population Status in Nova Scotia**

Common Name	Scientific Name	Preferred Habitat	Season	ACCDC Rank	NSDNR Rank	COSEWIC Rank	NSESA Rank	Distance (km)
Pondshore Knotweed	*Polygonum raii*	Coastal damp sands and gravels.	Likely July to September	S2S3	Undetermined			20 ±1
Ghost Antler Lichen	*Pseudevernia cladonia*	Occurs primarily in cool, humid, montane or coastal (and near-coastal) coniferous forests dominated by fir (*Abies balsamea, A. fraseri*) and (or) red spruce (*Picea rubens*). It is absent from more northerly boreal spruce-fir forests in which red spruce is replaced by black spruce (*P. mariana*) and/or white spruce (*P. glauca*). However, black spruce is present in some of the poorly drained coastal localities in New Brunswick and Nova Scotia. Key features of both the coastal and high elevation habitats of *P. cladonia* are their cool temperatures and their frequent and often prolonged immersion in fog or cloud. Where it occurs near the coast, *P. cladonia* is a species of humid, forest interiors, not wind-exposed headlands. The structure and topographic setting of its habitats in New Brunswick and Nova Scotia are otherwise quite variable.	Identifiable year-round	S2S3	Sensitive	Special Concern		16 ±10
Cut-Leaved Coneflower	*Rudbeckia laciniata var. gaspereauensis*	Swales, the edges of swamps, or in gullies - in small colonies.	August, can be identified when not in flower	S2	Undetermined			17 ±10
Yellow Nodding Ladies'-Tresses	*Spiranthes ochroleuca*	Characteristic of the driest sand barrens in southwestern counties. Also near rivers and in dry habitats such as roadsides and fields.	September to October	S2S3	Sensitive			7 ±10
Wavy-leaf American-Aster	*Symphyotrichum undulatum*	Old fields and the edges of thickets.	August and September	S2	Sensitive			23 ±10
American Germander	*Teucrium canadense*	Gravelly seashores, generally at crest of beach, above direct tidal influence.	Easiest to identify when flowering July to September, but identifiable from June to October	S3	Sensitive			7 ±0.5
Small Swollen Bladderwort	*Utricularia radiata*	Ponds and sluggish waters.	Flowers May to November	S3	Secure			9 ±1

Table 2 Locations of Plants listed as "S1" to "S3S4" within the Assessment Area

Common Name	Scientific Name	NSDNR Rank	ACCDC Rank	X	Y
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	414318	4943056
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	414244	4943023
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	415050	4943676
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	427899	4950944
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	418201	4944509
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	427856	4950905
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	426356	4949833
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	420686	4945755
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	414745	4943454
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	415071	4943668
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	429316	4950980
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	428707	4951202
Nova Scotia False-Foxglove	*Agalinis neoscotica*	Secure	S3	414256	4943094
Fernald's Hay Sedge	*Carex foenea*	Secure	S3?	415050	4943676
Fernald's Hay Sedge	*Carex foenea*	Secure	S3?	415050	4943676
Fernald's Hay Sedge	*Carex foenea*	Secure	S3?	415025	4943677
Fernald's Hay Sedge	*Carex foenea*	Secure	S3?	415024	4943669
Fernald's Hay Sedge	*Carex foenea*	Secure	S3?	427620	4950751
Early Coralroot	*Corallorhiza trifida*	Secure	S3	414342	4942896
Early Coralroot	*Corallorhiza trifida*	Secure	S3	414348	4942871
Purple Crowberry	*Empetrum eamesii ssp. eamesii*	Sensitive	S2S3	420719	4945787
Rough Horsetail	*Equisetum hyemale*	Secure	S3S4	416720	4944224
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	420756	4945812
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	420738	4945770
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	420814	4945896
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	420813	4945896
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	420806	4945884
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	420733	4945772
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	429824	4950608
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	429821	4950609
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	420769	4945830
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	429504	4950834
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	429843	4950625
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	420711	4945780
Greene's Rush	*Juncus greenei*	May Be At Risk	S1S2	420702	4945721
Woods-Rush	*Juncus subcaudatus*	Sensitive	S3	426920	4950178
Woods-Rush	*Juncus subcaudatus*	Sensitive	S3	416187	4944066
Woods-Rush	*Juncus subcaudatus*	Sensitive	S3	416288	4944098
Woods-Rush	*Juncus subcaudatus*	Sensitive	S3	426901	4950216
Woods-Rush	*Juncus subcaudatus*	Sensitive	S3	415847	4943904
Woods-Rush	*Juncus subcaudatus*	Sensitive	S3	416187	4944066
Woods-Rush	*Juncus subcaudatus*	Sensitive	S3	416288	4944098
Woods-Rush	*Juncus subcaudatus*	Sensitive	S3	415847	4943904
Loesel's Twayblade	*Liparis loeselii*	Secure	S3S4	428514	4951180
Loesel's Twayblade	*Liparis loeselii*	Secure	S3S4	428622	4951198
Loesel's Twayblade	*Liparis loeselii*	Secure	S3S4	428839	4951209
Loesel's Twayblade	*Liparis loeselii*	Secure	S3S4	428658	4951226
Loesel's Twayblade	*Liparis loeselii*	Secure	S3S4	428514	4951180
Loesel's Twayblade	*Liparis loeselii*	Secure	S3S4	428622	4951198
Loesel's Twayblade	*Liparis loeselii*	Secure	S3S4	428839	4951209
Loesel's Twayblade	*Liparis loeselii*	Secure	S3S4	428658	4951226
Southern Twayblade	*Listera australis*	May Be At Risk	S2	426460	4949871
Southern Twayblade	*Listera australis*	May Be At Risk	S2	426457	4949875
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418790	4944544
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418791	4944543
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418819	4944544
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418818	4944543
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418812	4944545
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418818	4944527
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418817	4944527
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418817	4944506
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418816	4944508
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418782	4944497

Table 2 Locations of Plants listed as "S1" to "S3S4" within the Assessment Area

Common Name	Scientific Name	NSDNR Rank	ACCDC Rank	X	Y
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418773	4944512
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418766	4944505
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418660	4944651
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418659	4944650
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418657	4944659
Southern Twayblade	*Listera australis*	May Be At Risk	S2	418658	4944669
Whorled Loosestrife	*Lysimachia quadrifolia*	na	na	428334	4951137
Whorled Loosestrife	*Lysimachia quadrifolia*	na	na	428299	4951124
Whorled Loosestrife	*Lysimachia quadrifolia*	na	na	428291	4951128
Whorled Loosestrife	*Lysimachia quadrifolia*	na	na	428291	4951127
Field Milkwort	*Polygala sanguinea*	Sensitive	S2S3	420769	4945827
Field Milkwort	*Polygala sanguinea*	Sensitive	S2S3	420769	4945831
Field Milkwort	*Polygala sanguinea*	Sensitive	S2S3	420782	4945846
Field Milkwort	*Polygala sanguinea*	Sensitive	S2S3	420705	4945720
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	Secure	S3S4	418438	4944473
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	Secure	S3S4	417455	4944430
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	Secure	S3S4	418666	4944459
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	Secure	S3S4	418691	4944491
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	Secure	S3S4	418631	4944483
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	Secure	S3S4	418438	4944473
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	Secure	S3S4	417455	4944430
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	Secure	S3S4	418666	4944459
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	Secure	S3S4	418691	4944491
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	Secure	S3S4	418631	4944483
Swamp Rose	*Rosa palustris*	Secure	S3	414254	4943070
Small Swollen Bladderwort	*Utricularia radiata*	Secure	S3	416128	4944080
Small Swollen Bladderwort	*Utricularia radiata*	Secure	S3	416291	4944092

Table 3 Plant Species Recorded in Project Area and Information on their Population Status within Nova Scotia

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Balsam Fir	*Abies balsamea*	S5	Secure
Striped Maple	*Acer pensylvanicum*	S5	Secure
Red Maple	*Acer rubrum*	S5	Secure
Sugar Maple	*Acer saccharum*	S5	Secure
Mountain Maple	*Acer spicatum*	S5	Secure
Common Yarrow	*Achillea millefolium*	S5	Secure
Bishops Goutweed	*Aegopodium podagraria*	SNA	Exotic
Horse Chestnut	*Aesculus hippocastanum*	SNA	Exotic
Nova Scotia False-Foxglove	*Agalinis neoscotica*	S3	Secure
Brown Bentgrass	*Agrostis canina*	SNA	Exotic
Colonial Bentgrass	*Agrostis capillaris*	SNA	Exotic
Black Bentgrass	*Agrostis gigantea*	SNA	Exotic
Perennial Bentgrass	*Agrostis perennans*	S4S5	Secure
Rough Bentgrass	*Agrostis scabra*	S5	Secure
Spreading Bentgrass	*Agrostis stolonifera*	S5	Secure
European Alder	*Alnus glutinosa*	SNA	Exotic
Speckled Alder	*Alnus incana*	S5	Secure
Green Alder	*Alnus viridis*	S5	Secure
Annual Ragweed	*Ambrosia artemisiifolia*	S5	Secure
Bartram Shadbush	*Amelanchier bartramiana*	S5	Secure
Oblong-Leaf Serviceberry	*Amelanchier canadensis*	S4?	Secure
Shadbush	*Amelanchier interior*	S4S5	Secure
Allegheny Service-Berry	*Amelanchier laevis*	S5	Secure
Running Serviceberry	*Amelanchier x intermedia*	SNA	Not Assessed
American Beachgrass	*Ammophila breviligulata*	S5	Secure
Pearly Everlasting	*Anaphalis margaritacea*	S5	Secure
Bog Rosemary	*Andromeda polifolia*	S5	Secure
Pussy-Toes	*Antennaria howellii ssp. neodioica*	S5	Secure
Sweet Vernal Grass	*Anthoxanthum odoratum*	SNA	Exotic
American Groundnut	*Apios americana*	S5	Secure
Spreading Dogbane	*Apocynum androsaemifolium*	S5	Secure
Bristly Sarsaparilla	*Aralia hispida*	S5	Secure
Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure
Bearberry	*Arctostaphylos uva-ursi*	S4	Secure
Silverweed	*Argentina anserina*	S5	Secure
Egede Cinquefoil	*Argentina egedii*	S4S5	Secure
Lady-Fern	*Athyrium filix-femina*	S5	Secure
Yellow Birch	*Betula alleghaniensis*	S5	Secure
Paper Birch	*Betula papyrifera*	S5	Secure
Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure
Gray Birch	*Betula populifolia*	S5	Secure
Purple-Stem Swamp Beggar-Ticks	*Bidens connata*	S4	Secure
Devil's Beggar-Ticks	*Bidens frondosa*	S5	Secure
Bearded Short-Husk	*Brachyelytrum septentrionale*	S5	Secure
Watershield	*Brasenia schreberi*	S5	Secure
Awnless Brome	*Bromus inermis*	SNA	Exotic
Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure
Pickering's Reed Bent-Grass	*Calamagrostis pickeringii*	S4S5	Secure
Vernal Water Starwort	*Callitriche palustris*	S5	Secure
Tuberous Grass-Pink	*Calopogon tuberosus*	S4	Secure
Hedge Bindweed	*Calystegia sepium*	S5	Secure
Marijuana	*Cannabis sativa*	SNA	na
Emmons Sedge	*Carex albicans var. emmonsii*	S4	Secure
Water Sedge	*Carex aquatilis*	S5	Secure
Black Sedge	*Carex arctata*	S5	Secure
Prickly Bog Sedge	*Carex atlantica*	S4	Secure

Table 3 Plant Species Recorded in Project Area and Information on their Population Status within Nova Scotia

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Brownish Sedge	*Carex brunnescens*	S5	Secure
Buxbaum's Sedge	*Carex buxbaumii*	S4	Secure
Hoary Sedge	*Carex canescens*	S5	Secure
Fibrous-Root Sedge	*Carex communis*	S5	Secure
Crawford Sedge	*Carex crawfordii*	S5	Secure
Fringed Sedge	*Carex crinita*	S5	Secure
White-Edge Sedge	*Carex debilis*	S5	Secure
Short-Stemmed Sedge	*Carex deflexa*	S4	Secure
Softleaf Sedge	*Carex disperma*	S5	Secure
Little Prickly Sedge	*Carex echinata*	S5	Secure
Coast Sedge	*Carex exilis*	S4	Secure
Fernald's Hay Sedge	*Carex foenea*	S3?	Secure
Long Sedge	*Carex folliculata*	S5	Secure
Graceful Sedge	*Carex gracillima*	S4S5	Secure
A Sedge	*Carex gynandra*	S5	Secure
Marsh Straw Sedge	*Carex hormathodes*	S4S5	Secure
Bladder Sedge	*Carex intumescens*	S5	Secure
Lake-Bank Sedge	*Carex lacustris*	S4	Secure
Slender Sedge	*Carex lasiocarpa*	S5	Secure
Shore Sedge	*Carex lenticularis*	S4	Secure
Bristly-Stalk Sedge	*Carex leptalea*	S5	Secure
Shallow Sedge	*Carex lurida*	S5	Secure
A Sedge	*Carex magellanica ssp. irrigua*	S5	Secure
Black Sedge	*Carex nigra*	S5	Secure
New England Sedge	*Carex novae-angliae*	S5	Secure
Few-Seeded Sedge	*Carex oligosperma*	S5	Secure
Chaffy Sedge	*Carex paleacea*	S5	Secure
Pale Sedge	*Carex pallescens*	S5	Secure
Necklace Sedge	*Carex projecta*	S5	Secure
Cyperus-Like Sedge	*Carex pseudocyperus*	S4S5	Secure
Pointed Broom Sedge	*Carex scoparia*	S5	Secure
Sea-Beach Sedge	*Carex silicea*	S4S5	Secure
Stalk-Grain Sedge	*Carex stipata*	S5	Secure
Tussock Sedge	*Carex stricta*	S5	Secure
Shaved Sedge	*Carex tonsa*	S5	Secure
Three-Seed Sedge	*Carex trisperma*	S5	Secure
Bear Sedge	*Carex utriculata*	S5	Secure
Little Green Sedge	*Carex viridula*	S4	Secure
Black Starthistle	*Centaurea nigra*	SNA	Exotic
Common Mouse-Ear Chickweed	*Cerastium fontanum*	SNA	Exotic
Leatherleaf	*Chamaedaphne calyculata*	S5	Secure
Fireweed	*Chamerion angustifolium*	S5	Secure
White Turtlehead	*Chelone glabra*	S5	Secure
Spotted Water-Hemlock	*Cicuta maculata*	S5	Secure
Small Enchanter's Nightshade	*Circaea alpina*	S5	Secure
Clinton Lily	*Clintonia borealis*	S5	Secure
Marsh Cinquefoil	*Comarum palustre*	S5	Secure
Sweet Fern	*Comptonia peregrina*	S5	Secure
Canada Horseweed	*Conyza canadensis*	S5	Secure
Goldthread	*Coptis trifolia*	S5	Secure
Early Coralroot	*Corallorhiza trifida*	S3	Secure
Broom Crowberry	*Corema conradii*	S4	Secure
Dwarf Dogwood	*Cornus canadensis*	S5	Secure
Beaked Hazelnut	*Corylus cornuta*	S5	Secure
A Hawthorn	*Crataegus monogyna*	SNA	Exotic
Pink Lady's-Slipper	*Cypripedium acaule*	S5	Secure

Table 3 Plant Species Recorded in Project Area and Information on their Population Status within Nova Scotia

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Orchard Grass	*Dactylis glomerata*	SNA	Exotic
Robin Runaway	*Dalibarda repens*	S5	Secure
Flattened Oatgrass	*Danthonia compressa*	S5	Secure
Poverty Oat-Grass	*Danthonia spicata*	S5	Secure
Wild Carrot	*Daucus carota*	SNA	Exotic
Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure
Tufted Hairgrass	*Deschampsia caespitosa*	S4	Secure
Crinkled Hairgrass	*Deschampsia flexuosa*	S5	Secure
Deptford-Pink	*Dianthus armeria*	SNA	Exotic
Panic Grass	*Dichanthelium acuminatum*	S5	Secure
Northern Witchgrass	*Dichanthelium boreale*	S5	Secure
Northern Bush-Honeysuckle	*Diervilla lonicera*	S5	Secure
Hairy Crabgrass	*Digitaria sanguinalis*	SNA	Exotic
Parasol White-Top	*Doellingeria umbellata*	S5	Secure
Spoon-Leaved Sundew	*Drosera intermedia*	S5	Secure
Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure
Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Secure
Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure
Crested Shield-Fern	*Dryopteris cristata*	S5	Secure
Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure
a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed
a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed
Three-Way Sedge	*Dulichium arundinaceum*	S5	Secure
Barnyard Grass	*Echinochloa crus-galli*	SNA	Exotic
Least Spike-Rush	*Eleocharis acicularis*	S5	Secure
Salt-Marsh Spike-Rush	*Eleocharis halophila*	S4S5	Secure
Blunt Spike-Rush	*Eleocharis obtusa*	S5	Secure
Creeping Spike-Rush	*Eleocharis palustris*	S5	Secure
Small Spikerush	*Eleocharis parvula*	S4	Secure
Robbins Spikerush	*Eleocharis robbinsii*	S4	Secure
Quackgrass	*Elymus repens*	SNA	Exotic
Virginia Wild-Rye	*Elymus virginicus*	S5	Secure
Purple Crowberry	*Empetrum eamesii ssp. eamesii*	S2S3	Sensitive
Black Crowberry	*Empetrum nigrum*	S5	Secure
Trailing Arbutus	*Epigaea repens*	S5	Secure
Hairy Willow-Herb	*Epilobium ciliatum*	S5	Secure
Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Secure
Marsh Willow-Herb	*Epilobium palustre*	S5	Secure
Field Horsetail	*Equisetum arvense*	S5	Secure
Water Horsetail	*Equisetum fluviatile*	S5	Secure
Rough Horsetail	*Equisetum hyemale*	S3S4	Secure
Woodland Horsetail	*Equisetum sylvaticum*	S5	Secure
Fireweed	*Erechtites hieraciifolia*	S5	Secure
White-Top Fleabane	*Erigeron annuus*	S4S5	Secure
Daisy Fleabane	*Erigeron strigosus*	S5	Secure
Seven-Angled Pipewort	*Eriocaulon aquaticum*	S5	Secure
Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*	S5	Secure
Rough Cotton-Grass	*Eriophorum tenellum*	S4S5	Secure
Tussock Cotton-Grass	*Eriophorum vaginatum*	S5	Secure
Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure
Common Boneset	*Eupatorium perfoliatum*	S5	Secure
Common Eyebright	*Euphrasia nemorosa*	S5	Secure
Drug Eyebright	*Euphrasia stricta*	SNA	Exotic
Rough-Leaved Aster	*Eurybia radula*	S5	Secure
Grass-Leaved Goldenrod	*Euthamia caroliniana*	S4	Secure
a Goldenrod	*Euthamia galetorum*	na	na

Table 3 Plant Species Recorded in Project Area and Information on their Population Status within Nova Scotia

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure
American Beech	*Fagus grandifolia*	S5	Secure
Hair Fescue	*Festuca filiformis*	SNA	Exotic
Red Fescue	*Festuca rubra*	S5	Secure
Virginia Strawberry	*Fragaria virginiana*	S5	Secure
Glossy Buckthorn	*Frangula alnus*	SNA	Exotic
White Ash	*Fraxinus americana*	S5	Secure
Brittle-Stem Hempnettle	*Galeopsis tetrahit*	SNA	Exotic
Rough Bedstraw	*Galium asprellum*	S5	Secure
Marsh Bedstraw	*Galium palustre*	S5	Secure
Stiff Marsh Bedstraw	*Galium tinctorium*	S5	Secure
Small Bedstraw	*Galium trifidum*	S5	Secure
Creeping Snowberry	*Gaultheria hispidula*	S5	Secure
Teaberry	*Gaultheria procumbens*	S5	Secure
Black Huckleberry	*Gaylussacia baccata*	S5	Secure
Small Floating Manna-Grass	*Glyceria borealis*	S5	Secure
Canada Manna-Grass	*Glyceria canadensis*	S5	Secure
American Mannagrass	*Glyceria grandis*	S4S5	Secure
Northern Mannagrass	*Glyceria laxa*	S4?	Secure
Blunt Manna-Grass	*Glyceria obtusa*	S4	Secure
Fowl Manna-Grass	*Glyceria striata*	S5	Secure
Low Cudweed	*Gnaphalium uliginosum*	SNA	Exotic
Northern Oak Fern	*Gymnocarpium dryopteris*	S5	Secure
American Witch-Hazel	*Hamamelis virginiana*	S5	Secure
Orange Hawkweed	*Hieracium aurantiacum*	SNA	Exotic
Meadow Hawkweed	*Hieracium caespitosum*	SNA	Exotic
Canada Hawkweed	*Hieracium canadense*	S4S5	Secure
Common Hawkweed	*Hieracium lachenalii*	SNA	Exotic
Mouseear	*Hieracium pilosella*	SNA	Exotic
Tall Hawkweed	*Hieracium piloselloides*	SNA	Exotic
Smoothish Hawkweed	*Hieracium x floribundum*	SNA	Exotic
Fox-Tail Barley	*Hordeum jubatum*	S5	Secure
Common Bluets	*Houstonia caerulea*	S5	Secure
Northern St. John's-Wort	*Hypericum boreale*	S5	Secure
Canadian St. John's-Wort	*Hypericum canadense*	S5	Secure
Pale St. John's-Wort	*Hypericum ellipticum*	S5	Secure
Orange-Grass St. John's-Wort	*Hypericum gentianoides*	SNA	Exotic
Slender St. John's-Wort	*Hypericum mutilum*	S4S5	Secure
A St. John's-Wort	*Hypericum perforatum*	SNA	Exotic
Black Holly	*Ilex verticillata*	S5	Secure
Spotted Jewel-Weed	*Impatiens capensis*	S5	Secure
Blueflag	*Iris versicolor*	S5	Secure
Spiny-Spored Quillwort	*Isoetes echinospora*	S5	Secure
Jointed Rush	*Juncus articulatus*	S5	Secure
Baltic Rush	*Juncus balticus*	S5	Secure
Narrow-Panicled Rush	*Juncus brevicaudatus*	S5	Secure
Toad Rush	*Juncus bufonius*	S5	Secure
Canada Rush	*Juncus canadensis*	S5	Secure
Soft Rush	*Juncus effusus*	S5	Secure
A Rush	*Juncus effusus var. solutus*	S5	Secure
Thread Rush	*Juncus filiformis*	S5	Secure
Black-Grass Rush	*Juncus gerardii*	S5	Secure
Greene's Rush	*Juncus greenei*	S1S2	May Be At Risk
Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure
Woods-Rush	*Juncus subcaudatus*	S3	Sensitive
Slender Rush	*Juncus tenuis*	S5	Secure

Table 3 Plant Species Recorded in Project Area and Information on their Population Status within Nova Scotia

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Ground Juniper	*Juniperus communis*	S5	Secure
Sheep-Laurel	*Kalmia angustifolia*	S5	Secure
Pale Laurel	*Kalmia polifolia*	S5	Secure
Tall Blue Lettuce	*Lactuca biennis*	S5	Secure
Canada Lettuce	*Lactuca canadensis*	S5	Secure
American Larch	*Larix laricina*	S5	Secure
Narrowleaf Pinweed	*Lechea intermedia*	S4	Secure
Common Labrador Tea	*Ledum groenlandicum*	S5	Secure
Rice Cutgrass	*Leersia oryzoides*	S5	Secure
Lesser Duckweed	*Lemna minor*	SNA	na
Autumn Hawkbit	*Leontodon autumnalis*	SNA	Exotic
Oxeye Daisy	*Leucanthemum vulgare*	SNA	Exotic
Butter-And-Eggs	*Linaria vulgaris*	SNA	Exotic
Twinflower	*Linnaea borealis*	S5	Secure
Loesel's Twayblade	*Liparis loeselii*	S3S4	Secure
Southern Twayblade	*Listera australis*	S2	May Be At Risk
Broad-Leaved Twayblade	*Listera convallarioides*	S4	Secure
Water Lobelia	*Lobelia dortmanna*	S5	Secure
Indian-Tobacco	*Lobelia inflata*	S5	Secure
Perennial Ryegrass	*Lolium perenne*	SNA	Exotic
Meadow Rye Grass	*Lolium pratense*	SNA	Exotic
American Fly-Honeysuckle	*Lonicera canadensis*	S5	Secure
Mountain Fly-Honeysuckle	*Lonicera villosa*	S4S5	Secure
Birds-Foot Trefoil	*Lotus corniculatus*	SNA	Exotic
Large-Leaved Lupine	*Lupinus polyphyllus*	SNA	Exotic
Common Woodrush	*Luzula multiflora*	S5	Secure
Ragged-Robin	*Lychnis flos-cuculi*	SNA	Exotic
Bog Clubmoss	*Lycopodiella inundata*	S5	Secure
Running Pine	*Lycopodium clavatum*	S5	Secure
Treelike Clubmoss	*Lycopodium dendroideum*	S5	Secure
Fan Club-Moss	*Lycopodium digitatum*	S5	Secure
Tree Clubmoss	*Lycopodium obscurum*	S4S5	Secure
American Bugleweed	*Lycopus americanus*	S5	Secure
Northern Bugleweed	*Lycopus uniflorus*	S5	Secure
Fringed Loosestrife	*Lysimachia ciliata*	S4	Secure
Whorled Loosestrife	*Lysimachia quadrifolia*	na	na
Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure
Purple Loosestrife	*Lythrum salicaria*	SNA	Exotic
Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure
Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S5	Secure
Common Apple	*Malus pumila*	SNA	Exotic
Running Cheeseweed	*Malva rotundifolia*	SNA	Exotic
Pineapple-Weed Chamomile	*Matricaria discoidea*	SNA	Exotic
Indian Cucumber-Root	*Medeola virginiana*	S5	Secure
American Cow-Wheat	*Melampyrum lineare*	S5	Secure
Yellow Sweetclover	*Melilotus officinalis*	SNA	Exotic
Partridge-Berry	*Mitchella repens*	S5	Secure
Grove Sandwort	*Moehringia lateriflora*	S5	Secure
Green Carpet-Weed	*Mollugo verticillata*	SNA	Exotic
One-Flower Wintergreen	*Moneses uniflora*	S5	Secure
American Pinesap	*Monotropa hypopithys*	S4	Secure
Indian-Pipe	*Monotropa uniflora*	S5	Secure
Northern Bayberry	*Morella pensylvanica*	S5	Secure
Fall Dropseed Muhly	*Muhlenbergia uniflora*	S5	Secure
Sweet Bayberry	*Myrica gale*	S5	Secure
a Water-milfoil	*Myriophyllum sp.*	na	na

Table 3 Plant Species Recorded in Project Area and Information on their Population Status within Nova Scotia

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Mountain Holly	*Nemopanthus mucronatus*	S5	Secure
Yellow Pond-Lily	*Nuphar lutea*	S5	Secure
Old-Field Toadflax	*Nuttallanthus canadensis*	SNA	Exotic
American Water-Lily	*Nymphaea odorata*	S5	Secure
Floating-Heart	*Nymphoides cordata*	S5	Secure
Whorled Aster	*Oclemena acuminata*	S5	Secure
Bog Aster	*Oclemena nemoralis*	S5	Secure
a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure
Red Odontites	*Odontites vernus*	SNA	Exotic
Common Evening-Primrose	*Oenothera biennis*	S5	Secure
Northern Evening-Primrose	*Oenothera parviflora*	S4?	Secure
Small Sundrops	*Oenothera perennis*	S5	Secure
Woodland Cudweed	*Omalotheca sylvatica*	S4S5	Secure
Sensitive Fern	*Onoclea sensibilis*	S5	Secure
One-Side Wintergreen	*Orthilia secunda*	S5	Secure
White-Grained Mountain-Ricegrass	*Oryzopsis asperifolia*	S5	Secure
Hairy Sweet-Cicely	*Osmorhiza claytonii*	S4	Secure
Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure
Interrupted Fern	*Osmunda claytoniana*	S5	Secure
Royal Fern	*Osmunda regalis*	S5	Secure
Dillen's Woodsorrel	*Oxalis dillenii*	SNA	Exotic
White Wood-Sorrel	*Oxalis montana*	S5	Secure
Upright Yellow Wood-Sorrel	*Oxalis stricta*	S5	Secure
Spreading Panicgrass	*Panicum dichotomiflorum*	S5	Secure
Panic Grass	*Panicum lanuginosum*	na	na
Northern Beech Fern	*Phegopteris connectilis*	S5	Secure
Meadow Timothy	*Phleum pratense*	SNA	Exotic
Purple Chokeberry	*Photinia floribunda*	S5	Secure
Black Chokeberry	*Photinia melanocarpa*	S5	Secure
Red Chokeberry	*Photinia pyrifolia*	S4?	Secure
White Spruce	*Picea glauca*	S5	Secure
Black Spruce	*Picea mariana*	S5	Secure
Red Spruce	*Picea rubens*	S5	Secure
Jack Pine	*Pinus banksiana*	S4	Secure
Red Pine	*Pinus resinosa*	S4S5	Secure
Eastern White Pine	*Pinus strobus*	S5	Secure
Scotch Pine	*Pinus sylvestris*	SNA	Exotic
Nipple-Seed Plantain	*Plantago major*	SNA	Exotic
Seaside Plantain	*Plantago maritima*	S5	Secure
Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure
Leafy Northern Green Orchid	*Platanthera hyperborea*	SNA	na
Green-Fringe Orchis	*Platanthera lacera*	S4S5	Secure
Canada Bluegrass	*Poa compressa*	SNA	Exotic
Fowl Bluegrass	*Poa palustris*	S5	Secure
Kentucky Bluegrass	*Poa pratensis*	S5	Secure
Scribner Bluegrass	*Poa trivialis*	SNA	Exotic
Rose Pogonia	*Pogonia ophioglossoides*	S4	Secure
Field Milkwort	*Polygala sanguinea*	S2S3	Sensitive
Fringed Black Bindweed	*Polygonum cilinode*	S5	Secure
Japanese Knotweed	*Polygonum cuspidatum*	SNA	Exotic
Dock-Leaf Smartweed	*Polygonum lapathifolium*	S5	Secure
Lady's Thumb	*Polygonum persicaria*	SNA	Exotic
Rock Polypody	*Polypodium virginianum*	S5	Secure
Christmas Fern	*Polystichum acrostichoides*	S5	Secure
Pickerel Weed	*Pontederia cordata*	S5	Secure
a hybrid Poplar	*Populus balsamifera x tremuloides*	SNA	Not Assessed

Table 3 Plant Species Recorded in Project Area and Information on their Population Status within Nova Scotia

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Large-Tooth Aspen	*Populus grandidentata*	S5	Secure
Quaking Aspen	*Populus tremuloides*	S5	Secure
Algae-Like Pondweed	*Potamogeton confervoides*	S4S5	Secure
Nuttall Pondweed	*Potamogeton epihydrus*	S5	Secure
Grassy Pondweed	*Potamogeton gramineus*	S5	Secure
Oakes Pondweed	*Potamogeton oakesianus*	S4S5	Secure
Flatleaf Pondweed	*Potamogeton robbinsii*	S4	Secure
Norwegian Cinquefoil	*Potentilla norvegica*	S5	Secure
Old-Field Cinquefoil	*Potentilla simplex*	S5	Secure
Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure
Self-Heal	*Prunella vulgaris*	S5	Secure
Fire Cherry	*Prunus pensylvanica*	S5	Secure
Wild Black Cherry	*Prunus serotina*	S5	Secure
Choke Cherry	*Prunus virginiana*	S5	Secure
Fragrant Cudweed	*Pseudognaphalium obtusifolium*	S3S4	Secure
Bracken Fern	*Pteridium aquilinum*	S5	Secure
Seaside Alkali Grass	*Puccinellia maritima*	SNA	na
a Grass	*Puccinellia pumila*	na	na
Shinleaf	*Pyrola elliptica*	S5	Secure
Northern Red Oak	*Quercus rubra*	S5	Secure
Seaside Crowfoot	*Ranunculus cymbalaria*	S5	Secure
Creeping Butter-Cup	*Ranunculus repens*	SNA	Exotic
Little Yellow-Rattle	*Rhinanthus minor*	S5	Secure
Rhodora	*Rhododendron canadense*	S5	Secure
White Beakrush	*Rhynchospora alba*	S5	Secure
Skunk Currant	*Ribes glandulosum*	S5	Secure
Bristly Black Currant	*Ribes lacustre*	S5	Secure
Dog Rose	*Rosa canina*	SNA	Exotic
Carolina Rose	*Rosa carolina*	S4S5	Secure
Rambler Rose	*Rosa multiflora*	SNA	Exotic
Shining Rose	*Rosa nitida*	S4	Secure
Swamp Rose	*Rosa palustris*	S3	Secure
Rugosa Rose	*Rosa rugosa*	SNA	Exotic
Virginia Rose	*Rosa virginiana*	S5	Secure
Allegheny Blackberry	*Rubus allegheniensis*	S5	Secure
Smooth Blackberry	*Rubus canadensis*	S5	Secure
Bristly Dewberry	*Rubus hispidus*	S5	Secure
Red Raspberry	*Rubus idaeus*	S5	Secure
Dwarf Red Raspberry	*Rubus pubescens*	S5	Secure
a bramble	*Rubus recurvicaulis*	SNR	Secure
Small Bristleberry	*Rubus setosus*	S4?	Secure
Black-Eyed Susan	*Rudbeckia hirta*	SNA	Exotic
Sheep Sorrel	*Rumex acetosella*	SNA	Exotic
Water Dock	*Rumex orbiculatus*	S5	Secure
Ditch-Grass	*Ruppia maritima*	S5	Secure
Procumbent Pearlwort	*Sagina procumbens*	S5	Exotic
Broadleaf Arrowhead	*Sagittaria latifolia*	S5	Secure
Bebb's Willow	*Salix bebbiana*	S5	Secure
Pussy Willow	*Salix discolor*	S5	Secure
Heart-Leaved Willow	*Salix eriocephala*	S5	Secure
Prairie Willow	*Salix humilis*	S5	Secure
Shining Willow	*Salix lucida*	S5	Secure
Balsam Willow	*Salix pyrifolia*	S5	Secure
Red Elderberry	*Sambucus racemosa*	S5	Secure
Northern Pitcher-Plant	*Sarracenia purpurea*	S5	Secure
Water Bulrush	*Schoenoplectus subterminalis*	S5	Secure

Table 3 Plant Species Recorded in Project Area and Information on their Population Status within Nova Scotia

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Woolgrass Bulrush	*Scirpus atrovirens*	SNA	na
Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure
Bulrush	*Scirpus hattorianus*	S5	Secure
Small-Fruit Bulrush	*Scirpus microcarpus*	S5	Secure
Hooded Skullcap	*Scutellaria galericulata*	S5	Secure
Mad Dog Skullcap	*Scutellaria lateriflora*	S5	Secure
Tansy Ragwort	*Senecio jacobaea*	SNA	Exotic
Sticky Groundsel	*Senecio viscosus*	SNA	Exotic
Three-Toothed Cinquefoil	*Sibbaldiopsis tridentata*	S5	Secure
Strict Blue-Eyed-Grass	*Sisyrinchium montanum*	S5	Secure
Hemlock Water-Parsnip	*Sium suave*	S5	Secure
Climbing Nightshade	*Solanum dulcamara*	SNA	Exotic
White Goldenrod	*Solidago bicolor*	S5	Secure
Canada Goldenrod	*Solidago canadensis*	S5	Secure
Early Goldenrod	*Solidago juncea*	S5	Secure
Field Goldenrod	*Solidago nemoralis*	S4S5	Secure
Downy Goldenrod	*Solidago puberula*	S5	Secure
Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure
Seaside Goldenrod	*Solidago sempervirens*	S5	Secure
Bog Goldenrod	*Solidago uliginosa*	S5	Secure
Field Sowthistle	*Sonchus arvensis*	SNA	Exotic
Spiny-Leaf Sowthistle	*Sonchus asper*	SNA	Exotic
American Mountain-Ash	*Sorbus americana*	S5	Secure
European Mountain-Ash	*Sorbus aucuparia*	SNA	Exotic
Northern Mountain-Ash	*Sorbus decora*	S4	Secure
American Bur-Reed	*Sparganium americanum*	S5	Secure
Narrow-Leaf Burreed	*Sparganium angustifolium*	S5	Secure
Green-fruited Burreed	*Sparganium emersum*	S5	Secure
Large Bur-Reed	*Sparganium eurycarpum*	S4	Secure
Saltwater Cordgrass	*Spartina alterniflora*	S5	Secure
Fresh Water Cordgrass	*Spartina pectinata*	S5	Secure
Purple Sandspurry	*Spergularia rubra*	SNA	Exotic
Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure
Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure
Nodding Ladies'-Tresses	*Spiranthes cernua*	S5	Secure
Ladies'-Tresses	*Spiranthes lacera*	S5	Secure
Sheathed Dropseed	*Sporobolus vaginiflorus*	SNA	Exotic
Marsh Hedge-Nettle	*Stachys palustris*	SNA	Exotic
Little Starwort	*Stellaria graminea*	SNA	Exotic
Common Starwort	*Stellaria media*	SNA	Exotic
Rosy Twistedstalk	*Streptopus lanceolatus*	S5	Secure
Farewell-Summer	*Symphyotrichum lateriflorum*	S5	Secure
New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure
Swamp Aster	*Symphyotrichum puniceum*	S5	Secure
Prickly Comfrey	*Symphytum asperum*	SNA	Exotic
Common Tansy	*Tanacetum vulgare*	SNA	Exotic
Red-Seeded Dandelion	*Taraxacum laevigatum*	SNA	Exotic
Common Dandelion	*Taraxacum officinale*	SNA	Exotic
Tall Meadow-Rue	*Thalictrum pubescens*	S5	Secure
New York Fern	*Thelypteris noveboracensis*	S5	Secure
Marsh Fern	*Thelypteris palustris*	S5	Secure
Bog Fern	*Thelypteris simulata*	S4S5	Secure
Eastern Poison Ivy	*Toxicodendron radicans*	S4	Secure
Northern Poison Oak	*Toxicodendron rydbergii*	S5	Secure
Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure
Marsh St. John's Wort	*Triadenum virginicum*	S5	Secure

Table 3 Plant Species Recorded in Project Area and Information on their Population Status within Nova Scotia

Common Name	Scientific Name	ACCDC Rank	NSDNR Rank
Northern Starflower	*Trientalis borealis*	S5	Secure
Rabbit-Foot Clover	*Trifolium arvense*	SNA	Exotic
Yellow Clover	*Trifolium aureum*	SNA	Exotic
Low Hop Clover	*Trifolium campestre*	SNA	Exotic
Alsike Clover	*Trifolium hybridum*	SNA	Exotic
Zigzag Clover	*Trifolium medium*	SNA	Exotic
Red Clover	*Trifolium pratense*	SNA	Exotic
White Clover	*Trifolium repens*	SNA	Exotic
Slender Bog Arrow-Grass	*Triglochin palustris*	S4	Secure
Painted Trillium	*Trillium undulatum*	S5	Secure
Eastern Hemlock	*Tsuga canadensis*	S4S5	Secure
Colt's Foot	*Tussilago farfara*	SNA	Exotic
Narrow-Leaved Cattail	*Typha angustifolia*	S5	Secure
Broad-Leaf Cattail	*Typha latifolia*	S5	Secure
Wych Elm	*Ulmus glabra*	SNA	Exotic
Hidden-Fruited Bladderwort	*Utricularia geminiscapa*	S4	Secure
Greater Bladder-Wort	*Utricularia macrorhiza*	S5	Secure
Purple Bladderwort	*Utricularia purpurea*	S5	Secure
Small Swollen Bladderwort	*Utricularia radiata*	S3	Secure
Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure
Large Cranberry	*Vaccinium macrocarpon*	S5	Secure
Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure
Small Cranberry	*Vaccinium oxycoccos*	S5	Secure
Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure
Gypsy-Weed	*Veronica officinalis*	S5	Exotic
Thyme-Leaved Speedwell	*Veronica serpyllifolia*	S5	Secure
Spring Speedwell	*Veronica verna*	SNA	Exotic
Alderleaf Viburnum	*Viburnum lantanoides*	S5	Secure
Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure
Guelder-Rose Viburnum	*Viburnum opulus*	S5	Secure
Tufted Vetch	*Vicia cracca*	SNA	Exotic
Marsh Blue Violet	*Viola cucullata*	S5	Secure
Lance-Leaf Violet	*Viola lanceolata*	S5	Secure
Smooth White Violet	*Viola macloskeyi*	S5	Secure
Woolly Blue Violet	*Viola sororia*	S5	Secure
Virginia Chainfern	*Woodwardia virginica*	S4	Secure

Table 4 Number of Birds Observed by Habitat during the Breeding Bird Surveys

Species	Mature Softwood	Mature Mixedwood	Mature Hardwood	Immature Softwood	Immature Mixedwood	Immature Hardwood	Clear-cut	Tall shrub Thicket	Low shrub Thicket	Semi-Barrens	Disturbed Area	Residential Area	Coniferous Treed Swamp	Mixedwood Treed Swamp	Deciduous Treed Swamp	Tall Shrub Swamp	Low Shrub Swamp	Treed Bog	Bog	Fen	Fresh Marsh	Brackish Marsh	Open Water	Flew Over	Habitat Unknown	Grand Total
Common Loon	1																1						1	1	1	**5**
Double-crested Cormorant																								1		**1**
Great Blue Heron																	1						1	1		**3**
Canada Goose																							1			**1**
Wood Duck	1																									**1**
American Black Duck	1													1						1	1	1	1			**6**
Turkey Vulture																								1		**1**
Osprey		1							1		1	1											1	1		**6**
Bald Eagle	1																									**1**
Northern Goshawk	1																									**1**
Broad-winged Hawk	1	1	1		1																			1		**5**
Merlin				1																						**1**
Spruce Grouse													1													**1**
Ruffed Grouse		1	1		1																					**3**
American Woodcock			1																							**1**
Herring Gull																						1	1	1		**3**
Great Black-backed Gull																								1		**1**
Rock Dove																							1			**1**
Mourning Dove	1	1										1		1										1	1	**6**
Ruby-throated Hummingbird		1	1				1																	1		**4**
Belted Kingfisher	1			1												1							1		1	**5**
Downy Woodpecker						1										1										**2**
Hairy Woodpecker	1	1	1	1	1								1	1		1								1		**9**
Black-backed Woodpecker		1																								**1**
Northern Flicker	1	1	1		1		1						1												1	**7**
Pileated Woodpecker	1	1			1																					**3**
Yellow-bellied Flycatcher													1			1										**2**
Alder Flycatcher		1						1			1		1	1		1	1								1	**8**
Tree Swallow																							1	1		**2**
Barn Swallow																							1	1		**2**
Blue Jay	1	1		1	1	1							1											1	1	**8**
American Crow	1	1		1	1						1	1	1	1					1					1	1	**11**
Common Raven	1	1									1		1	1										1	1	**7**
Black-capped Chickadee	1	1	1	1	1	1				1		1	1	1					1						1	**12**
Boreal Chickadee	1	1		1															1							**4**
Red-breasted Nuthatch	1	1			1								1	1											1	**6**
White-breasted Nuthatch		1																								**1**
Brown Creeper	1	1											1													**3**

Table 4 Number of Birds Observed by Habitat during the Breeding Bird Surveys

Species	Mature Softwood	Mature Mixedwood	Mature Hardwood	Immature Softwood	Immature Mixedwood	Immature Hardwood	Clear-cut	Tall shrub Thicket	Low shrub Thicket	Semi-Barrens	Disturbed Area	Residential Area	Coniferous Treed Swamp	Mixedwood Treed Swamp	Deciduous Treed Swamp	Tall Shrub Swamp	Low Shrub Swamp	Treed Bog	Bog	Fen	Fresh Marsh	Brackish Marsh	Open Water	Flew Over	Habitat Unknown	Grand Total
Winter Wren	1	1			1								1	1											1	**6**
Golden-crowned Kinglet	1	1	1	1	1					1			1	1												**8**
Ruby-crowned Kinglet	1	1		1	1	1				1			1	1											1	**9**
Veery		1																								**1**
Swainson's Thrush	1	1	1	1	1								1												1	**7**
Hermit Thrush	1	1	1	1	1		1			1			1	1					1						1	**11**
American Robin	1	1	1	1	1	1	1	1			1	1	1	1											1	**13**
Cedar Waxwing	1	1			1		1	1																1		**6**
Blue-headed Vireo	1	1		1										1											1	**5**
Red-eyed Vireo	1	1	1		1	1		1																	1	**7**
Nashville Warbler	1	1		1	1	1							1	1												**7**
Northern Parula	1	1	1		1	1						1	1													**7**
Yellow Warbler		1			1						1	1														**4**
Chestnut-sided Warbler	1		1													1										**3**
Magnolia Warbler	1	1	1	1	1	1				1			1	1											1	**10**
Cape May Warbler	1			1	1								1													**4**
Black-throated Blue Warbler		1	1		1									1											1	**5**
Yellow-rumped Warbler	1	1	1	1	1					1			1	1		1							1		1	**11**
Black-throated Green Warbler	1	1	1	1	1	1				1			1	1											1	**10**
Blackburnian Warbler	1	1	1		1																				1	**5**
Palm Warbler	1			1			1			1			1	1			1		1						1	**9**
Bay-breasted Warbler	1	1		1																						**3**
Black-and-White Warbler	1	1	1	1	1	1				1			1	1												**9**
American Redstart		1	1					1																		**3**
Ovenbird		1	1		1	1																			1	**5**
Northern Waterthrush	1																									**1**
Common Yellowthroat	2	1	1	1	1		1	1		1	1		1	1		1	1		1						1	**16**
Canada Warbler	1												1													**2**
Scarlet Tanager		1													1											**2**
Song Sparrow	1	1			1			1	1		1	1		1		1	1			1					1	**12**
Lincoln's Sparrow							1							1											1	**3**
Swamp Sparrow	1												1	1		1	1		1							**6**
White-throated Sparrow	1	1	1	1	1		1	1		1	1		1	1					1						1	**13**
Dark-eyed Junco	1	1	1	1	1		1	1	1	1	1		1	1		1		1	1						1	**16**
Red-winged Blackbird	1																									**1**
Rusty Blackbird	1							1					1			1										**4**
Common Grackle	1	1			1											1	1						1	1		**7**

Table 4 Number of Birds Observed by Habitat during the Breeding Bird Surveys

Species	Mature Softwood	Mature Mixedwood	Mature Hardwood	Immature Softwood	Immature Mixedwood	Immature Hardwood	Clear-cut	Tall shrub Thicket	Low shrub Thicket	Semi-Barrens	Disturbed Area	Residential Area	Coniferous Treed Swamp	Mixedwood Treed Swamp	Deciduous Treed Swamp	Tall Shrub Swamp	Low Shrub Swamp	Treed Bog	Bog	Fen	Fresh Marsh	Brackish Marsh	Open Water	Flew Over	Habitat Unknown	Grand Total
Purple Finch	1	1		1	1					1			1	1											1	**8**
Red Crossbill	1																									**1**
White-winged Crossbill																								1		**1**
Pine Siskin		1																								**1**
American Goldfinch	1	1	1					1			1	1		1		1								1		**9**
Total	**52**	**49**	**26**	**25**	**34**	**12**	**10**	**11**	**3**	**13**	**11**	**9**	**32**	**29**	**1**	**14**	**8**	**1**	**9**	**2**	**1**	**2**	**12**	**20**	**30**	**416**

Table 5 Breeding and Population Statuses of Recorded Bird Species

Common Name	Scientific Name	COSEWIC Rank	ACCDC Rank	NSESA Rank	NSDNR Rank	MBBA Breeding Status	Field Survey Breeding Status
Common Loon	*Gavia immer*	Not at Risk	S3B,S4N		May Be At Risk	Confirmed	Confirmed
Double-crested Cormorant	*Phalacrocorax auritus*	Not at Risk	S5B		Secure	Confirmed	Observed
Great Blue Heron	*Ardea herodias*		S4B		Secure	Possible	Observed
Canada Goose	*Branta canadensis*		SNAB,S4N		Secure	Confirmed	Probable
Wood Duck	*Aix sponsa*		S4S5B		Secure	Confirmed	Observed
American Black Duck	*Anas rubripes*		S5		Secure	Confirmed	Confirmed
Mallard	*Anas platyrhynchos*		S5		Secure	Confirmed	Not Observed
Ring-necked Duck	*Aythya collaris*		S5B		Secure	Confirmed	Not Observed
Common Eider	*Somateria mollissima*		S4		Secure	Observed	Not Observed
Hooded Merganser	*Lophodytes cucullatus*		S4S5B		Secure	Probable	Not Observed
Common Merganser	*Mergus merganser*		S5		Secure	Confirmed	Not Observed
Red-breasted Merganser	*Mergus serrator*		S3B,S5N		Secure	Probable	Not Observed
Turkey Vulture	*Cathartes aura*		S2S3B		Sensitive	Not Observed	Observed
Osprey	*Pandion haliaetus*		S5B		Secure	Confirmed	Confirmed
Bald Eagle	*Haliaeetus leucocephalus*	Not at Risk	S4		Secure	Confirmed	Observed
Sharp-shinned Hawk	*Accipiter striatus*	Not at Risk	S4S5B		Secure	Possible	Not Observed
Northern Goshawk	*Accipiter gentilis*	Not at Risk	S3S4B		Secure	Possible	Probable
Broad-winged Hawk	*Buteo platypterus*		S4S5B		Secure	Confirmed	Probable
Red-tailed Hawk	*Buteo jamaicensis*	Not at Risk	S5		Secure	Probable	Observed
American Kestrel	*Falco sparverius*		S5B		Secure	Confirmed	Not Observed
Merlin	*Falco columbarius*	Not at Risk	S5B		Secure	Possible	Possible
Ring-necked Pheasant	*Phasianus colchicus*		SNA		Exotic	Confirmed	Not Observed
Spruce Grouse	*Falcipennis canadensis*		S5		Secure	Confirmed	Observed
Ruffed Grouse	*Bonasa umbellus*		S4S5		Secure	Confirmed	Possible
Sora	*Porzana carolina*		S4S5B		Secure	Probable	Not Observed
Killdeer	*Charadrius vociferus*		S3S4B		Sensitive	Confirmed	Not Observed
Greater Yellowlegs	*Tringa melanoleuca*		S3B,S5M		Sensitive	Possible	Not Observed
Spotted Sandpiper	*Actitis macularius*		S3S4B		Sensitive	Confirmed	Not Observed
Least Sandpiper	*Calidris minutilla*		S1B,S5M		Secure	Probable	Not Observed
Wilson's Snipe	*Gallinago delicata*		S3S4B		Sensitive	Possible	Not Observed
American Woodcock	*Scolopax minor*		S4S5B		Secure	Confirmed	Possible
Ring-billed Gull	*Larus delawarensis*		S1?B,S5N		Secure	Observed	Not Observed
Herring Gull	*Larus argentatus*		S4S5		Secure	Confirmed	Possible
Great Black-backed Gull	*Larus marinus*		S4		Secure	Confirmed	Observed
Common Tern	*Sterna hirundo*	Not at Risk	S3B		Sensitive	Probable	Not Observed
Rock Dove	*Columba livia*		SNA		Exotic	Confirmed	Confirmed
Mourning Dove	*Zenaida macroura*		S5		Secure	Confirmed	Possible
Great Horned Owl	*Bubo virginianus*		S5		Secure	Possible	Not Observed
Barred Owl	*Strix varia*		S5		Secure	Confirmed	Not Observed
Long-eared Owl	*Asio otus*		S2		May Be At Risk	Possible	Not Observed
Northern Saw-whet Owl	*Aegolius acadicus*		S4		Secure	Probable	Not Observed
Common Nighthawk	*Chordeiles minor*	Threatened	S3B	Threatened	At Risk	Probable	Not Observed
Chimney Swift	*Chaetura pelagica*	Threatened	S2S3B	Endangered	At Risk	Possible	Not Observed

Table 5 Breeding and Population Statuses of Recorded Bird Species

Common Name	Scientific Name	COSEWIC Rank	ACCDC Rank	NSESA Rank	NSDNR Rank	MBBA Breeding Status	Field Survey Breeding Status
Ruby-throated Hummingbird	*Archilochus colubris*		S5B		Secure	Confirmed	Confirmed
Belted Kingfisher	*Megaceryle alcyon*		S5B		Secure	Confirmed	Observed
Yellow-bellied Sapsucker	*Sphyrapicus varius*		S4S5B		Secure	Probable	Not Observed
Downy Woodpecker	*Picoides pubescens*		S5		Secure	Confirmed	Possible
Hairy Woodpecker	*Picoides villosus*		S5		Secure	Confirmed	Confirmed
Black-backed Woodpecker	*Picoides arcticus*		S3S4		Sensitive	Probable	Possible
Northern Flicker	*Colaptes auratus*		S5B		Secure	Confirmed	Possible
Pileated Woodpecker	*Dryocopus pileatus*		S5		Secure	Probable	Observed
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	S3B		At Risk	Confirmed	Not Observed
Eastern Wood-Pewee	*Contopus virens*		S3S4B		Sensitive	Possible	Not Observed
Yellow-bellied Flycatcher	*Empidonax flaviventris*		S3S4B		Sensitive	Probable	Possible
Alder Flycatcher	*Empidonax alnorum*		S5B		Secure	Confirmed	Possible
Least Flycatcher	*Empidonax minimus*		S4B		Secure	Confirmed	Not Observed
Tree Swallow	*Tachycineta bicolor*		S4B		Sensitive	Confirmed	Probable
Bank Swallow	*Riparia riparia*		S3B		May Be At Risk	Confirmed	Not Observed
Cliff Swallow	*Petrochelidon pyrrhonota*		S3B		May Be At Risk	Possible	Not Observed
Barn Swallow	*Hirundo rustica*		S3B		Sensitive	Confirmed	Confirmed
Gray Jay	*Perisoreus canadensis*		S3S4		Sensitive	Confirmed	Not Observed
Blue Jay	*Cyanocitta cristata*		S5		Secure	Confirmed	Confirmed
American Crow	*Corvus brachyrhynchos*		S5		Secure	Confirmed	Probable
Common Raven	*Corvus corax*		S5		Secure	Confirmed	Probable
Black-capped Chickadee	*Poecile atricapilla*		S5		Secure	Confirmed	Confirmed
Boreal Chickadee	*Poecile hudsonica*		S3		Sensitive	Confirmed	Confirmed
Red-breasted Nuthatch	*Sitta canadensis*		S4S5		Secure	Confirmed	Confirmed
White-breasted Nuthatch	*Sitta carolinensis*		S4		Secure	Possible	Observed
Brown Creeper	*Certhia americana*		S5		Secure	Confirmed	Confirmed
Winter Wren	*Troglodytes troglodytes*		S5B		Secure	Confirmed	Probable
Golden-crowned Kinglet	*Regulus satrapa*		S4		Sensitive	Confirmed	Confirmed
Ruby-crowned Kinglet	*Regulus calendula*		S4B		Sensitive	Confirmed	Probable
Veery	*Catharus fuscescens*		S4B		Secure	Possible	Possible
Swainson's Thrush	*Catharus ustulatus*		S4S5B		Secure	Confirmed	Probable
Hermit Thrush	*Catharus guttatus*		S5B		Secure	Confirmed	Confirmed
American Robin	*Turdus migratorius*		S5B		Secure	Confirmed	Confirmed
Gray Catbird	*Dumetella carolinensis*		S3B		May Be At Risk	Possible	Not Observed
Cedar Waxwing	*Bombycilla cedrorum*		S5B		Secure	Confirmed	Confirmed
European Starling	*Sturnus vulgaris*		SNA		Exotic	Confirmed	Not Observed
Blue-headed Vireo	*Vireo solitarius*		S5B		Secure	Confirmed	Confirmed
Red-eyed Vireo	*Vireo olivaceus*		S5B		Secure	Confirmed	Probable
Tennessee Warbler	*Vermivora peregrina*		S3S4B		Sensitive	Possible	Not Observed
Nashville Warbler	*Vermivora ruficapilla*		S5B		Secure	Probable	Probable
Northern Parula	*Parula americana*		S5B		Secure	Probable	Probable
Yellow Warbler	*Dendroica petechia*		S5B		Secure	Confirmed	Possible
Chestnut-sided Warbler	*Dendroica pensylvanica*		S5B		Secure	Probable	Possible

Table 5 Breeding and Population Statuses of Recorded Bird Species

Common Name	Scientific Name	COSEWIC Rank	ACCDC Rank	NSESA Rank	NSDNR Rank	MBBA Breeding Status	Field Survey Breeding Status
Magnolia Warbler	*Dendroica magnolia*		S5B		Secure	Confirmed	Confirmed
Cape May Warbler	*Dendroica tigrina*		S3?B		Sensitive	Probable	Confirmed
Black-throated Blue Warbler	*Dendroica caerulescens*		S5B		Secure	Confirmed	Possible
Yellow-rumped Warbler	*Dendroica coronata*		S5B		Secure	Confirmed	Confirmed
Black-throated Green Warbler	*Dendroica virens*		S4S5B		Secure	Confirmed	Probable
Blackburnian Warbler	*Dendroica fusca*		S4B		Secure	Confirmed	Probable
Palm Warbler	*Dendroica palmarum*		S5B		Secure	Confirmed	Confirmed
Bay-breasted Warbler	*Dendroica castanea*		S3S4B		Sensitive	Confirmed	Possible
Blackpoll Warbler	*Dendroica striata*		S3S4B		Sensitive	Confirmed	Not Observed
Black-and-White Warbler	*Mniotilta varia*		S4S5B		Secure	Confirmed	Probable
American Redstart	*Setophaga ruticilla*		S5B		Secure	Confirmed	Possible
Ovenbird	*Seiurus aurocapillus*		S5B		Secure	Probable	Confirmed
Northern Waterthrush	*Seiurus noveboracensis*		S4B		Secure	Probable	Possible
Mourning Warbler	*Oporornis philadelphia*		S4B		Secure	Possible	Possible
Common Yellowthroat	*Geothlypis trichas*		S5B		Secure	Confirmed	Confirmed
Wilson's Warbler	*Wilsonia pusilla*		S3S4B		Sensitive	Probable	Not Observed
Canada Warbler	*Wilsonia canadensis*	Threatened	S3B		At Risk	Not Observed	Probable
Scarlet Tanager	*Piranga olivacea*		S2B		Undetermined	Probable	Probable
Rose-breasted Grosbeak	*Pheucticus ludovicianus*		S3S4B		Sensitive	Observed	Not Observed
Chipping Sparrow	*Spizella passerina*		S4S5B		Secure	Probable	Not Observed
Savannah Sparrow	*Passerculus sandwichensis*		S4B		Secure	Confirmed	Not Observed
Fox Sparrow	*Passerella iliaca*		S3S4B		Secure	Probable	Not Observed
Song Sparrow	*Melospiza melodia*		S5B		Secure	Confirmed	Confirmed
Lincoln's Sparrow	*Melospiza lincolnii*		S4B		Secure	Confirmed	Possible
Swamp Sparrow	*Melospiza georgiana*		S5B		Secure	Confirmed	Confirmed
White-throated Sparrow	*Zonotrichia albicollis*		S5B		Secure	Confirmed	Confirmed
Dark-eyed Junco	*Junco hyemalis*		S4S5		Secure	Confirmed	Confirmed
Bobolink	*Dolichonyx oryzivorus*	Threatened	S3S4B		Sensitive	Probable	Not Observed
Red-winged Blackbird	*Agelaius phoeniceus*		S4S5B		Secure	Confirmed	Observed
Rusty Blackbird	*Euphagus carolinus*	Special Conce	S2S3B		May Be At Risk	Possible	Confirmed
Common Grackle	*Quiscalus quiscula*		S5B		Secure	Confirmed	Confirmed
Brown-headed Cowbird	*Molothrus ater*		S2S3B		May Be At Risk	Observed	Not Observed
Baltimore Oriole	*Icterus galbula*		S2S3B		May Be At Risk	Possible	Not Observed
Pine Grosbeak	*Pinicola enucleator*		S3?B,S5N		May Be At Risk	Possible	Not Observed
Purple Finch	*Carpodacus purpureus*		S4S5		Secure	Confirmed	Probable
Red Crossbill	*Loxia curvirostra*		S4?		Secure	Probable	Confirmed
White-winged Crossbill	*Loxia leucoptera*		S4S5		Secure	Possible	Possible
Pine Siskin	*Carduelis pinus*		S3S4B,S5N		Sensitive	Confirmed	Probable
American Goldfinch	*Carduelis tristis*		S5		Secure	Confirmed	Confirmed
Evening Grosbeak	*Coccothraustes vespertinus*		S4B,S5N		Secure	Probable	Not Observed
House Sparrow	*Passer domesticus*		SNA		Exotic	Probable	Not Observed

APPENDIX H

WETLAND EVALUATIONS

WETLAND FUNCTIONAL ASSESSMENT:
Reference Guide for Wildlife Functions
(Modified from Tiner, 2009)

Contents

Vegetation

Interpretation: The vegetation component of the assessment incorporates two principal components: diversity and integrity. Measures of plant diversity are to be interpreted in terms of the ability of the wetland to provide habitat for plants themselves as well as for other wildlife. A range of diversity indicators have been selected and include the number of distinct plant communities, plant species richness, and the occurrence of rare taxa within the wetland. Integrity refers to the overall condition of the plant community and for the purposes of this functional assessment, is interpreted by indicators of anthropogenic stress.

1. Number of plant communities[1] associated with the wetland.
2. Types of plant communities associated with the wetland (which occupy >10% of area).
3. List all species of vascular plants observed in wetland.
4. Plant species richness within wetland.
5. Does the wetland support plant species that are considered “at Risk” or of “Conservation concern”[2] (for information on specific species refer to wetland plant lists)?
6. Does the wetland have any dominant species that are non-native to NS (see habitat descriptions for species and estimated cover).
7. Does the wetland contain any potentially invasive exotic plant species (as identified by Hill and Blaney 2010)?
8. Intensity of disturbance: Severe (H)_____ Minor (M) _____ Relatively Undisturbed (L)_____

   Types of disturbance: Harvest (H)___ Herbicides (He)___ Salt Intrusion (SI)___ Grazing (G)___ Mowing (M)____ Ditching/drainage (D)___ Impoundment (I)___ Other Altered Hydrology (OH)___ Insect Infestation (II)___ Storm Damage (SD)___ Sedimentation (S)____ Eutrophication (E)

   Comments:____
9. Stressed vegetation: Dead woody plants (DW)_____ Other_____ (specify__________________)

[1] The Canadian Wetland Classification System (CWCS) is to be adhered to for the identification and naming of plant communities
[2] Defined in the Highway 103 EA

10. Characterize the current vegetative quality of each wetland. Use the following definitions:

- *High Quality*: Plant community shows minimal evidence of human disturbance or other influences. Community composed of native species characteristic of the wetland type. Exotic species are absent or of minimal importance.

- *Moderate Quality*: Plant community shows obvious signs of human disturbance or other influences but is composed mostly of native species characteristic of the wetland type. Exotic species cumulatively comprise less than 20 percent cover of any stratum.

- *Low Quality*: Plant community strongly reflects human disturbance or other human influence; non-native species cumulatively comprise >20 percent cover of any stratum.

Interpretation: The vegetative quality / integrity of the wetland is determined by a combination of factors, including the presence and abundance of exotics, human disturbance, and surrounding land-use. Although guidelines have been outlined, these designations are somewhat subjective. To ensure consistency, discussion amongst field surveyors is essential.

Fauna

General

11. Vegetation interspersion: for freshwater marshes or shallow open water-wetland types select the cover category that best illustrates the interspersion of open water and emergent, submergent, or floating-leaved vegetation within the wetland. High_____ Medium_____ Low_____ N/A_____ (Not applicable for other wetland types).

12. What is the ratio of this vegetation to open water? _____

13. For wetlands having more than one vegetative community, indicate the interspersion category that best fits the wetland. High_____ Medium_____ Low_____ *N/A* =Only one community present.

Birds

14. Check whether the following wetland types are present:
__Salt marsh with tidal creeks and neighboring tidal flats (SM)
__Freshwater marsh adjacent to open water (FM)
__Swamp with adjacent open water (e.g., beaver pond) (SW)

15. List species birds observed (highlight waterfowl and other water birds).

16. Does the wetland support any birds that are "At Risk' or of "Conservation Concern"?

Herpetiles

17. Amphibian breeding potential – is the wetland is inundated long enough in most years to provide appropriate herpetile breeding potential for:
____Vernal pool species (V)
____Permanent pool species (PP)
____Vernal pool and permanent pool species (VPP)

Interpretation: Frogs, toads and salamanders reproduce at different times from late March into June, depending on the species. Early breeders (such as spring peepers, wood frogs, and salamanders) typically reproduce in shallow, seasonal wetlands. Green frogs reproduce in larger more permanent wetlands. For breeding to be successful, the wetland must remain inundated long enough for the larval stages to metamorphose into adults. Direct evidence of amphibian breeding may be an indication of a sufficient hydroperiod. Such evidence would include observations of frogs calling, egg masses in the water, presence of tadpoles or presence of young, newly metamorphosed frogs, toads or salamanders at, the wetland. Note however, that some species are opportunistic and will lay eggs in temporary pools that will not remain inundated long enough for successful reproduction. Exercise caution when using this indicator.

18. Amphibian breeding potential - fish presence
    H =Wetland is connected with a lake or river so that predatory fish are always present or the wetland is used for rearing of game fish.
    M =Wetland may occasionally be connected to other waters; predatory fish may be present in some years.
    L =Wetland is isolated so that predatory fish are never present.
    Comments____________________

Interpretation: Optimal amphibian breeding habitat is characterized by a lack of predatory fish. These habitats are wetlands that winterkill, dry periodically, are periodically anoxic, and are not connected to waters bearing predatory fish. The wetland should not be used to rear bait or game fish. This question utilizes observable characteristics of the wetland to infer about the status of fish. Direct observation or knowledge about fish presence should be substituted where possible.

19. Herpetile overwintering habitat

    H =Wetland is normally more than 1.5 meters deep (never or rarely winterkills).
    M = Wetland is normally around I meter deep (may occasionally winterkill).
    L =Wetland is normally less than I meter deep and often freezes to the bottom.
    N/A =Wetland never or rarely contains standing water or is nearly always dry in winter.

Interpretation: Wetlands that are deep and well oxygenated provide overwintering habitat for leopard, green, bull, and mink frogs, as well as turtles. Evidence of over-wintering would be observations of migrations of frogs to the wetland in fall and away from the wetland in spring and basking turtles in the spring.

20. Logs floating in water (resting areas for turtles): Yes_ No_

21. Amphibian species for which there is evidence of occurrence (visual observations, heard calling, egg masses, juveniles, etc.).

22. Presence of herpetiles that are “At Risk’ or of “Conservation Concern”.

Mammals

23. Potential habitat for otter?

24. Potential habitat for mink?

25. Potential habitat for muskrat?

26. Potential habitat for beaver?

27. List mammals for which evidence was observed within wetland.

28. Presence of mammals that are “At Risk’ or of “Conservation Concern”

Fish

29. Rate the value of the wetland as fish habitat, based on the following descriptions:

    High Value - Those wetlands that are lentic, lotic, or estuarine or otherwise contiguous with a permanent waterbody or watercourse that was determined to support native fish species.

    Moderate Value – Wetlands that were contiguous with a permanent watercourse considered to have potential to support fish, but for which no fish were found during fish-out efforts.

    Low Value - Wetlands which were connected to a watercourse which was not considered to have potential for supporting fish (and for which no fishing effort was thereby performed).

    Negligible Value - Wetlands which are isolated from all waterbodies or watercourses.

30. Were any fish observed? Y N
    List species (if possible):____

WETLAND FUNCTIONAL ASSESSMENT:
Reference Guide for Non-wildlife Functions

Contents

WETLAND EVALUATION FORM ADDITIONAL INSTRUCTIONS

The following provides extra detail and references for filling out the Wetland Evaluation Form

1. From the Canadian Wetland Classification System (NWWG 1997). Try to limit it to three types for wetland complexes but use back if more are needed.
2. Leave blank if wetland is undisturbed/unaltered
3. What is the cover type of adjacent uplands that are connected to wetland hydrological
4. What is the slope of adjacent areas, and any other anecdotal observations of these
5. General morphological form of wetland – if other, identify.
6. Topography of the wetland surface – if other, identify
7. Rank if it is apparent what the comparative contributions are, check if unknown
8. Are springs in the wetland or discharging to wetland from upgradient. Make note if spring supports a watercourse that discharges directly to wetland, if apparent.
9. Open water areas include channels, hollows, large pools, etc.
10. If there is no flow in wetland, try to discern what the flow might look like at highwater.
11. This may be in delineation sheet as well, but record here for convenience
12. If channel is dry, place ‘0’ in wet width. Use margins or back for additional channels.
13. If channel is dry, place ‘0’ in wet width. Use margins or back for additional channels.
14. These are Army Corps hydrological indicators. Goal is to find evidence of water table fluctuations above current water table.
15. Estimate the distance between the current water table and the estimated high water.
16. If you can, give an indication of how frequently the area is flooded. Very subjective.
17. Is peat present?
18. A rough estimate based on test pits or or soil probes in several locations, if possible

19. Good to compare data from 12 and 13 and make a judgment call in the field
20. If water levels are low in the watershed due to seasonal dry periods, wetland may still discharge water and support baseflow.

21. – 25. explained below.

FUNCTION ASSESSMENT

This proposed method considers the wetland structural features as indicators of potential for performance of functions. For some functions, evidence of functional performance may also be available. Information will be collected using the Stantec Wetland Evaluation Form. Numbers shown in bold **below (#)** refer to the corresponding questions on that form. **(DE)** indicates that desktop evaluation is required to answer a certain question.

Hydrology

Baseflow Maintenance:

Wetland contributes to flow in downgradient water bodies in dry conditions. The conditions that would exist for a wetland to have potential to provide this function include (some of these may be redundant in some situations):

1. Wetland apparently has greater channel outflow than inflow **(12, 13)**. Assumption is that the channel inflow and outflow on an individual wetland are in the same surficial material and therefore wet / dry width and centre depth can be used to compare relative discharge. If the wetland or watershed is recently altered, this may not be valid (**2).**

2. Wetland is a headwater to a stream (channel outflow but no channel inflow, spring source water) **(8, 12, 13).**

3. Wetland has a channel outflow and a stable water level **(11, 13, 14).** Wetland may or may not have channel inflow.

4. Wetland is very large with good storage capacity and/or abundance of saturated organic soil **(DE, 6, 9,11,delineation form).** If the wetland provides long term water storage, the assumption is that it is raising local water table and therefore contributing directly or indirectly to the baseflow of adjacent watercourses.

5. In certain conditions, evidence of function performance may be observed

   - In “dry” (subjective) conditions, outflow from wetland was observed **(21)**

   - The key determinant of the capacity of wetlands to modify flow from a watershed is the extent of wetland area in comparison to the total drainage area (Mitsch and Gosselink 2000). **(DE)**

   - Active springs are observed feeding the wetland **(8)**

Stormwater Management:

Wetland collects and stores surface water during storm/high water events. Evaluation of this function is based on the features of stormwater retention and detention basins design where peak flows are maintained for 18 to 48 hours (Schueler, 1992). The conditions that would exist for a wetland to have potential to provide this function would be that it has a fluctuating water table (Winter and Woo 1990; Devito et al. 1996; Gosselink et al. 1990; Waddington et al. 1993)

6. Regular and/or high water marks observed above existing water levels **(14, 15, 16)**

7. Wetland is topographically confined (basin form) and surface water fed (at least partially) **(5, 13)**

8. Wetland has a dry discharge channel, or much larger dry channel than wet channel (>30cm) and is surface water fed (watercourse or runoff) **(13)**

9. Wetland is not a bog because by definition, bogs do not collect surface flows (exception, question 11) **(1)**

10. Wetland is a floodplain form **(1, 5)**

11. Sloped BOG or FEN with ribbed microtopograhy perpendicular to slope provides stormwater management (1 & 6)

12. In certain conditions, evidence of function performance or value may be observed

    - Wetland water levels have been observed at multiple elevations, or high water marks (from other than freshet ["in-growing-season"]) are readily observable on trees or in surrounding upland **(DE)**

    - Valued resources are present downgradient that benefit from stormflow moderation (fish habitat, human infrastructure, etc.). **DE**

    - A culvert, drainage ditch or other artificial surface water conveyance discharges directly or indirectly to the wetland. **(2, 7)**

Shoreline Erosion Control:

Wetland slows flow, stabilizes soils or disperses energy in a way that reduces erosive forces of flows (Tiner 2003). By nature of wetland vegetation, all vegetated riparian forms have the potential to provide this function

13. Wetland is a vegetated shoreline feature fringing on an upland **(1,5)**

14. In certain conditions, evidence of function performance or value may be observed

    - Waves or currents observed in adjacent waters indicate erosive potential of water **(22)**

    - Ice scouring on trees/vegetation observed where the shoreline is intact indicate erosive action of water **(23)**

    - Observations of erosion in shoreline areas lacking wetland vegetation indicate erosion control performance of wetland vegetation **(24)**

Coastal Surge Protection:

Wetland disperses wave energy from coastal surge, thereby protecting in land areas from erosion or damage. None in our study area so not included on FA form.

Water Storage

The function of water storage (as opposed to stormwater management) is related to the general value of water retained on the surface for wildlife, raising local water table, local climate moderation, aesthetics, chemical processes, agricultural and fire use, etc. This function is generally captured in other categories.

15. Water is retained at or near surface **(9,11, 19)**

Groundwater Recharge:

Wetland captures surface flows and/or direct precipitation and discharges all or a portion to the water table. The extent of groundwater recharge by a wetland is dependent upon substrate permeability, vegetation, site, perimeter to volume ratio, and water table gradient (Dempster et al. 2006; Verry and Timmons 1982; Carter and Novitzki 1988) and the position of the wetland with respect to different-scale groundwater flow systems (Winter 1999; Price and Waddington 2000). Each situation is unique and dependent on local topography, climate, geology and watershed characteristics; using wetland ecology and geomorphology as groundwater recharge indicators is associated with high uncertainty. Watershed location will be used as the determinant of potential performance because the presence of wetlands in areas of groundwater recharge may increase water retention time to facilitate infiltration of precipitation and runoff (Mitsch and Gosselink 2000; Carter 1997). The conditions that would exist for a wetland to have potential to provide this function include:

16. Basin or flat wetlands located in topographical highs, or near watershed divides **(1, 5, DE)**

17. Not spring or groundwater fed, not riparian form, and outflow is not greater than inflow **(7, 20)**

18. Non-riparian wetlands with a channel inflow but no channel outflow (or subterranean outflow) **(12 and 13)**

Biogeochemical Function

Water Quality Improvement:

Wetland improves water quality through physical processes and chemical and metabolic transformations. Several conditions may indicate the potential of a wetland to improve water quality:

19. Surface- flow sourced wetlands with fluctuating water tables associated with precipitation events (i.e., alternating aerobic and anaerobic conditions, high primary productivity, and high soil-water interactions) are the most efficient nutrient transformers. These are also associated with sediment removal. **(14,15,16)**

20. Groundwater or spring source wetlands in agricultural watersheds (high soil/water interaction, source of nutrients; Hill 1991) **(DE,7,8)**

21. Riparian wetlands are important sinks for pollutants carried in upland runoff and from upstream areas such as agricultural soils (Gilliam 1996; Carpenter et al. 1998). They are noted for processing large fluxes of energy and materials from upstream sources, and they typically show high primary productivity (Mitsch and Gosselink 2000). **(1, 5, 7)**

22. Because precipitation-fed systems (bogs and certain marshes) are largely isolated from other surface water resources, they typically contribute little to watershed surface water quality (Mitsch and Gosselink 2000). **(1, 7)**

23. Surface-flow sourced wetlands with sheet flow (no open channel) and flow-impeding stem density **(7, 10, 24)**

24. Surface-flow sourced wetlands with flow-impeding micro-topography (hummocks, sinuous or braided flow channels, ribs/ridges) **(6, 7)**

Carbon Sequestration and Storage:

Wetland captures atmospheric carbon and stores it such that it contributes to mitigation of global climate change. Two generalizations can be made regarding wetlands performance of the carbon sequestration function:

25. Fluctuating water tables allow deposited organic material to be oxidized and thus lower carbon sequestration rates can be expected (Whiting and Chanton 2001). **(14,15,16,1)**

26. Greater water flows and gradients would not generally promote accumulation or organic matter, however lower gradients and flows would allow deposition. **(9,10,11)**

27. Other strong evidence of carbon storage are peat presence (arbitrarily greater than 50cm depth) **(17, 18)** and woody vegetation **(Delineation forms/Wildlife FA)**

Food Chain Support:

Wetlands provide or export nutrients, organic carbon or other food sources to support the food web. It is assumed that any riparian form wetland, or any wetland with an outflow feature is performing this function

28. Riparian or floodplain form wetland, or wetland with a surface water discharge **(1, 13)**

Social Function

Observations of the following (or observations along the same vein) may indicate human use or value of the wetland

29. Actual observations of humans in the wetland **(26)**

30. Indirect observations of human presence in the wetland, such as garbage, hunting blinds, shell casings, canoe-launch, trails, boardwalks, interpretive signs, protective signs [e.g. “no ATVs”] etc. **(26)**

31. Documentation of commercial use such as peat, salt hay, rice, fruit or wood harvesting **(DE)**

32. Evidence or documentation of indigenous use or value of the wetland **(DE)**

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Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant Plant Species)

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																			
			5	6	6	8	9	9	10	10	10	10	12	13	16	16	18	19	22	25	26	31
			Mixed Treed Swamp	Graminoid Marsh	Mixed Shrub Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Graminoid Marsh	Tall Shrub Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Cut-over Mixed Treed Swamp	Deciduous Treed Swamp	Cut-over Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Graminoid Marsh	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp
Tree	American Larch	*Larix laricina*																				
Tree	Balsam Fir	*Abies balsamea*	10			10		15			20			20	1	5	40	13		15		20
Tree	Black Spruce	*Picea mariana*	25			1		5													2	
Tree	Eastern Hemlock	*Tsuga canadensis*									15											
Tree	Eastern White Pine	*Pinus strobus*																				
Tree	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	0.5			5		5														
Tree	Paper Birch	*Betula papyrifera*																				
Tree	Red Maple	*Acer rubrum*	20		5	25		25			15			65		60	60	30		12	50	30
Tree	Red Spruce	*Picea rubens*				5		10			50				1	5	15	25		35	25	10
Tree	White Spruce	*Picea glauca*																				
Tree	Yellow Birch	*Betula alleghaniensis*																				
Shrub	a Blackberry	*Rubus sp.*										2	10									3
Shrub	a Serviceberry	*Amelanchier sp.*																				
Shrub	a Willow	*Salix sp.*																				
Shrub	American Larch	*Larix laricina*																				
Shrub	Balsam Fir	*Abies balsamea*	20			20	5	20		5		1		10	10	20	40	10		30	10	45
Shrub	Balsam Willow	*Salix pyrifolia*		10	40																	
Shrub	Beaked Hazelnut	*Corylus cornuta*																				
Shrub	Bebb's Willow	*Salix bebbiana*			8																	
Shrub	Black Chokeberry	*Photinia melanocarpa*																				
Shrub	Black Holly	*Ilex verticillata*				3	3	2				2		5	0.5			9		1		
Shrub	Black Huckleberry	*Gaylussacia baccata*										5			2							
Shrub	Black Spruce	*Picea mariana*	15					2.5	0.5			10			10			10				
Shrub	Bog Rosemary	*Andromeda polifolia*																				
Shrub	Bristly Dewberry	*Rubus hispidus*								10		10										
Shrub	Common Labrador Tea	*Ledum groenlandicum*																				
Shrub	Fire Cherry	*Prunus pensylvanica*																				
Shrub	Green Alder	*Alnus viridis*											5						2			
Shrub	Hardhack Spiraea	*Spiraea tomentosa*		1	10		1		5													
Shrub	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	1								1	5			2	1						
Shrub	Large Cranberry	*Vaccinium macrocarpon*		5	30																	
Shrub	Late Lowbush Blueberry	*Vaccinium angustifolium*							0.5													
Shrub	Leatherleaf	*Chamaedaphne calyculata*																				
Shrub	Mountain Fly-Honeysuckle	*Lonicera villosa*																				
Shrub	Mountain Holly	*Nemopanthus mucronatus*											20		0.5							
Shrub	Narrow-Leaved Meadow-Sweet	*Spiraea alba*			10		5					5	8						5			
Shrub	Northern Bayberry	*Morella pensylvanica*																				
Shrub	Northern Poison Oak	*Toxicodendron rydbergii*																				
Shrub	Paper Birch	*Betula papyrifera*																				
Shrub	Possum-Haw Viburnum	*Viburnum nudum*	1								2				0.5							
Shrub	Prairie Willow	*Salix humilis*																				
Shrub	Quaking Aspen	*Populus tremuloides*																	1			
Shrub	Red Maple	*Acer rubrum*			5		3			2		4	10		20				1	1	3	
Shrub	Red Raspberry	*Rubus idaeus*											4		0.5							
Shrub	Red Spruce	*Picea rubens*						2.5			15	15	5	2	10	20	15	20		15	15	5
Shrub	Rhodora	*Rhododendron canadense*			1				0.5				3									
Shrub	Sheep-Laurel	*Kalmia angustifolia*	3		5															0.5		
Shrub	Shining Rose	*Rosa nitida*																				
Shrub	Small Cranberry	*Vaccinium oxycoccos*																				
Shrub	Smooth Blackberry	*Rubus canadensis*																				
Shrub	Speckled Alder	*Alnus incana*				1	35	5		60			2		2			5			10	5
Shrub	Sweet Bayberry	*Myrica gale*																				
Shrub	Velvetleaf Blueberry	*Vaccinium myrtilloides*	3																			
Shrub	White Ash	*Fraxinus americana*																				
Shrub	White Spruce	*Picea glauca*																				
Shrub	Yellow Birch	*Betula alleghaniensis*																				
Ground Vegetation	a Bladderwort	*Utricularia sp.*																				
Ground Vegetation	a Bur-Reed	*Sparganium sp.*																				
Ground Vegetation	a Cotton-Grass	*Eriophorum sp.*																				
Ground Vegetation	a hybrid White Panicled American-Aster	*Oclemena x blakei*																				

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant Plant Species)

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																			
			5	6	6	8	9	9	10	10	10	10	12	13	16	16	18	19	22	25	26	31
			Mixed Treed Swamp	Graminoid Marsh	Mixed Shrub Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Graminoid Marsh	Tall Shrub Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Cut-over Mixed Treed Swamp	Deciduous Treed Swamp	Cut-over Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Graminoid Marsh	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp
Ground Vegetation	a Manna-Grass	*Glyceria sp.*					20															
Ground Vegetation	a Pondweed	*Potamogeton spp.*																				
Ground Vegetation	a Rush	*Juncus sp.*																				
Ground Vegetation	A Sedge	*Carex gynandra*																				
Ground Vegetation	A Sedge	*Carex magellanica ssp. irrigua*																				
Ground Vegetation	a Sedge	*Carex sp.*																				
Ground Vegetation	a Spikerush	*Eleocharis sp.*																				
Ground Vegetation	a Violet	*Viola sp.*																				
Ground Vegetation	a Wood Fern	*Dryopteris sp.*												4								
Ground Vegetation	Algae	*Algae spp.*																				
Ground Vegetation	American Bur-Reed	*Sparganium americanum*					10													85		
Ground Vegetation	American Water-Lily	*Nymphaea odorata*																				
Ground Vegetation	Bear Sedge	*Carex utriculata*																				
Ground Vegetation	Blueflag	*Iris versicolor*																				
Ground Vegetation	Blue-Joint Reedgrass	*Calamagrostis canadensis*																				
Ground Vegetation	Blunt Manna-Grass	*Glyceria obtusa*																				
Ground Vegetation	Bog Aster	*Oclemena nemoralis*																				
Ground Vegetation	Bog Clubmoss	*Lycopodiella inundata*																				
Ground Vegetation	Bog Goldenrod	*Solidago uliginosa*																				
Ground Vegetation	Braided moss	*Hypnum spp.*																				
Ground Vegetation	Bristly-Stalk Sedge	*Carex leptalea*																				
Ground Vegetation	Broad-Leaf Cattail	*Typha latifolia*							40													
Ground Vegetation	Brown-Fruited Rush	*Juncus pelocarpus*																				
Ground Vegetation	Brownish Sedge	*Carex brunnescens*																				
Ground Vegetation	Canada Manna-Grass	*Glyceria canadensis*																				
Ground Vegetation	Canada Rush	*Juncus canadensis*																				
Ground Vegetation	Christmas Fern	*Polystichum acrostichoides*																				
Ground Vegetation	Cinnamon Fern	*Osmunda cinnamomea*	50		1	40		30		60	30	30	25	50	80	70	20	75		70	35	3
Ground Vegetation	Climbing Nightshade	*Solanum dulcamara*																				
Ground Vegetation	Cottongrass Bulrush	*Scirpus cyperinus*		40					5				2		2				55			
Ground Vegetation	Creeping Butter-Cup	*Ranunculus repens*																				
Ground Vegetation	Creeping Snowberry	*Gaultheria hispidula*	5																			
Ground Vegetation	Crested Shield-Fern	*Dryopteris cristata*																				
Ground Vegetation	Crinkled Hairgrass	*Deschampsia flexuosa*																				
Ground Vegetation	Dwarf Dog	*Cornus canadensis*	5					3		3		5			10		4				15	
Ground Vegetation	Early Coralroot	*Corallorhiza trifida*																				
Ground Vegetation	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*											30									
Ground Vegetation	Evergreen fern	*Dryopteris intermedia*																				
Ground Vegetation	Field Horsetail	*Equisetum arvense*																				
Ground Vegetation	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*																				
Ground Vegetation	Fowl Bluegrass	*Poa palustris*																	5			
Ground Vegetation	Goldthread	*Coptis trifolia*														3	4			1		
Ground Vegetation	Hair-cap Moss	*Polytrichum sp.*			15																	
Ground Vegetation	Hairy Willow-Herb	*Epilobium ciliatum*								5												
Ground Vegetation	Hoary Sedge	*Carex canescens*		10	5		3		20													
Ground Vegetation	Indian-Pipe	*Monotropa uniflora*																				
Ground Vegetation	Interrupted Fern	*Osmunda claytoniana*												3								
Ground Vegetation	Kentucky Bluegrass	*Poa pratensis*																				
Ground Vegetation	Lady-Fern	*Athyrium filix-femina*												10								
Ground Vegetation	Least Spike-Rush	*Eleocharis acicularis*																				
Ground Vegetation	Little Prickly Sedge	*Carex echinata*																				
Ground Vegetation	Long Sedge	*Carex folliculata*																				
Ground Vegetation	Mad Dog Skullcap	*Scutellaria lateriflora*																				
Ground Vegetation	Marsh Bedstraw	*Galium palustre*					10															
Ground Vegetation	Marsh Blue Violet	*Viola cucullata*																				
Ground Vegetation	Marsh St. John's-Wort	*Triadenum fraseri*		1																		
Ground Vegetation	Mountain -Fern	*Dryopteris campyloptera*																				
Ground Vegetation	Narrow-Leaved Cattail	*Typha angustifolia*																				
Ground Vegetation	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*																				
Ground Vegetation	Narrow-Panicled Rush	*Juncus brevicaudatus*																				

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant Plant Species)

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																			
			5	6	6	8	9	9	10	10	10	10	12	13	16	16	18	19	22	25	26	31
			Mixed Treed Swamp	Graminoid Marsh	Mixed Shrub Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Graminoid Marsh	Tall Shrub Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Cut-over Mixed Treed Swamp	Deciduous Treed Swamp	Cut-over Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Graminoid Marsh	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp
Ground Vegetation	New Belgium American-Aster	*Symphyotrichum novi-belgii*			3																	
Ground Vegetation	New York Fern	*Thelypteris noveboracensis*	1								5				10	10	5	5				2
Ground Vegetation	Northern Beech Fern	*Phegopteris connectilis*																				
Ground Vegetation	Northern Bugleweed	*Lycopus uniflorus*							0.5													
Ground Vegetation	Northern Mannagrass	*Glyceria laxa*																				
Ground Vegetation	Northern Pitcher-Plant	*Sarracenia purpurea*																				
Ground Vegetation	Northern Starflower	*Trientalis borealis*	7					10						3		5	4	3			10	
Ground Vegetation	Parasol White-Top	*Doellingeria umbellata*																				
Ground Vegetation	Partridge-Berry	*Mitchella repens*																		1		
Ground Vegetation	Peatmoss	*Sphagnum spp.*	80		15	40	60	55	50	60	80	60	60	18	85		15	80			90	90
Ground Vegetation	Pickerel Weed	*Pontederia cordata*																				
Ground Vegetation	Purple Avens	*Geum rivale*																				
Ground Vegetation	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*								10												
Ground Vegetation	Red Fescue	*Festuca rubra*																	15			
Ground Vegetation	Red-stemmed Moss	*Pleurozium schreberi*																				
Ground Vegetation	Reindeer Lichen	*Cladina spp.*																				
Ground Vegetation	Rhytidiadelphus Moss	*Rhytidiadelphus sp.*															5					
Ground Vegetation	Rough Bentgrass	*Agrostis scabra*																				
Ground Vegetation	Rough Sedge	*Carex scabrata*																				
Ground Vegetation	Rough-Leaf Goldenrod	*Solidago rugosa*								3									3			
Ground Vegetation	Roundleaf Sundew	*Drosera rotundifolia*																				
Ground Vegetation	Royal Fern	*Osmunda regalis*			5																	
Ground Vegetation	Sensitive Fern	*Onoclea sensibilis*		30																		
Ground Vegetation	Seven-Angled Pipewort	*Eriocaulon aquaticum*																				
Ground Vegetation	Slender Sedge	*Carex lasiocarpa*																				
Ground Vegetation	Small Enchanter's Nightshade	*Circaea alpina*																				
Ground Vegetation	Small Green Woodland Orchid	*Platanthera clavellata*																				
Ground Vegetation	Small Purple-Fringe Orchis	*Platanthera psycodes*																				
Ground Vegetation	Small-Fruit Bulrush	*Scirpus microcarpus*																				
Ground Vegetation	Smooth White Violet	*Viola macloskeyi*																				
Ground Vegetation	Soft Rush	*Juncus effusus*							2													
Ground Vegetation	Spinulose Shield Fern	*Dryopteris carthusiana*						20		4												
Ground Vegetation	Spotted Jewel-Weed	*Impatiens capensis*																				
Ground Vegetation	St. John's-Wort	*Triadenum sp.*					8															3
Ground Vegetation	Stair-step Moss	*Hylocomium splendens*															5					
Ground Vegetation	Stiff Clubmoss	*Lycopodium annotinum*																				
Ground Vegetation	Swamp Loosestrife	*Lysimachia terrestris*																				
Ground Vegetation	Tawny Cotton-Grass	*Eriophorum virginicum*																				
Ground Vegetation	Teaberry	*Gaultheria procumbens*																				
Ground Vegetation	Thread Rush	*Juncus filiformis*																				
Ground Vegetation	Three-lobed Bazzania	*Bazzania trilobata*																				
Ground Vegetation	Three-Seed Sedge	*Carex trisperma*	3					3			20				5	3				5		15
Ground Vegetation	Three-Way Sedge	*Dulichium arundinaceum*																				
Ground Vegetation	Tussock Sedge	*Carex stricta*																				
Ground Vegetation	Twinflower	*Linnaea borealis*																				
Ground Vegetation	Water Sedge	*Carex aquatilis*																				
Ground Vegetation	Water Sedge	*Carex nigra*																				
Ground Vegetation	Watershield	*Brasenia schreberi*																				
Ground Vegetation	White -Sorrel	*Oxalis montana*	4					20			15			3			4	5		10		
Ground Vegetation	White Turtlehead	*Chelone glabra*																				
Ground Vegetation	Whorled Aster	*Oclemena acuminata*												3								
Ground Vegetation	Wild Lily-of-The-Valley	*Maianthemum canadense*	2			10		3								5				2		
Ground Vegetation	Wild Sarsaparilla	*Aralia nudicaulis*														50	2					
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																				
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																				

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																						
			34	39	39	40	40	49	49	49	49	49	50	50	55	55	63	65	65	68	68	80	80	82	82
			Tall Shrub Swamp	Aquatic Shallow Water	Tall Shrub Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Aquatic Shallow Water	Graminoid Fen	Low Shrub Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Aquatic Shallow Water	Low Shrub Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Graminoid Marsh	Mixed Shrub Swamp	Moss Shallow Water	Coniferous Treed Swamp	Low Shrub Swamp	Tall Shrub Swamp	Cut-over Mixed Treed Swamp	Moss Swamp
Tree	American Larch	*Larix laricina*				3																			
Tree	Balsam Fir	*Abies balsamea*					15					30				35	5				5				
Tree	Black Spruce	*Picea mariana*				3	45							1							40				
Tree	Eastern Hemlock	*Tsuga canadensis*																							
Tree	Eastern White Pine	*Pinus strobus*																							
Tree	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*																							
Tree	Paper Birch	*Betula papyrifera*																							
Tree	Red Maple	*Acer rubrum*				2	10					7		1			10				10				
Tree	Red Spruce	*Picea rubens*										30			5	40	15								
Tree	White Spruce	*Picea glauca*																							
Tree	Yellow Birch	*Betula alleghaniensis*																							
Shrub	a Blackberry	*Rubus sp.*																							
Shrub	a Serviceberry	*Amelanchier sp.*																							
Shrub	a Willow	*Salix sp.*																							
Shrub	American Larch	*Larix laricina*																							
Shrub	Balsam Fir	*Abies balsamea*					20					12.5				15					10			5	
Shrub	Balsam Willow	*Salix pyrifolia*	1																						
Shrub	Beaked Hazelnut	*Corylus cornuta*																							
Shrub	Bebb's Willow	*Salix bebbiana*																							
Shrub	Black Chokeberry	*Photinia melanocarpa*																							
Shrub	Black Holly	*Ilex verticillata*				15	5					2		5											
Shrub	Black Huckleberry	*Gaylussacia baccata*																							
Shrub	Black Spruce	*Picea mariana*			15		20					20		2							5		30	5	
Shrub	Bog Rosemary	*Andromeda polifolia*																							
Shrub	Bristly Dewberry	*Rubus hispidus*				10																			
Shrub	Common Labrador Tea	*Ledum groenlandicum*			0.5																				
Shrub	Fire Cherry	*Prunus pensylvanica*																							
Shrub	Green Alder	*Alnus viridis*																							
Shrub	Hardhack Spiraea	*Spiraea tomentosa*																					2		
Shrub	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*										1		1											
Shrub	Large Cranberry	*Vaccinium macrocarpon*																				40	10		
Shrub	Late Lowbush Blueberry	*Vaccinium angustifolium*																							
Shrub	Leatherleaf	*Chamaedaphne calyculata*			40	20								40											
Shrub	Mountain Fly-Honeysuckle	*Lonicera villosa*																							
Shrub	Mountain Holly	*Nemopanthus mucronatus*				5															5			1	
Shrub	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	8		2	10													5			0.5			
Shrub	Northern Bayberry	*Morella pensylvanica*																							
Shrub	Northern Poison Oak	*Toxicodendron rydbergii*																							
Shrub	Paper Birch	*Betula papyrifera*																							
Shrub	Possum-Haw Viburnum	*Viburnum nudum*				5						3													
Shrub	Prairie Willow	*Salix humilis*																							
Shrub	Quaking Aspen	*Populus tremuloides*																							
Shrub	Red Maple	*Acer rubrum*			3	3						10		5					10				10	5	0.5
Shrub	Red Raspberry	*Rubus idaeus*																							
Shrub	Red Spruce	*Picea rubens*										15				10			5						
Shrub	Rhodora	*Rhododendron canadense*			20	7				2				1								5	15		1
Shrub	Sheep-Laurel	*Kalmia angustifolia*	5													1			50		5	1		2	
Shrub	Shining Rose	*Rosa nitida*																							
Shrub	Small Cranberry	*Vaccinium oxycoccos*																							
Shrub	Smooth Blackberry	*Rubus canadensis*																							
Shrub	Speckled Alder	*Alnus incana*	25			15	5			7.5	70	20				10			10			5	60		
Shrub	Sweet Bayberry	*Myrica gale*			20	25			1	60	1			30											
Shrub	Velvetleaf Blueberry	*Vaccinium myrtilloides*																							
Shrub	White Ash	*Fraxinus americana*																							
Shrub	White Spruce	*Picea glauca*																							
Shrub	Yellow Birch	*Betula alleghaniensis*																							
Ground Vegetation	a Bladderwort	*Utricularia sp.*		60																					
Ground Vegetation	a Bur-Reed	*Sparganium sp.*																							
Ground Vegetation	a Cotton-Grass	*Eriophorum sp.*										20													
Ground Vegetation	a hybrid White Panicled American-Aster	*Oclemena x blakei*																							

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																						
			34 Tall Shrub Swamp	39 Aquatic Shallow Water	39 Tall Shrub Swamp	40 Tall Shrub Swamp	40 Coniferous Treed Swamp	49 Aquatic Shallow Water	49 Graminoid Fen	49 Low Shrub Swamp	49 Tall Shrub Swamp	49 Coniferous Treed Swamp	50 Aquatic Shallow Water	50 Low Shrub Swamp	55 Tall Shrub Swamp	55 Coniferous Treed Swamp	63 Mixed Treed Swamp	65 Graminoid Marsh	65 Mixed Shrub Swamp	68 Moss Shallow Water	68 Coniferous Treed Swamp	80 Low Shrub Swamp	80 Tall Shrub Swamp	82 Cut-over Mixed Treed Swamp	82 Moss Swamp
Ground Vegetation	a Manna-Grass	*Glyceria sp.*																							
Ground Vegetation	a Pondweed	*Potamogeton spp.*																							
Ground Vegetation	a Rush	*Juncus sp.*	1																						
Ground Vegetation	A Sedge	*Carex gynandra*																							
Ground Vegetation	A Sedge	*Carex magellanica ssp. irrigua*																							
Ground Vegetation	a Sedge	*Carex sp.*																							
Ground Vegetation	a Spikerush	*Eleocharis sp.*																				10			
Ground Vegetation	a Violet	*Viola sp.*																							
Ground Vegetation	a Wood Fern	*Dryopteris sp.*																							
Ground Vegetation	Algae	*Algae spp.*																							
Ground Vegetation	American Bur-Reed	*Sparganium americanum*											10												
Ground Vegetation	American Water-Lily	*Nymphaea odorata*		12				15					10												
Ground Vegetation	Bear Sedge	*Carex utriculata*							20	10			25	2											
Ground Vegetation	Blueflag	*Iris versicolor*										1													
Ground Vegetation	Blue-Joint Reedgrass	*Calamagrostis canadensis*							15	12.5	5			2											
Ground Vegetation	Blunt Manna-Grass	*Glyceria obtusa*			1																				
Ground Vegetation	Bog Aster	*Oclemena nemoralis*			3	5																			
Ground Vegetation	Bog Clubmoss	*Lycopodiella inundata*																							
Ground Vegetation	Bog Goldenrod	*Solidago uliginosa*																							
Ground Vegetation	Braided moss	*Hypnum spp.*																							
Ground Vegetation	Bristly-Stalk Sedge	*Carex leptalea*																							
Ground Vegetation	Broad-Leaf Cattail	*Typha latifolia*								25								10		7					
Ground Vegetation	Brown-Fruited Rush	*Juncus pelocarpus*																							
Ground Vegetation	Brownish Sedge	*Carex brunnescens*									15														
Ground Vegetation	Canada Manna-Grass	*Glyceria canadensis*																							
Ground Vegetation	Canada Rush	*Juncus canadensis*																							
Ground Vegetation	Christmas Fern	*Polystichum acrostichoides*																					20		
Ground Vegetation	Cinnamon Fern	*Osmunda cinnamomea*			3	15	50					28.33333333					15		7		10			15	
Ground Vegetation	Climbing Nightshade	*Solanum dulcamara*																							
Ground Vegetation	Cottongrass Bulrush	*Scirpus cyperinus*																							
Ground Vegetation	Creeping Butter-Cup	*Ranunculus repens*																							
Ground Vegetation	Creeping Snowberry	*Gaultheria hispidula*																							
Ground Vegetation	Crested Shield-Fern	*Dryopteris cristata*																							
Ground Vegetation	Crinkled Hairgrass	*Deschampsia flexuosa*																							
Ground Vegetation	Dwarf Dog	*Cornus canadensis*										7				5	5				5			2	
Ground Vegetation	Early Coralroot	*Corallorhiza trifida*																							
Ground Vegetation	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*															5								
Ground Vegetation	Evergreen fern	*Dryopteris intermedia*													5										
Ground Vegetation	Field Horsetail	*Equisetum arvense*																							1
Ground Vegetation	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*																							
Ground Vegetation	Fowl Bluegrass	*Poa palustris*																							
Ground Vegetation	Goldthread	*Coptis trifolia*															2								
Ground Vegetation	Hair-cap Moss	*Polytrichum sp.*	65									15		10	25										
Ground Vegetation	Hairy Willow-Herb	*Epilobium ciliatum*																							
Ground Vegetation	Hoary Sedge	*Carex canescens*			1																	15	5		
Ground Vegetation	Indian-Pipe	*Monotropa uniflora*																							
Ground Vegetation	Interrupted Fern	*Osmunda claytoniana*															25								
Ground Vegetation	Kentucky Bluegrass	*Poa pratensis*																							
Ground Vegetation	Lady-Fern	*Athyrium filix-femina*																							
Ground Vegetation	Least Spike-Rush	*Eleocharis acicularis*																							
Ground Vegetation	Little Prickly Sedge	*Carex echinata*																							
Ground Vegetation	Long Sedge	*Carex folliculata*																							
Ground Vegetation	Mad Dog Skullcap	*Scutellaria lateriflora*																							
Ground Vegetation	Marsh Bedstraw	*Galium palustre*																							
Ground Vegetation	Marsh Blue Violet	*Viola cucullata*																							
Ground Vegetation	Marsh St. John's-Wort	*Triadenum fraseri*			3																	1			
Ground Vegetation	Mountain -Fern	*Dryopteris campyloptera*																							
Ground Vegetation	Narrow-Leaved Cattail	*Typha angustifolia*																							
Ground Vegetation	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*																							6
Ground Vegetation	Narrow-Panicled Rush	*Juncus brevicaudatus*																				20			15

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																						
			34	39	39	40	40	49	49	49	49	49	50	50	55	55	63	65	65	68	68	80	80	82	82
			Tall Shrub Swamp	Aquatic Shallow Water	Tall Shrub Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Aquatic Shallow Water	Graminoid Fen	Low Shrub Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Aquatic Shallow Water	Low Shrub Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Graminoid Marsh	Mixed Shrub Swamp	Moss Shallow Water	Coniferous Treed Swamp	Low Shrub Swamp	Tall Shrub Swamp	Cut-over Mixed Treed Swamp	Moss Swamp
Ground Vegetation	New Belgium American-Aster	*Symphyotrichum novi-belgii*																	2						
Ground Vegetation	New York Fern	*Thelypteris noveboracensis*										5					10								
Ground Vegetation	Northern Beech Fern	*Phegopteris connectilis*																							
Ground Vegetation	Northern Bugleweed	*Lycopus uniflorus*																							
Ground Vegetation	Northern Mannagrass	*Glyceria laxa*																							
Ground Vegetation	Northern Pitcher-Plant	*Sarracenia purpurea*			5																				
Ground Vegetation	Northern Starflower	*Trientalis borealis*										5			5				4						
Ground Vegetation	Parasol White-Top	*Doellingeria umbellata*																					2		
Ground Vegetation	Partridge-Berry	*Mitchella repens*																							
Ground Vegetation	Peatmoss	*Sphagnum spp.*	8		98	90	80		90	35	60	83.33333333		50	40	55	40	10	60	60	70	60	20	40	99
Ground Vegetation	Pickerel Weed	*Pontederia cordata*						15					30												
Ground Vegetation	Purple Avens	*Geum rivale*																							
Ground Vegetation	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*																							
Ground Vegetation	Red Fescue	*Festuca rubra*																							
Ground Vegetation	Red-stemmed Moss	*Pleurozium schreberi*														10									
Ground Vegetation	Reindeer Lichen	*Cladina spp.*																							
Ground Vegetation	Rhytidiadelphus Moss	*Rhytidiadelphus sp.*																							
Ground Vegetation	Rough Bentgrass	*Agrostis scabra*																							
Ground Vegetation	Rough Sedge	*Carex scabrata*																							
Ground Vegetation	Rough-Leaf Goldenrod	*Solidago rugosa*																							
Ground Vegetation	Roundleaf Sundew	*Drosera rotundifolia*																				4			
Ground Vegetation	Royal Fern	*Osmunda regalis*																							
Ground Vegetation	Sensitive Fern	*Onoclea sensibilis*																2							
Ground Vegetation	Seven-Angled Pipewort	*Eriocaulon aquaticum*																							
Ground Vegetation	Slender Sedge	*Carex lasiocarpa*							50																
Ground Vegetation	Small Enchanter's Nightshade	*Circaea alpina*																							
Ground Vegetation	Small Green Woodland Orchid	*Platanthera clavellata*																							
Ground Vegetation	Small Purple-Fringe Orchis	*Platanthera psycodes*																							
Ground Vegetation	Small-Fruit Bulrush	*Scirpus microcarpus*																							
Ground Vegetation	Smooth White Violet	*Viola macloskeyi*													2										
Ground Vegetation	Soft Rush	*Juncus effusus*																20							
Ground Vegetation	Spinulose Shield Fern	*Dryopteris carthusiana*									1														
Ground Vegetation	Spotted Jewel-Weed	*Impatiens capensis*																							
Ground Vegetation	St. John's-Wort	*Triadenum sp.*																							
Ground Vegetation	Stair-step Moss	*Hylocomium splendens*																							
Ground Vegetation	Stiff Clubmoss	*Lycopodium annotinum*																							
Ground Vegetation	Swamp Loosestrife	*Lysimachia terrestris*																							
Ground Vegetation	Tawny Cotton-Grass	*Eriophorum virginicum*																							
Ground Vegetation	Teaberry	*Gaultheria procumbens*																							
Ground Vegetation	Thread Rush	*Juncus filiformis*																							
Ground Vegetation	Three-lobed Bazzania	*Bazzania trilobata*														5									
Ground Vegetation	Three-Seed Sedge	*Carex trisperma*			3						10	18			5	15					30			5	
Ground Vegetation	Three-Way Sedge	*Dulichium arundinaceum*																							
Ground Vegetation	Tussock Sedge	*Carex stricta*																							
Ground Vegetation	Twinflower	*Linnaea borealis*																						5	
Ground Vegetation	Water Sedge	*Carex aquatilis*																							
Ground Vegetation	Water Sedge	*Carex nigra*											5												
Ground Vegetation	Watershield	*Brasenia schreberi*		1				5																	
Ground Vegetation	White -Sorrel	*Oxalis montana*										15													
Ground Vegetation	White Turtlehead	*Chelone glabra*																							
Ground Vegetation	Whorled Aster	*Oclemena acuminata*													10										
Ground Vegetation	Wild Lily-of-The-Valley	*Maianthemum canadense*										5													
Ground Vegetation	Wild Sarsaparilla	*Aralia nudicaulis*										20									5				
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*		30				20	5				15												
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																							

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																					
			82	84	84	88	88	88	91	92	93	93	94	99	99	102	102	103	103	107	107	109	114	114
			Coniferous Treed Swamp	Moss Swamp	Mixed Treed Swamp	Coniferous Treed Bog	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Graminoid Marsh	Non-Vegetated Shallow Water	Coniferous Treed Swamp	Moss Swamp	Mixed Treed Swamp	Cut-over Deciduous Treed Swamp	Coniferous Treed Swamp	Graminoid Marsh	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Moss Marsh	Tall Shrub Bog	Coniferous Treed Swamp
Tree	American Larch	*Larix laricina*																						
Tree	Balsam Fir	*Abies balsamea*			30			10		5			25											5
Tree	Black Spruce	*Picea mariana*	20		10	10		35	5				40				25		10		10			20
Tree	Eastern Hemlock	*Tsuga canadensis*																						
Tree	Eastern White Pine	*Pinus strobus*																						
Tree	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*																						
Tree	Paper Birch	*Betula papyrifera*	5																					
Tree	Red Maple	*Acer rubrum*	10		15			1		15									5					10
Tree	Red Spruce	*Picea rubens*			10					55														
Tree	White Spruce	*Picea glauca*					1																	
Tree	Yellow Birch	*Betula alleghaniensis*																						
Shrub	a Blackberry	*Rubus sp.*																						
Shrub	a Serviceberry	*Amelanchier sp.*																						
Shrub	a Willow	*Salix sp.*	5																					
Shrub	American Larch	*Larix laricina*																						
Shrub	Balsam Fir	*Abies balsamea*	15		6			10		5			10		10		10		5		5			15
Shrub	Balsam Willow	*Salix pyrifolia*																1				10		
Shrub	Beaked Hazelnut	*Corylus cornuta*																						
Shrub	Bebb's Willow	*Salix bebbiana*																						
Shrub	Black Chokeberry	*Photinia melanocarpa*																						
Shrub	Black Holly	*Ilex verticillata*						2																
Shrub	Black Huckleberry	*Gaylussacia baccata*																						
Shrub	Black Spruce	*Picea mariana*	40	5	5	15		5	10		2		15	5	5		20		5	2	30	1	0.5	10
Shrub	Bog Rosemary	*Andromeda polifolia*																						
Shrub	Bristly Dewberry	*Rubus hispidus*			1		5		5															
Shrub	Common Labrador Tea	*Ledum groenlandicum*																	20	10				
Shrub	Fire Cherry	*Prunus pensylvanica*														1								
Shrub	Green Alder	*Alnus viridis*																		15				
Shrub	Hardhack Spiraea	*Spiraea tomentosa*																						
Shrub	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*			0.5												2							
Shrub	Large Cranberry	*Vaccinium macrocarpon*		2										10						35				
Shrub	Late Lowbush Blueberry	*Vaccinium angustifolium*									5			2										
Shrub	Leatherleaf	*Chamaedaphne calyculata*																					40	
Shrub	Mountain Fly-Honeysuckle	*Lonicera villosa*																						
Shrub	Mountain Holly	*Nemopanthus mucronatus*				1										2	5		7					8
Shrub	Narrow-Leaved Meadow-Sweet	*Spiraea alba*		1														2		5				
Shrub	Northern Bayberry	*Morella pensylvanica*																		1				
Shrub	Northern Poison Oak	*Toxicodendron rydbergii*																						
Shrub	Paper Birch	*Betula papyrifera*							1		2		1			10								
Shrub	Possum-Haw Viburnum	*Viburnum nudum*																						
Shrub	Prairie Willow	*Salix humilis*		1																				
Shrub	Quaking Aspen	*Populus tremuloides*																						
Shrub	Red Maple	*Acer rubrum*	5	2	12.5	2	10	1	10	2			10	5	1	15	10	1	25	4	5			2
Shrub	Red Raspberry	*Rubus idaeus*														5								
Shrub	Red Spruce	*Picea rubens*			5		2			10														
Shrub	Rhodora	*Rhododendron canadense*	10	5					15		25									5			1	
Shrub	Sheep-Laurel	*Kalmia angustifolia*			1	1		1	10		5			2	5						5	5	1	5
Shrub	Shining Rose	*Rosa nitida*																						
Shrub	Small Cranberry	*Vaccinium oxycoccos*				15																		
Shrub	Smooth Blackberry	*Rubus canadensis*																						
Shrub	Speckled Alder	*Alnus incana*			0.5		60	2	5	2			5											
Shrub	Sweet Bayberry	*Myrica gale*																						
Shrub	Velvetleaf Blueberry	*Vaccinium myrtilloides*																	10		10			
Shrub	White Ash	*Fraxinus americana*																						
Shrub	White Spruce	*Picea glauca*																						
Shrub	Yellow Birch	*Betula alleghaniensis*																						
Ground Vegetation	a Bladderwort	*Utricularia sp.*																						
Ground Vegetation	a Bur-Reed	*Sparganium sp.*																						
Ground Vegetation	a Cotton-Grass	*Eriophorum sp.*																						
Ground Vegetation	a hybrid White Panicled American-Aster	*Oclemena x blakei*																						

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																					
			82	84	84	88	88	88	91	92	93	93	94	99	99	102	102	103	103	107	107	109	114	114
			Coniferous Treed Swamp	Moss Swamp	Mixed Treed Swamp	Coniferous Treed Bog	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Graminoid Marsh	Non-Vegetated Shallow Water	Coniferous Treed Swamp	Moss Swamp	Mixed Treed Swamp	Cut-over Deciduous Treed Swamp	Coniferous Treed Swamp	Graminoid Marsh	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Moss Marsh	Tall Shrub Bog	Coniferous Treed Swamp
Ground Vegetation	a Manna-Grass	*Glyceria sp.*																						
Ground Vegetation	a Pondweed	*Potamogeton spp.*																						
Ground Vegetation	a Rush	*Juncus sp.*		2										5				5		5				
Ground Vegetation	A Sedge	*Carex gynandra*																						
Ground Vegetation	A Sedge	*Carex magellanica ssp. irrigua*				10																		
Ground Vegetation	a Sedge	*Carex sp.*																						
Ground Vegetation	a Spikerush	*Eleocharis sp.*																						
Ground Vegetation	a Violet	*Viola sp.*																						
Ground Vegetation	a Wood Fern	*Dryopteris sp.*																						
Ground Vegetation	Algae	*Algae spp.*										80												
Ground Vegetation	American Bur-Reed	*Sparganium americanum*																						
Ground Vegetation	American Water-Lily	*Nymphaea odorata*																						
Ground Vegetation	Bear Sedge	*Carex utriculata*																						
Ground Vegetation	Blueflag	*Iris versicolor*																						
Ground Vegetation	Blue-Joint Reedgrass	*Calamagrostis canadensis*																						
Ground Vegetation	Blunt Manna-Grass	*Glyceria obtusa*																						
Ground Vegetation	Bog Aster	*Oclemena nemoralis*																						
Ground Vegetation	Bog Clubmoss	*Lycopodiella inundata*																						
Ground Vegetation	Bog Goldenrod	*Solidago uliginosa*																						
Ground Vegetation	Braided moss	*Hypnum spp.*																						
Ground Vegetation	Bristly-Stalk Sedge	*Carex leptalea*																						
Ground Vegetation	Broad-Leaf Cattail	*Typha latifolia*																						
Ground Vegetation	Brown-Fruited Rush	*Juncus pelocarpus*																						
Ground Vegetation	Brownish Sedge	*Carex brunnescens*																		15				
Ground Vegetation	Canada Manna-Grass	*Glyceria canadensis*		5			20																	
Ground Vegetation	Canada Rush	*Juncus canadensis*									2													
Ground Vegetation	Christmas Fern	*Polystichum acrostichoides*																						
Ground Vegetation	Cinnamon Fern	*Osmunda cinnamomea*	5		15	1	15	15					40		15	10	35		1	5	10			15
Ground Vegetation	Climbing Nightshade	*Solanum dulcamara*																						
Ground Vegetation	Cottongrass Bulrush	*Scirpus cyperinus*		20	10				1		40			25	10	15		50				20		
Ground Vegetation	Creeping Butter-Cup	*Ranunculus repens*																						
Ground Vegetation	Creeping Snowberry	*Gaultheria hispidula*						5											2					2
Ground Vegetation	Crested Shield-Fern	*Dryopteris cristata*																						
Ground Vegetation	Crinkled Hairgrass	*Deschampsia flexuosa*																						
Ground Vegetation	Dwarf Dog	*Cornus canadensis*	5		1			3					2		5	5	5		2					
Ground Vegetation	Early Coralroot	*Corallorhiza trifida*																						
Ground Vegetation	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*																						
Ground Vegetation	Evergreen fern	*Dryopteris intermedia*																						
Ground Vegetation	Field Horsetail	*Equisetum arvense*																						
Ground Vegetation	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*																						
Ground Vegetation	Fowl Bluegrass	*Poa palustris*																						
Ground Vegetation	Goldthread	*Coptis trifolia*																						
Ground Vegetation	Hair-cap Moss	*Polytrichum sp.*																5				70	2	
Ground Vegetation	Hairy Willow-Herb	*Epilobium ciliatum*																						
Ground Vegetation	Hoary Sedge	*Carex canescens*		5										7							15		15	
Ground Vegetation	Indian-Pipe	*Monotropa uniflora*																						
Ground Vegetation	Interrupted Fern	*Osmunda claytoniana*			10																			
Ground Vegetation	Kentucky Bluegrass	*Poa pratensis*																						
Ground Vegetation	Lady-Fern	*Athyrium filix-femina*																						
Ground Vegetation	Least Spike-Rush	*Eleocharis acicularis*																						
Ground Vegetation	Little Prickly Sedge	*Carex echinata*																						
Ground Vegetation	Long Sedge	*Carex folliculata*																						
Ground Vegetation	Mad Dog Skullcap	*Scutellaria lateriflora*																						
Ground Vegetation	Marsh Bedstraw	*Galium palustre*																						
Ground Vegetation	Marsh Blue Violet	*Viola cucullata*																						
Ground Vegetation	Marsh St. John's-Wort	*Triadenum fraseri*																						
Ground Vegetation	Mountain -Fern	*Dryopteris campyloptera*																						
Ground Vegetation	Narrow-Leaved Cattail	*Typha angustifolia*																						
Ground Vegetation	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*																						
Ground Vegetation	Narrow-Panicled Rush	*Juncus brevicaudatus*																						

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																					
			82	84	84	88	88	88	91	92	93	93	94	99	99	102	102	103	103	107	107	109	114	114
			Coniferous Treed Swamp	Moss Swamp	Mixed Treed Swamp	Coniferous Treed Bog	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Graminoid Marsh	Non-Vegetated Shallow Water	Coniferous Treed Swamp	Moss Swamp	Mixed Treed Swamp	Cut-over Deciduous Treed Swamp	Coniferous Treed Swamp	Graminoid Marsh	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Moss Marsh	Tall Shrub Bog	Coniferous Treed Swamp
Ground Vegetation	New Belgium American-Aster	*Symphyotrichum novi-belgii*																						
Ground Vegetation	New York Fern	*Thelypteris noveboracensis*			10								5											
Ground Vegetation	Northern Beech Fern	*Phegopteris connectilis*																						
Ground Vegetation	Northern Bugleweed	*Lycopus uniflorus*																						
Ground Vegetation	Northern Mannagrass	*Glyceria laxa*																						
Ground Vegetation	Northern Pitcher-Plant	*Sarracenia purpurea*																						
Ground Vegetation	Northern Starflower	*Trientalis borealis*											2											
Ground Vegetation	Parasol White-Top	*Doellingeria umbellata*		1			1																	
Ground Vegetation	Partridge-Berry	*Mitchella repens*																						
Ground Vegetation	Peatmoss	*Sphagnum spp.*	60	70	40	90	70	80	95	15			80	90	90	85	90	15	65	90	90		95	90
Ground Vegetation	Pickerel Weed	*Pontederia cordata*																						
Ground Vegetation	Purple Avens	*Geum rivale*																						
Ground Vegetation	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*																						
Ground Vegetation	Red Fescue	*Festuca rubra*																						
Ground Vegetation	Red-stemmed Moss	*Pleurozium schreberi*								10									20					
Ground Vegetation	Reindeer Lichen	*Cladina spp.*																						
Ground Vegetation	Rhytidiadelphus Moss	*Rhytidiadelphus sp.*																						
Ground Vegetation	Rough Bentgrass	*Agrostis scabra*																						
Ground Vegetation	Rough Sedge	*Carex scabrata*																						
Ground Vegetation	Rough-Leaf Goldenrod	*Solidago rugosa*																						
Ground Vegetation	Roundleaf Sundew	*Drosera rotundifolia*																						
Ground Vegetation	Royal Fern	*Osmunda regalis*																2						
Ground Vegetation	Sensitive Fern	*Onoclea sensibilis*																						
Ground Vegetation	Seven-Angled Pipewort	*Eriocaulon aquaticum*																						
Ground Vegetation	Slender Sedge	*Carex lasiocarpa*																						
Ground Vegetation	Small Enchanter's Nightshade	*Circaea alpina*																						
Ground Vegetation	Small Green Woodland Orchid	*Platanthera clavellata*																						
Ground Vegetation	Small Purple-Fringe Orchis	*Platanthera psycodes*																						
Ground Vegetation	Small-Fruit Bulrush	*Scirpus microcarpus*																						
Ground Vegetation	Smooth White Violet	*Viola macloskeyi*																						
Ground Vegetation	Soft Rush	*Juncus effusus*																						
Ground Vegetation	Spinulose Shield Fern	*Dryopteris carthusiana*																						
Ground Vegetation	Spotted Jewel-Weed	*Impatiens capensis*																						
Ground Vegetation	St. John's-Wort	*Triadenum sp.*																						
Ground Vegetation	Stair-step Moss	*Hylocomium splendens*								5														
Ground Vegetation	Stiff Clubmoss	*Lycopodium annotinum*																						
Ground Vegetation	Swamp Loosestrife	*Lysimachia terrestris*																						
Ground Vegetation	Tawny Cotton-Grass	*Eriophorum virginicum*				10											10							20
Ground Vegetation	Teaberry	*Gaultheria procumbens*																						
Ground Vegetation	Thread Rush	*Juncus filiformis*																						
Ground Vegetation	Three-lobed Bazzania	*Bazzania trilobata*								5														
Ground Vegetation	Three-Seed Sedge	*Carex trisperma*	15		16			30	5	5			10		20	30	25		15		25			15
Ground Vegetation	Three-Way Sedge	*Dulichium arundinaceum*																						
Ground Vegetation	Tussock Sedge	*Carex stricta*																						
Ground Vegetation	Twinflower	*Linnaea borealis*	5																					
Ground Vegetation	Water Sedge	*Carex aquatilis*																						
Ground Vegetation	Water Sedge	*Carex nigra*																						
Ground Vegetation	Watershield	*Brasenia schreberi*																						
Ground Vegetation	White -Sorrel	*Oxalis montana*																						
Ground Vegetation	White Turtlehead	*Chelone glabra*																						
Ground Vegetation	Whorled Aster	*Oclemena acuminata*													2	2								
Ground Vegetation	Wild Lily-of-The-Valley	*Maianthemum canadense*																						
Ground Vegetation	Wild Sarsaparilla	*Aralia nudicaulis*						1																
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																						
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																						

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																					
			118	122	125	126	127	129	129	131	135	135	138	141	142	142	145	145	146	146	148	148	148	149
			Mixed Treed Swamp	Tall Shrub Swamp	Graminoid Swamp	Graminoid Swamp	Tall Shrub Swamp	Cut-over Mixed Treed Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Cut-over Coniferous Treed Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Graminoid Marsh	Tall Shrub Swamp	Graminoid Fen	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Moss Swamp	Tall Shrub Swamp
Tree	American Larch	*Larix laricina*																						
Tree	Balsam Fir	*Abies balsamea*	10				10		30	5				5		50					15	1		
Tree	Black Spruce	*Picea mariana*							35	50	30	60	15	50					10	40	10	60		
Tree	Eastern Hemlock	*Tsuga canadensis*																						
Tree	Eastern White Pine	*Pinus strobus*											2											
Tree	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*							2											5				5
Tree	Paper Birch	*Betula papyrifera*												7								5		
Tree	Red Maple	*Acer rubrum*	20				0.5		10	15	3	10	5	20										
Tree	Red Spruce	*Picea rubens*	40							20			15			50								50
Tree	White Spruce	*Picea glauca*																						
Tree	Yellow Birch	*Betula alleghaniensis*																						
Shrub	a Blackberry	*Rubus sp.*																						
Shrub	a Serviceberry	*Amelanchier sp.*																						
Shrub	a Willow	*Salix sp.*																						
Shrub	American Larch	*Larix laricina*																						
Shrub	Balsam Fir	*Abies balsamea*	60		0.5	1	10	2	25	10					5	5					5	2		20
Shrub	Balsam Willow	*Salix pyrifolia*																						
Shrub	Beaked Hazelnut	*Corylus cornuta*																						
Shrub	Bebb's Willow	*Salix bebbiana*																						
Shrub	Black Chokeberry	*Photinia melanocarpa*																						
Shrub	Black Holly	*Ilex verticillata*									2	5												
Shrub	Black Huckleberry	*Gaylussacia baccata*																						
Shrub	Black Spruce	*Picea mariana*						5	15		20	20	10	10					20	20	5	20		
Shrub	Bog Rosemary	*Andromeda polifolia*																						
Shrub	Bristly Dewberry	*Rubus hispidus*		20	5										5	2		5			5			
Shrub	Common Labrador Tea	*Ledum groenlandicum*		35																				
Shrub	Fire Cherry	*Prunus pensylvanica*																						
Shrub	Green Alder	*Alnus viridis*																						
Shrub	Hardhack Spiraea	*Spiraea tomentosa*																						
Shrub	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*								5	5	5	5	5	5	7								15
Shrub	Large Cranberry	*Vaccinium macrocarpon*																						
Shrub	Late Lowbush Blueberry	*Vaccinium angustifolium*																						
Shrub	Leatherleaf	*Chamaedaphne calyculata*					80																	
Shrub	Mountain Fly-Honeysuckle	*Lonicera villosa*																						
Shrub	Mountain Holly	*Nemopanthus mucronatus*		15				1		5	5		7		5									
Shrub	Narrow-Leaved Meadow-Sweet	*Spiraea alba*					5								5			2			2			
Shrub	Northern Bayberry	*Morella pensylvanica*																						
Shrub	Northern Poison Oak	*Toxicodendron rydbergii*																						
Shrub	Paper Birch	*Betula papyrifera*																						
Shrub	Possum-Haw Viburnum	*Viburnum nudum*																						
Shrub	Prairie Willow	*Salix humilis*																						
Shrub	Quaking Aspen	*Populus tremuloides*																						
Shrub	Red Maple	*Acer rubrum*	5	5	2	2		15																
Shrub	Red Raspberry	*Rubus idaeus*		5				1																
Shrub	Red Spruce	*Picea rubens*											5			5								40
Shrub	Rhodora	*Rhododendron canadense*									60													
Shrub	Sheep-Laurel	*Kalmia angustifolia*		5					1					2										
Shrub	Shining Rose	*Rosa nitida*																						
Shrub	Small Cranberry	*Vaccinium oxycoccos*																						
Shrub	Smooth Blackberry	*Rubus canadensis*				2																		
Shrub	Speckled Alder	*Alnus incana*					50	1	2					10	70		10	90	1	50		60	7	80
Shrub	Sweet Bayberry	*Myrica gale*															15							
Shrub	Velvetleaf Blueberry	*Vaccinium myrtilloides*	2							2	5	2												
Shrub	White Ash	*Fraxinus americana*																						
Shrub	White Spruce	*Picea glauca*																						
Shrub	Yellow Birch	*Betula alleghaniensis*																						
Ground Vegetation	a Bladderwort	*Utricularia sp.*																						
Ground Vegetation	a Bur-Reed	*Sparganium sp.*																						
Ground Vegetation	a Cotton-Grass	*Eriophorum sp.*					3																	
Ground Vegetation	a hybrid White Panicled American-Aster	*Oclemena x blakei*																						

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																					
			118	122	125	126	127	129	129	131	135	135	138	141	142	142	145	145	146	146	148	148	148	149
			Mixed Treed Swamp	Tall Shrub Swamp	Graminoid Swamp	Graminoid Swamp	Tall Shrub Swamp	Cut-over Mixed Treed Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Cut-over Coniferous Treed Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Graminoid Marsh	Tall Shrub Swamp	Graminoid Fen	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Moss Swamp	Tall Shrub Swamp
Ground Vegetation	a Manna-Grass	*Glyceria sp.*																						
Ground Vegetation	a Pondweed	*Potamogeton spp.*																						
Ground Vegetation	a Rush	*Juncus sp.*																						
Ground Vegetation	A Sedge	*Carex gynandra*																						
Ground Vegetation	A Sedge	*Carex magellanica ssp. irrigua*																						
Ground Vegetation	a Sedge	*Carex sp.*																						
Ground Vegetation	a Spikerush	*Eleocharis sp.*																						
Ground Vegetation	a Violet	*Viola sp.*																					1	
Ground Vegetation	a Wood Fern	*Dryopteris sp.*																						
Ground Vegetation	Algae	*Algae spp.*																						
Ground Vegetation	American Bur-Reed	*Sparganium americanum*															2		20					
Ground Vegetation	American Water-Lily	*Nymphaea odorata*																						
Ground Vegetation	Bear Sedge	*Carex utriculata*																						
Ground Vegetation	Blueflag	*Iris versicolor*													5									
Ground Vegetation	Blue-Joint Reedgrass	*Calamagrostis canadensis*				10									15			60	10					
Ground Vegetation	Blunt Manna-Grass	*Glyceria obtusa*																						
Ground Vegetation	Bog Aster	*Oclemena nemoralis*																						
Ground Vegetation	Bog Clubmoss	*Lycopodiella inundata*																						
Ground Vegetation	Bog Goldenrod	*Solidago uliginosa*																						
Ground Vegetation	Braided moss	*Hypnum spp.*																						30
Ground Vegetation	Bristly-Stalk Sedge	*Carex leptalea*																						
Ground Vegetation	Broad-Leaf Cattail	*Typha latifolia*																						
Ground Vegetation	Brown-Fruited Rush	*Juncus pelocarpus*																						
Ground Vegetation	Brownish Sedge	*Carex brunnescens*			15	20																		
Ground Vegetation	Canada Manna-Grass	*Glyceria canadensis*						15																
Ground Vegetation	Canada Rush	*Juncus canadensis*															10							
Ground Vegetation	Christmas Fern	*Polystichum acrostichoides*																						
Ground Vegetation	Cinnamon Fern	*Osmunda cinnamomea*	20	5	35	15		20	15	10	10	5	10	10									1	
Ground Vegetation	Climbing Nightshade	*Solanum dulcamara*																						
Ground Vegetation	Cottongrass Bulrush	*Scirpus cyperinus*						5															2	
Ground Vegetation	Creeping Butter-Cup	*Ranunculus repens*																						
Ground Vegetation	Creeping Snowberry	*Gaultheria hispidula*	5																					
Ground Vegetation	Crested Shield-Fern	*Dryopteris cristata*																						
Ground Vegetation	Crinkled Hairgrass	*Deschampsia flexuosa*		15	20	20																		
Ground Vegetation	Dwarf Dog	*Cornus canadensis*		25	10				2		25	15	7	5		15				10		5		
Ground Vegetation	Early Coralroot	*Corallorhiza trifida*																						
Ground Vegetation	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*										5												
Ground Vegetation	Evergreen fern	*Dryopteris intermedia*																						
Ground Vegetation	Field Horsetail	*Equisetum arvense*																						
Ground Vegetation	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*																						
Ground Vegetation	Fowl Bluegrass	*Poa palustris*																						
Ground Vegetation	Goldthread	*Coptis trifolia*									5		3			2								
Ground Vegetation	Hair-cap Moss	*Polytrichum sp.*			5	10							10											
Ground Vegetation	Hairy Willow-Herb	*Epilobium ciliatum*																						
Ground Vegetation	Hoary Sedge	*Carex canescens*													2		5							
Ground Vegetation	Indian-Pipe	*Monotropa uniflora*																						
Ground Vegetation	Interrupted Fern	*Osmunda claytoniana*				5										10								
Ground Vegetation	Kentucky Bluegrass	*Poa pratensis*																						
Ground Vegetation	Lady-Fern	*Athyrium filix-femina*																						
Ground Vegetation	Least Spike-Rush	*Eleocharis acicularis*																						
Ground Vegetation	Little Prickly Sedge	*Carex echinata*					10																	
Ground Vegetation	Long Sedge	*Carex folliculata*													5									
Ground Vegetation	Mad Dog Skullcap	*Scutellaria lateriflora*																						
Ground Vegetation	Marsh Bedstraw	*Galium palustre*																						
Ground Vegetation	Marsh Blue Violet	*Viola cucullata*																						
Ground Vegetation	Marsh St. John's-Wort	*Triadenum fraseri*																						
Ground Vegetation	Mountain -Fern	*Dryopteris campyloptera*																						
Ground Vegetation	Narrow-Leaved Cattail	*Typha angustifolia*																						
Ground Vegetation	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*																						
Ground Vegetation	Narrow-Panicled Rush	*Juncus brevicaudatus*																						

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																					
			118	122	125	126	127	129	129	131	135	135	138	141	142	142	145	145	146	146	148	148	148	149
			Mixed Treed Swamp	Tall Shrub Swamp	Graminoid Swamp	Graminoid Swamp	Tall Shrub Swamp	Cut-over Mixed Treed Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Cut-over Coniferous Treed Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Graminoid Marsh	Tall Shrub Swamp	Graminoid Fen	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Moss Swamp	Tall Shrub Swamp
Ground Vegetation	New Belgium American-Aster	*Symphyotrichum novi-belgii*					1																	
Ground Vegetation	New York Fern	*Thelypteris noveboracensis*								5														
Ground Vegetation	Northern Beech Fern	*Phegopteris connectilis*					1																	
Ground Vegetation	Northern Bugleweed	*Lycopus uniflorus*																						
Ground Vegetation	Northern Mannagrass	*Glyceria laxa*																			5			
Ground Vegetation	Northern Pitcher-Plant	*Sarracenia purpurea*																						
Ground Vegetation	Northern Starflower	*Trientalis borealis*																			5			0.5
Ground Vegetation	Parasol White-Top	*Doellingeria umbellata*					10																	
Ground Vegetation	Partridge-Berry	*Mitchella repens*																						
Ground Vegetation	Peatmoss	*Sphagnum spp.*	30	25	40	30	10	80	85	60	40	65	60	50	40	50	50	70	20	60	90	40		40
Ground Vegetation	Pickerel Weed	*Pontederia cordata*																						
Ground Vegetation	Purple Avens	*Geum rivale*																						
Ground Vegetation	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*																						
Ground Vegetation	Red Fescue	*Festuca rubra*																						
Ground Vegetation	Red-stemmed Moss	*Pleurozium schreberi*	30	20			3			10	5					20								
Ground Vegetation	Reindeer Lichen	*Cladina spp.*																						
Ground Vegetation	Rhytidiadelphus Moss	*Rhytidiadelphus sp.*																						
Ground Vegetation	Rough Bentgrass	*Agrostis scabra*																		2			7	
Ground Vegetation	Rough Sedge	*Carex scabrata*																						
Ground Vegetation	Rough-Leaf Goldenrod	*Solidago rugosa*													15			20						
Ground Vegetation	Roundleaf Sundew	*Drosera rotundifolia*																						
Ground Vegetation	Royal Fern	*Osmunda regalis*																						
Ground Vegetation	Sensitive Fern	*Onoclea sensibilis*																						
Ground Vegetation	Seven-Angled Pipewort	*Eriocaulon aquaticum*																						
Ground Vegetation	Slender Sedge	*Carex lasiocarpa*																						
Ground Vegetation	Small Enchanter's Nightshade	*Circaea alpina*																						
Ground Vegetation	Small Green Woodland Orchid	*Platanthera clavellata*																						
Ground Vegetation	Small Purple-Fringe Orchis	*Platanthera psycodes*																						
Ground Vegetation	Small-Fruit Bulrush	*Scirpus microcarpus*																						
Ground Vegetation	Smooth White Violet	*Viola macloskeyi*																						
Ground Vegetation	Soft Rush	*Juncus effusus*															30							
Ground Vegetation	Spinulose Shield Fern	*Dryopteris carthusiana*		5																				
Ground Vegetation	Spotted Jewel-Weed	*Impatiens capensis*																						
Ground Vegetation	St. John's-Wort	*Triadenum sp.*																						
Ground Vegetation	Stair-step Moss	*Hylocomium splendens*																						
Ground Vegetation	Stiff Clubmoss	*Lycopodium annotinum*					5																	
Ground Vegetation	Swamp Loosestrife	*Lysimachia terrestris*																						
Ground Vegetation	Tawny Cotton-Grass	*Eriophorum virginicum*																						
Ground Vegetation	Teaberry	*Gaultheria procumbens*																						
Ground Vegetation	Thread Rush	*Juncus filiformis*																						
Ground Vegetation	Three-lobed Bazzania	*Bazzania trilobata*	25							15				10							7			
Ground Vegetation	Three-Seed Sedge	*Carex trisperma*			20	5		25	5	15		30	15	30					5	20		20		
Ground Vegetation	Three-Way Sedge	*Dulichium arundinaceum*																						
Ground Vegetation	Tussock Sedge	*Carex stricta*																						
Ground Vegetation	Twinflower	*Linnaea borealis*																		10		5		
Ground Vegetation	Water Sedge	*Carex aquatilis*																						
Ground Vegetation	Water Sedge	*Carex nigra*																						
Ground Vegetation	Watershield	*Brasenia schreberi*																						
Ground Vegetation	White -Sorrel	*Oxalis montana*								2														
Ground Vegetation	White Turtlehead	*Chelone glabra*																						
Ground Vegetation	Whorled Aster	*Oclemena acuminata*					15																	0.5
Ground Vegetation	Wild Lily-of-The-Valley	*Maianthemum canadense*																						
Ground Vegetation	Wild Sarsaparilla	*Aralia nudicaulis*																						
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																						
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																						

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																					
			149	150	153	153	154	167	168	168	169	172	172	176	178	178	185	186	192	193	202	202	207	207
			Coniferous Treed Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Coniferous Treed Swamp	Non-Vegetated Shallow Water	Coniferous Treed Swamp	Coniferous Treed Swamp	Mixed Shrub Swamp	Non-Vegetated Shallow Water	Coniferous Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Mixed Shrub Bog	Mixed Treed Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Low Shrub Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Mixed Treed Swamp
Tree	American Larch	*Larix laricina*							10			0.5			1						2			
Tree	Balsam Fir	*Abies balsamea*	40	10			50	10		2	30					30		5	60			10		
Tree	Black Spruce	*Picea mariana*	30			35	2	5	2	30		0.5	30		10	5		1	30		45			
Tree	Eastern Hemlock	*Tsuga canadensis*																						
Tree	Eastern White Pine	*Pinus strobus*																						
Tree	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	15					7																
Tree	Paper Birch	*Betula papyrifera*																						
Tree	Red Maple	*Acer rubrum*					20	10			5			2		7		10			0.5	25		15
Tree	Red Spruce	*Picea rubens*													10	5								
Tree	White Spruce	*Picea glauca*																						
Tree	Yellow Birch	*Betula alleghaniensis*																						
Shrub	a Blackberry	*Rubus sp.*																		5				
Shrub	a Serviceberry	*Amelanchier sp.*																						
Shrub	a Willow	*Salix sp.*																						
Shrub	American Larch	*Larix laricina*							5								10	2						
Shrub	Balsam Fir	*Abies balsamea*	20	10	5		20	30			10				1	15		7	30	2		7		0.5
Shrub	Balsam Willow	*Salix pyrifolia*												5	0.5									
Shrub	Beaked Hazelnut	*Corylus cornuta*									2													
Shrub	Bebb's Willow	*Salix bebbiana*																						
Shrub	Black Chokeberry	*Photinia melanocarpa*										0.5												
Shrub	Black Holly	*Ilex verticillata*																						
Shrub	Black Huckleberry	*Gaylussacia baccata*										0.5										4		
Shrub	Black Spruce	*Picea mariana*	2	10		20			2	10		3	7				15	15		5	10	6		1
Shrub	Bog Rosemary	*Andromeda polifolia*																			0.5			
Shrub	Bristly Dewberry	*Rubus hispidus*												10	15		1	15	10					
Shrub	Common Labrador Tea	*Ledum groenlandicum*										7					30	15	10		5	5		5
Shrub	Fire Cherry	*Prunus pensylvanica*																						
Shrub	Green Alder	*Alnus viridis*		10	50	15			5											1			20	35
Shrub	Hardhack Spiraea	*Spiraea tomentosa*																						
Shrub	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*						2									1							
Shrub	Large Cranberry	*Vaccinium macrocarpon*																					10	
Shrub	Late Lowbush Blueberry	*Vaccinium angustifolium*				20			15															
Shrub	Leatherleaf	*Chamaedaphne calyculata*							40		60	35												3
Shrub	Mountain Fly-Honeysuckle	*Lonicera villosa*																						
Shrub	Mountain Holly	*Nemopanthus mucronatus*				20						0.5	1						5					
Shrub	Narrow-Leaved Meadow-Sweet	*Spiraea alba*		5						7				8		5				2		5		5
Shrub	Northern Bayberry	*Morella pensylvanica*																						1
Shrub	Northern Poison Oak	*Toxicodendron rydbergii*									10													
Shrub	Paper Birch	*Betula papyrifera*									3													
Shrub	Possum-Haw Viburnum	*Viburnum nudum*		5		5	1		1				0.5		0.5		5		10		3	3		
Shrub	Prairie Willow	*Salix humilis*																						
Shrub	Quaking Aspen	*Populus tremuloides*								25														
Shrub	Red Maple	*Acer rubrum*			5					5										2	2		3	
Shrub	Red Raspberry	*Rubus idaeus*																						
Shrub	Red Spruce	*Picea rubens*											7							5				1
Shrub	Rhodora	*Rhododendron canadense*				5			40			20						15	3			0.5		
Shrub	Sheep-Laurel	*Kalmia angustifolia*		5		5			1				3				13	10				4		2
Shrub	Shining Rose	*Rosa nitida*																						
Shrub	Small Cranberry	*Vaccinium oxycoccos*																						
Shrub	Smooth Blackberry	*Rubus canadensis*																						
Shrub	Speckled Alder	*Alnus incana*	5			3								5	80			30						
Shrub	Sweet Bayberry	*Myrica gale*										25												
Shrub	Velvetleaf Blueberry	*Vaccinium myrtilloides*											4				5							
Shrub	White Ash	*Fraxinus americana*																						
Shrub	White Spruce	*Picea glauca*																						
Shrub	Yellow Birch	*Betula alleghaniensis*																						
Ground Vegetation	a Bladderwort	*Utricularia sp.*																						
Ground Vegetation	a Bur-Reed	*Sparganium sp.*																						
Ground Vegetation	a Cotton-Grass	*Eriophorum sp.*																						
Ground Vegetation	a hybrid White Panicled American-Aster	*Oclemena x blakei*																						

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																					
			149 Coniferous Treed Swamp	150 Coniferous Treed Swamp	153 Tall Shrub Swamp	153 Tall Shrub Swamp	154 Mixed Treed Swamp	167 Coniferous Treed Swamp	168 Non-Vegetated Shallow Water	168 Coniferous Treed Swamp	169 Coniferous Treed Swamp	172 Mixed Shrub Swamp	172 Non-Vegetated Shallow Water	176 Coniferous Treed Swamp	178 Tall Shrub Swamp	178 Coniferous Treed Swamp	185 Mixed Shrub Bog	186 Mixed Treed Swamp	192 Coniferous Treed Swamp	193 Tall Shrub Swamp	202 Low Shrub Swamp	202 Mixed Treed Swamp	207 Tall Shrub Swamp	207 Mixed Treed Swamp
Ground Vegetation	a Manna-Grass	*Glyceria sp.*																						
Ground Vegetation	a Pondweed	*Potamogeton spp.*																						
Ground Vegetation	a Rush	*Juncus sp.*																						
Ground Vegetation	A Sedge	*Carex gynandra*																						
Ground Vegetation	A Sedge	*Carex magellanica ssp. irrigua*																						
Ground Vegetation	a Sedge	*Carex sp.*																						
Ground Vegetation	a Spikerush	*Eleocharis sp.*																						
Ground Vegetation	a Violet	*Viola sp.*																						
Ground Vegetation	a Wood Fern	*Dryopteris sp.*																						
Ground Vegetation	Algae	*Algae spp.*																						
Ground Vegetation	American Bur-Reed	*Sparganium americanum*																						
Ground Vegetation	American Water-Lily	*Nymphaea odorata*																						
Ground Vegetation	Bear Sedge	*Carex utriculata*																						
Ground Vegetation	Blueflag	*Iris versicolor*																						
Ground Vegetation	Blue-Joint Reedgrass	*Calamagrostis canadensis*								5				40										
Ground Vegetation	Blunt Manna-Grass	*Glyceria obtusa*																						
Ground Vegetation	Bog Aster	*Oclemena nemoralis*																						
Ground Vegetation	Bog Clubmoss	*Lycopodiella inundata*																						
Ground Vegetation	Bog Goldenrod	*Solidago uliginosa*																5		8				
Ground Vegetation	Braided moss	*Hypnum spp.*																						
Ground Vegetation	Bristly-Stalk Sedge	*Carex leptalea*																						
Ground Vegetation	Broad-Leaf Cattail	*Typha latifolia*																						
Ground Vegetation	Brown-Fruited Rush	*Juncus pelocarpus*																						
Ground Vegetation	Brownish Sedge	*Carex brunnescens*		15						5						3								
Ground Vegetation	Canada Manna-Grass	*Glyceria canadensis*																						
Ground Vegetation	Canada Rush	*Juncus canadensis*																						
Ground Vegetation	Christmas Fern	*Polystichum acrostichoides*																						
Ground Vegetation	Cinnamon Fern	*Osmunda cinnamomea*		0.5									20	5	20							20		3
Ground Vegetation	Climbing Nightshade	*Solanum dulcamara*									25													
Ground Vegetation	Cottongrass Bulrush	*Scirpus cyperinus*		1	0.5																		3	
Ground Vegetation	Creeping Butter-Cup	*Ranunculus repens*																						
Ground Vegetation	Creeping Snowberry	*Gaultheria hispidula*											2									3		
Ground Vegetation	Crested Shield-Fern	*Dryopteris cristata*																						
Ground Vegetation	Crinkled Hairgrass	*Deschampsia flexuosa*																						
Ground Vegetation	Dwarf Dog	*Cornus canadensis*								0.5		0.5	3			2	30	15	20		10			
Ground Vegetation	Early Coralroot	*Corallorhiza trifida*																						
Ground Vegetation	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	2																					
Ground Vegetation	Evergreen fern	*Dryopteris intermedia*																						
Ground Vegetation	Field Horsetail	*Equisetum arvense*																						
Ground Vegetation	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*																					3	
Ground Vegetation	Fowl Bluegrass	*Poa palustris*																						
Ground Vegetation	Goldthread	*Coptis trifolia*	2																					
Ground Vegetation	Hair-cap Moss	*Polytrichum sp.*				10												10		5				
Ground Vegetation	Hairy Willow-Herb	*Epilobium ciliatum*																						
Ground Vegetation	Hoary Sedge	*Carex canescens*														3							5	
Ground Vegetation	Indian-Pipe	*Monotropa uniflora*																						
Ground Vegetation	Interrupted Fern	*Osmunda claytoniana*																						
Ground Vegetation	Kentucky Bluegrass	*Poa pratensis*									2													
Ground Vegetation	Lady-Fern	*Athyrium filix-femina*																						
Ground Vegetation	Least Spike-Rush	*Eleocharis acicularis*																					20	
Ground Vegetation	Little Prickly Sedge	*Carex echinata*																					3	
Ground Vegetation	Long Sedge	*Carex folliculata*																						
Ground Vegetation	Mad Dog Skullcap	*Scutellaria lateriflora*																						
Ground Vegetation	Marsh Bedstraw	*Galium palustre*																						
Ground Vegetation	Marsh Blue Violet	*Viola cucullata*																						
Ground Vegetation	Marsh St. John's-Wort	*Triadenum fraseri*																					10	5
Ground Vegetation	Mountain -Fern	*Dryopteris campyloptera*																						
Ground Vegetation	Narrow-Leaved Cattail	*Typha angustifolia*																						
Ground Vegetation	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*																						
Ground Vegetation	Narrow-Panicled Rush	*Juncus brevicaudatus*																						

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities 149 Coniferous Treed Swamp	150 Coniferous Treed Swamp	153 Tall Shrub Swamp	153 Tall Shrub Swamp	154 Mixed Treed Swamp	167 Coniferous Treed Swamp	168 Non-Vegetated Shallow Water	168 Coniferous Treed Swamp	169 Coniferous Treed Swamp	172 Mixed Shrub Swamp	172 Non-Vegetated Shallow Water	176 Coniferous Treed Swamp	178 Tall Shrub Swamp	178 Coniferous Treed Swamp	185 Mixed Shrub Bog	186 Mixed Treed Swamp	192 Coniferous Treed Swamp	193 Tall Shrub Swamp	202 Low Shrub Swamp	202 Mixed Treed Swamp	207 Tall Shrub Swamp	207 Mixed Treed Swamp
Ground Vegetation	New Belgium American-Aster	*Symphyotrichum novi-belgii*																				3		
Ground Vegetation	New York Fern	*Thelypteris noveboracensis*									20													
Ground Vegetation	Northern Beech Fern	*Phegopteris connectilis*																						
Ground Vegetation	Northern Bugleweed	*Lycopus uniflorus*																						
Ground Vegetation	Northern Mannagrass	*Glyceria laxa*																						
Ground Vegetation	Northern Pitcher-Plant	*Sarracenia purpurea*																						
Ground Vegetation	Northern Starflower	*Trientalis borealis*								0.5			5			3			5		5			
Ground Vegetation	Parasol White-Top	*Doellingeria umbellata*												15	15					10		10		10
Ground Vegetation	Partridge-Berry	*Mitchella repens*																						
Ground Vegetation	Peatmoss	*Sphagnum spp.*	20	60	4	65	20	70	30			90	55	80	70	40	90	90	85	95	85	70	85	85
Ground Vegetation	Pickerel Weed	*Pontederia cordata*																						
Ground Vegetation	Purple Avens	*Geum rivale*									0.5													
Ground Vegetation	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*																						
Ground Vegetation	Red Fescue	*Festuca rubra*																						
Ground Vegetation	Red-stemmed Moss	*Pleurozium schreberi*	5						5		0.5		10						15					
Ground Vegetation	Reindeer Lichen	*Cladina spp.*							15															
Ground Vegetation	Rhytidiadelphus Moss	*Rhytidiadelphus sp.*																						
Ground Vegetation	Rough Bentgrass	*Agrostis scabra*																						
Ground Vegetation	Rough Sedge	*Carex scabrata*																						
Ground Vegetation	Rough-Leaf Goldenrod	*Solidago rugosa*													10									
Ground Vegetation	Roundleaf Sundew	*Drosera rotundifolia*																						
Ground Vegetation	Royal Fern	*Osmunda regalis*												6	5							10		
Ground Vegetation	Sensitive Fern	*Onoclea sensibilis*													5									
Ground Vegetation	Seven-Angled Pipewort	*Eriocaulon aquaticum*																						
Ground Vegetation	Slender Sedge	*Carex lasiocarpa*																						
Ground Vegetation	Small Enchanter's Nightshade	*Circaea alpina*																						
Ground Vegetation	Small Green Woodland Orchid	*Platanthera clavellata*													6									
Ground Vegetation	Small Purple-Fringe Orchis	*Platanthera psycodes*																						
Ground Vegetation	Small-Fruit Bulrush	*Scirpus microcarpus*																						
Ground Vegetation	Smooth White Violet	*Viola macloskeyi*																						
Ground Vegetation	Soft Rush	*Juncus effusus*																					3	7
Ground Vegetation	Spinulose Shield Fern	*Dryopteris carthusiana*																						
Ground Vegetation	Spotted Jewel-Weed	*Impatiens capensis*																						
Ground Vegetation	St. John's-Wort	*Triadenum sp.*																						
Ground Vegetation	Stair-step Moss	*Hylocomium splendens*	4										10											
Ground Vegetation	Stiff Clubmoss	*Lycopodium annotinum*									3													
Ground Vegetation	Swamp Loosestrife	*Lysimachia terrestris*																					1	
Ground Vegetation	Tawny Cotton-Grass	*Eriophorum virginicum*																						
Ground Vegetation	Teaberry	*Gaultheria procumbens*																						
Ground Vegetation	Thread Rush	*Juncus filiformis*																		15				
Ground Vegetation	Three-lobed Bazzania	*Bazzania trilobata*						30			15											10		
Ground Vegetation	Three-Seed Sedge	*Carex trisperma*					5	2		5			5					3	20		20			
Ground Vegetation	Three-Way Sedge	*Dulichium arundinaceum*																						
Ground Vegetation	Tussock Sedge	*Carex stricta*										20												
Ground Vegetation	Twinflower	*Linnaea borealis*									3													
Ground Vegetation	Water Sedge	*Carex aquatilis*																						
Ground Vegetation	Water Sedge	*Carex nigra*																		5				
Ground Vegetation	Watershield	*Brasenia schreberi*																						
Ground Vegetation	White -Sorrel	*Oxalis montana*	2					10			25													
Ground Vegetation	White Turtlehead	*Chelone glabra*																						
Ground Vegetation	Whorled Aster	*Oclemena acuminata*														15								
Ground Vegetation	Wild Lily-of-The-Valley	*Maianthemum canadense*														2								
Ground Vegetation	Wild Sarsaparilla	*Aralia nudicaulis*																						
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																						
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																						

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																						
			208	210	211	215	215	215	219	220	220	221	222	222	223	224	224	226	227	227	233	234	244	248	248
			mixed treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Cut-over Coniferous Treed Swamp	Low Shrub Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Graminoid Marsh	Tall Shrub Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Non-Vegetated Shallow Water	Coniferous Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Cut-over Mixed Treed Swamp	Mixed Treed Swamp
Tree	American Larch	*Larix laricina*		1											7	10								30	
Tree	Balsam Fir	*Abies balsamea*	10	5	20			15	40		5					1	15	5	10	10	15	20	40	5	30
Tree	Black Spruce	*Picea mariana*		15	15	40		25		5		15	7		15	50	30			5	5			10	
Tree	Eastern Hemlock	*Tsuga canadensis*																							
Tree	Eastern White Pine	*Pinus strobus*																							
Tree	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*																							
Tree	Paper Birch	*Betula papyrifera*																							
Tree	Red Maple	*Acer rubrum*	5		30			5	35		10				30	2	10	10	5	30	50	30	60		40
Tree	Red Spruce	*Picea rubens*		15	15	35	5			5								5	5				10		
Tree	White Spruce	*Picea glauca*									15														
Tree	Yellow Birch	*Betula alleghaniensis*																							
Shrub	a Blackberry	*Rubus sp.*																							
Shrub	a Serviceberry	*Amelanchier sp.*																							
Shrub	a Willow	*Salix sp.*																							
Shrub	American Larch	*Larix laricina*									2	2		5											5
Shrub	Balsam Fir	*Abies balsamea*	5	40		5		15	5						10		15	40		2	5			10	15
Shrub	Balsam Willow	*Salix pyrifolia*																							
Shrub	Beaked Hazelnut	*Corylus cornuta*																							
Shrub	Bebb's Willow	*Salix bebbiana*																							
Shrub	Black Chokeberry	*Photinia melanocarpa*																							
Shrub	Black Holly	*Ilex verticillata*																							
Shrub	Black Huckleberry	*Gaylussacia baccata*																							
Shrub	Black Spruce	*Picea mariana*		4				5				25	5		5		5			5	5				5
Shrub	Bog Rosemary	*Andromeda polifolia*																							
Shrub	Bristly Dewberry	*Rubus hispidus*																		1		20			
Shrub	Common Labrador Tea	*Ledum groenlandicum*		2								15													
Shrub	Fire Cherry	*Prunus pensylvanica*																							
Shrub	Green Alder	*Alnus viridis*	10									4		15											
Shrub	Hardhack Spiraea	*Spiraea tomentosa*																							
Shrub	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*															2								
Shrub	Large Cranberry	*Vaccinium macrocarpon*																							20
Shrub	Late Lowbush Blueberry	*Vaccinium angustifolium*																							
Shrub	Leatherleaf	*Chamaedaphne calyculata*																							
Shrub	Mountain Fly-Honeysuckle	*Lonicera villosa*																							
Shrub	Mountain Holly	*Nemopanthus mucronatus*			1							25				?	1								
Shrub	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	0.5																			5			
Shrub	Northern Bayberry	*Morella pensylvanica*																							
Shrub	Northern Poison Oak	*Toxicodendron rydbergii*																							
Shrub	Paper Birch	*Betula papyrifera*																							
Shrub	Possum-Haw Viburnum	*Viburnum nudum*	0.5	3							5			5	2		1						2	5	
Shrub	Prairie Willow	*Salix humilis*																							
Shrub	Quaking Aspen	*Populus tremuloides*																							
Shrub	Red Maple	*Acer rubrum*				3	5					3		2				5						10	
Shrub	Red Raspberry	*Rubus idaeus*																							
Shrub	Red Spruce	*Picea rubens*		4						5								2	2						
Shrub	Rhodora	*Rhododendron canadense*										5													2
Shrub	Sheep-Laurel	*Kalmia angustifolia*		5	1						10	5		5									5		
Shrub	Shining Rose	*Rosa nitida*																							
Shrub	Small Cranberry	*Vaccinium oxycoccos*																							
Shrub	Smooth Blackberry	*Rubus canadensis*																							
Shrub	Speckled Alder	*Alnus incana*	25		40		8			60		30		20		70	10							5	
Shrub	Sweet Bayberry	*Myrica gale*																							
Shrub	Velvetleaf Blueberry	*Vaccinium myrtilloides*						2						10							2		3		
Shrub	White Ash	*Fraxinus americana*																							
Shrub	White Spruce	*Picea glauca*												10											
Shrub	Yellow Birch	*Betula alleghaniensis*																							
Ground Vegetation	a Bladderwort	*Utricularia sp.*																							
Ground Vegetation	a Bur-Reed	*Sparganium sp.*																							
Ground Vegetation	a Cotton-Grass	*Eriophorum sp.*																							
Ground Vegetation	a hybrid White Panicled American-Aster	*Oclemena x blakei*	20																						

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities 208 mixed treed Swamp	210 Coniferous Treed Swamp	211 Mixed Treed Swamp	215 Cut-over Coniferous Treed Swamp	215 Low Shrub Swamp	215 Coniferous Treed Swamp	219 Mixed Treed Swamp	220 Tall Shrub Swamp	220 Coniferous Treed Swamp	221 Tall Shrub Swamp	222 Graminoid Marsh	222 Tall Shrub Swamp	223 Mixed Treed Swamp	224 Tall Shrub Swamp	224 Coniferous Treed Swamp	226 Coniferous Treed Swamp	227 Non-Vegetated Shallow Water	227 Coniferous Treed Swamp	233 Mixed Treed Swamp	234 Mixed Treed Swamp	244 Mixed Treed Swamp	248 Cut-over Mixed Treed Swamp	248 Mixed Treed Swamp
Ground Vegetation	a Manna-Grass	*Glyceria sp.*																							
Ground Vegetation	a Pondweed	*Potamogeton spp.*																							
Ground Vegetation	a Rush	*Juncus sp.*																							
Ground Vegetation	A Sedge	*Carex gynandra*																							
Ground Vegetation	A Sedge	*Carex magellanica ssp. irrigua*																							
Ground Vegetation	a Sedge	*Carex sp.*																							
Ground Vegetation	a Spikerush	*Eleocharis sp.*																							
Ground Vegetation	a Violet	*Viola sp.*																							
Ground Vegetation	a Wood Fern	*Dryopteris sp.*																							
Ground Vegetation	Algae	*Algae spp.*																							
Ground Vegetation	American Bur-Reed	*Sparganium americanum*																							
Ground Vegetation	American Water-Lily	*Nymphaea odorata*																							
Ground Vegetation	Bear Sedge	*Carex utriculata*																							
Ground Vegetation	Blueflag	*Iris versicolor*																							
Ground Vegetation	Blue-Joint Reedgrass	*Calamagrostis canadensis*	25	7			2															10		50	10
Ground Vegetation	Blunt Manna-Grass	*Glyceria obtusa*																							
Ground Vegetation	Bog Aster	*Oclemena nemoralis*																							
Ground Vegetation	Bog Clubmoss	*Lycopodiella inundata*																							
Ground Vegetation	Bog Goldenrod	*Solidago uliginosa*																							
Ground Vegetation	Braided moss	*Hypnum spp.*											5								10		20		
Ground Vegetation	Bristly-Stalk Sedge	*Carex leptalea*																							
Ground Vegetation	Broad-Leaf Cattail	*Typha latifolia*																							
Ground Vegetation	Brown-Fruited Rush	*Juncus pelocarpus*																							
Ground Vegetation	Brownish Sedge	*Carex brunnescens*																							
Ground Vegetation	Canada Manna-Grass	*Glyceria canadensis*																							
Ground Vegetation	Canada Rush	*Juncus canadensis*																							
Ground Vegetation	Christmas Fern	*Polystichum acrostichoides*																							
Ground Vegetation	Cinnamon Fern	*Osmunda cinnamomea*		10	15			30	30	10		3			20	25	25	7	7	50	15	5	30	15	
Ground Vegetation	Climbing Nightshade	*Solanum dulcamara*																							
Ground Vegetation	Cottongrass Bulrush	*Scirpus cyperinus*									0.5														5
Ground Vegetation	Creeping Butter-Cup	*Ranunculus repens*																							
Ground Vegetation	Creeping Snowberry	*Gaultheria hispidula*									1			2	1										
Ground Vegetation	Crested Shield-Fern	*Dryopteris cristata*																							
Ground Vegetation	Crinkled Hairgrass	*Deschampsia flexuosa*																							
Ground Vegetation	Dwarf Dog	*Cornus canadensis*		15	25			5				5	4	7	1	5	5	5	5				2	5	
Ground Vegetation	Early Coralroot	*Corallorhiza trifida*																							
Ground Vegetation	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*																							
Ground Vegetation	Evergreen fern	*Dryopteris intermedia*																							
Ground Vegetation	Field Horsetail	*Equisetum arvense*																						5	
Ground Vegetation	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*																							
Ground Vegetation	Fowl Bluegrass	*Poa palustris*																							
Ground Vegetation	Goldthread	*Coptis trifolia*			15			2						7							1				
Ground Vegetation	Hair-cap Moss	*Polytrichum sp.*																							
Ground Vegetation	Hairy Willow-Herb	*Epilobium ciliatum*																							
Ground Vegetation	Hoary Sedge	*Carex canescens*																							20
Ground Vegetation	Indian-Pipe	*Monotropa uniflora*																							
Ground Vegetation	Interrupted Fern	*Osmunda claytoniana*																							
Ground Vegetation	Kentucky Bluegrass	*Poa pratensis*																							
Ground Vegetation	Lady-Fern	*Athyrium filix-femina*																							
Ground Vegetation	Least Spike-Rush	*Eleocharis acicularis*																							
Ground Vegetation	Little Prickly Sedge	*Carex echinata*																							10
Ground Vegetation	Long Sedge	*Carex folliculata*																							
Ground Vegetation	Mad Dog Skullcap	*Scutellaria lateriflora*																							
Ground Vegetation	Marsh Bedstraw	*Galium palustre*																							
Ground Vegetation	Marsh Blue Violet	*Viola cucullata*																							
Ground Vegetation	Marsh St. John's-Wort	*Triadenum fraseri*																							
Ground Vegetation	Mountain -Fern	*Dryopteris campyloptera*											6												
Ground Vegetation	Narrow-Leaved Cattail	*Typha angustifolia*																							
Ground Vegetation	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*																							
Ground Vegetation	Narrow-Panicled Rush	*Juncus brevicaudatus*																							

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																						
			208	210	211	215	215	215	219	220	220	221	222	222	223	224	224	226	227	227	233	234	244	248	248
			mixed treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Cut-over Coniferous Treed Swamp	Low Shrub Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Graminoid Marsh	Tall Shrub Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Non-Vegetated Shallow Water	Coniferous Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Cut-over Mixed Treed Swamp	Mixed Treed Swamp
Ground Vegetation	New Belgium American-Aster	*Symphyotrichum novi-belgii*																							
Ground Vegetation	New York Fern	*Thelypteris noveboracensis*																							
Ground Vegetation	Northern Beech Fern	*Phegopteris connectilis*																							
Ground Vegetation	Northern Bugleweed	*Lycopus uniflorus*	1																						
Ground Vegetation	Northern Mannagrass	*Glyceria laxa*																							
Ground Vegetation	Northern Pitcher-Plant	*Sarracenia purpurea*																							
Ground Vegetation	Northern Starflower	*Trientalis borealis*		5	5						1		4							2			2		
Ground Vegetation	Parasol White-Top	*Doellingeria umbellata*	4																			2			
Ground Vegetation	Partridge-Berry	*Mitchella repens*																							
Ground Vegetation	Peatmoss	*Sphagnum spp.*	75	75	85		8	60	60	40	85	95	40	90		90	90	30	30	90	25	50	20	65	60
Ground Vegetation	Pickerel Weed	*Pontederia cordata*																							
Ground Vegetation	Purple Avens	*Geum rivale*																							
Ground Vegetation	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*																							
Ground Vegetation	Red Fescue	*Festuca rubra*																							
Ground Vegetation	Red-stemmed Moss	*Pleurozium schreberi*																							
Ground Vegetation	Reindeer Lichen	*Cladina spp.*																							
Ground Vegetation	Rhytidiadelphus Moss	*Rhytidiadelphus sp.*																							
Ground Vegetation	Rough Bentgrass	*Agrostis scabra*																							
Ground Vegetation	Rough Sedge	*Carex scabrata*																							
Ground Vegetation	Rough-Leaf Goldenrod	*Solidago rugosa*	5																						
Ground Vegetation	Roundleaf Sundew	*Drosera rotundifolia*																							
Ground Vegetation	Royal Fern	*Osmunda regalis*																				10			
Ground Vegetation	Sensitive Fern	*Onoclea sensibilis*																							
Ground Vegetation	Seven-Angled Pipewort	*Eriocaulon aquaticum*																							
Ground Vegetation	Slender Sedge	*Carex lasiocarpa*																							
Ground Vegetation	Small Enchanter's Nightshade	*Circaea alpina*																							
Ground Vegetation	Small Green Woodland Orchid	*Platanthera clavellata*																							
Ground Vegetation	Small Purple-Fringe Orchis	*Platanthera psycodes*																							
Ground Vegetation	Small-Fruit Bulrush	*Scirpus microcarpus*																							
Ground Vegetation	Smooth White Violet	*Viola macloskeyi*																							
Ground Vegetation	Soft Rush	*Juncus effusus*																							
Ground Vegetation	Spinulose Shield Fern	*Dryopteris carthusiana*	3																						
Ground Vegetation	Spotted Jewel-Weed	*Impatiens capensis*					1																		
Ground Vegetation	St. John's-Wort	*Triadenum sp.*																							
Ground Vegetation	Stair-step Moss	*Hylocomium splendens*																							
Ground Vegetation	Stiff Clubmoss	*Lycopodium annotinum*																							
Ground Vegetation	Swamp Loosestrife	*Lysimachia terrestris*	2				2																		
Ground Vegetation	Tawny Cotton-Grass	*Eriophorum virginicum*																							
Ground Vegetation	Teaberry	*Gaultheria procumbens*																							
Ground Vegetation	Thread Rush	*Juncus filiformis*																							
Ground Vegetation	Three-lobed Bazzania	*Bazzania trilobata*																							
Ground Vegetation	Three-Seed Sedge	*Carex trisperma*		25	10			20	5	10	70	30		40	10										
Ground Vegetation	Three-Way Sedge	*Dulichium arundinaceum*																							
Ground Vegetation	Tussock Sedge	*Carex stricta*					1																		
Ground Vegetation	Twinflower	*Linnaea borealis*																							
Ground Vegetation	Water Sedge	*Carex aquatilis*																							
Ground Vegetation	Water Sedge	*Carex nigra*																							
Ground Vegetation	Watershield	*Brasenia schreberi*																							
Ground Vegetation	White -Sorrel	*Oxalis montana*																							
Ground Vegetation	White Turtlehead	*Chelone glabra*																							
Ground Vegetation	Whorled Aster	*Oclemena acuminata*								1															
Ground Vegetation	Wild Lily-of-The-Valley	*Maianthemum canadense*		3	5								5			5	5	5	5	5	2				
Ground Vegetation	Wild Sarsaparilla	*Aralia nudicaulis*																							
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																							
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																							

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																						
			249	249	252	253	253	259	259	261	262	265	267	268	268	270	277	277	279	279	279	279	283	285	285
			Cut-over Coniferous Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Cut-over Mixed Treed Swamp	Mixed Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Moss Shallow Water	Mixed Treed Swamp	Graminoid Marsh	Mixed Shrub Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Coniferous Treed Bog	Graminoid Marsh	Mixed Treed Swamp
Tree	American Larch	*Larix laricina*			5	10	20	5						5						5					
Tree	Balsam Fir	*Abies balsamea*			30		15		10	30	30	30	30		50	5		5							40
Tree	Black Spruce	*Picea mariana*	30			5	20	15		30				40						12.5	25				
Tree	Eastern Hemlock	*Tsuga canadensis*																							
Tree	Eastern White Pine	*Pinus strobus*																							
Tree	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*																							
Tree	Paper Birch	*Betula papyrifera*					5							1							2				
Tree	Red Maple	*Acer rubrum*		1	65		40	10	50	80	80	60	75		35	60		40					0.5		30
Tree	Red Spruce	*Picea rubens*																1		10	25	15	10	20	
Tree	White Spruce	*Picea glauca*																							
Tree	Yellow Birch	*Betula alleghaniensis*																							
Shrub	a Blackberry	*Rubus sp.*																2							
Shrub	a Serviceberry	*Amelanchier sp.*																							
Shrub	a Willow	*Salix sp.*																							
Shrub	American Larch	*Larix laricina*		0.5			5		5							2									
Shrub	Balsam Fir	*Abies balsamea*	3		40		5		5	15	15	10	15		30	5		7							5
Shrub	Balsam Willow	*Salix pyrifolia*																							
Shrub	Beaked Hazelnut	*Corylus cornuta*																							
Shrub	Bebb's Willow	*Salix bebbiana*																							
Shrub	Black Chokeberry	*Photinia melanocarpa*																							
Shrub	Black Holly	*Ilex verticillata*													8						0.5				
Shrub	Black Huckleberry	*Gaylussacia baccata*																							
Shrub	Black Spruce	*Picea mariana*	7					10		5				15									2.5		
Shrub	Bog Rosemary	*Andromeda polifolia*																							
Shrub	Bristly Dewberry	*Rubus hispidus*				5																			
Shrub	Common Labrador Tea	*Ledum groenlandicum*	1					10					0.5												
Shrub	Fire Cherry	*Prunus pensylvanica*																							
Shrub	Green Alder	*Alnus viridis*																							
Shrub	Hardhack Spiraea	*Spiraea tomentosa*																							
Shrub	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*																							
Shrub	Large Cranberry	*Vaccinium macrocarpon*										2						5			1				
Shrub	Late Lowbush Blueberry	*Vaccinium angustifolium*																					0.5		
Shrub	Leatherleaf	*Chamaedaphne calyculata*		10	30			10								2		18.333333		10					
Shrub	Mountain Fly-Honeysuckle	*Lonicera villosa*																							
Shrub	Mountain Holly	*Nemopanthus mucronatus*						20		1						2				5					
Shrub	Narrow-Leaved Meadow-Sweet	*Spiraea alba*			15	2	5		1		3	10	1		15	2		4.6666667		2					
Shrub	Northern Bayberry	*Morella pensylvanica*																							
Shrub	Northern Poison Oak	*Toxicodendron rydbergii*																2							
Shrub	Paper Birch	*Betula papyrifera*																							
Shrub	Possum-Haw Viburnum	*Viburnum nudum*																		3					
Shrub	Prairie Willow	*Salix humilis*																							
Shrub	Quaking Aspen	*Populus tremuloides*																							
Shrub	Red Maple	*Acer rubrum*	2			2	5			2	2	10		10		10	5	10							
Shrub	Red Raspberry	*Rubus idaeus*																							
Shrub	Red Spruce	*Picea rubens*																			15	5	2.5	3	
Shrub	Rhodora	*Rhododendron canadense*	5	10	25		2	30												3					
Shrub	Sheep-Laurel	*Kalmia angustifolia*						5					0.5	0.5	1					5	0.5		0.5		
Shrub	Shining Rose	*Rosa nitida*																							
Shrub	Small Cranberry	*Vaccinium oxycoccos*																							
Shrub	Smooth Blackberry	*Rubus canadensis*																							
Shrub	Speckled Alder	*Alnus incana*			35		5					5		90		20	10	5	2		80	50		15	
Shrub	Sweet Bayberry	*Myrica gale*			25	2										2		41.666667							
Shrub	Velvetleaf Blueberry	*Vaccinium myrtilloides*						20																	
Shrub	White Ash	*Fraxinus americana*																							
Shrub	White Spruce	*Picea glauca*																							
Shrub	Yellow Birch	*Betula alleghaniensis*																							
Ground Vegetation	a Bladderwort	*Utricularia sp.*									10														
Ground Vegetation	a Bur-Reed	*Sparganium sp.*																							
Ground Vegetation	a Cotton-Grass	*Eriophorum sp.*																							
Ground Vegetation	a hybrid White Panicled American-Aster	*Oclemena x blakei*																							

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																						
			249	249	252	253	253	259	259	261	262	265	267	268	268	270	277	277	279	279	279	279	283	285	285
			Cut-over Coniferous Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Cut-over Mixed Treed Swamp	Mixed Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Mixed Treed Swamp	Moss Shallow Water	Mixed Treed Swamp	Graminoid Marsh	Mixed Shrub Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Coniferous Treed Bog	Graminoid Marsh	Mixed Treed Swamp
Ground Vegetation	a Manna-Grass	*Glyceria sp.*										10	3												
Ground Vegetation	a Pondweed	*Potamogeton spp.*															1								
Ground Vegetation	a Rush	*Juncus sp.*																							
Ground Vegetation	A Sedge	*Carex gynandra*										3													
Ground Vegetation	A Sedge	*Carex magellanica ssp. irrigua*																							
Ground Vegetation	a Sedge	*Carex sp.*											2		1										
Ground Vegetation	a Spikerush	*Eleocharis sp.*																							
Ground Vegetation	a Violet	*Viola sp.*																							
Ground Vegetation	a Wood Fern	*Dryopteris sp.*																				2			
Ground Vegetation	Algae	*Algae spp.*																							
Ground Vegetation	American Bur-Reed	*Sparganium americanum*																							
Ground Vegetation	American Water-Lily	*Nymphaea odorata*															1	5	5						
Ground Vegetation	Bear Sedge	*Carex utriculata*																							
Ground Vegetation	Blueflag	*Iris versicolor*																							
Ground Vegetation	Blue-Joint Reedgrass	*Calamagrostis canadensis*		30	15	60			80									11.666667		15.5		5			
Ground Vegetation	Blunt Manna-Grass	*Glyceria obtusa*																							
Ground Vegetation	Bog Aster	*Oclemena nemoralis*																9							
Ground Vegetation	Bog Clubmoss	*Lycopodiella inundata*																							
Ground Vegetation	Bog Goldenrod	*Solidago uliginosa*									10														
Ground Vegetation	Braided moss	*Hypnum spp.*																							
Ground Vegetation	Bristly-Stalk Sedge	*Carex leptalea*																							
Ground Vegetation	Broad-Leaf Cattail	*Typha latifolia*							5		30	20													
Ground Vegetation	Brown-Fruited Rush	*Juncus pelocarpus*																							
Ground Vegetation	Brownish Sedge	*Carex brunnescens*																					2		
Ground Vegetation	Canada Manna-Grass	*Glyceria canadensis*																							
Ground Vegetation	Canada Rush	*Juncus canadensis*																							
Ground Vegetation	Christmas Fern	*Polystichum acrostichoides*																							
Ground Vegetation	Cinnamon Fern	*Osmunda cinnamomea*	10											10	0.5			5		27.5	35	30	40	45	
Ground Vegetation	Climbing Nightshade	*Solanum dulcamara*																							
Ground Vegetation	Cottongrass Bulrush	*Scirpus cyperinus*			5						3	12													
Ground Vegetation	Creeping Butter-Cup	*Ranunculus repens*																							
Ground Vegetation	Creeping Snowberry	*Gaultheria hispidula*								1															
Ground Vegetation	Crested Shield-Fern	*Dryopteris cristata*																							
Ground Vegetation	Crinkled Hairgrass	*Deschampsia flexuosa*																							
Ground Vegetation	Dwarf Dog	*Cornus canadensis*								2				5											
Ground Vegetation	Early Coralroot	*Corallorhiza trifida*																							
Ground Vegetation	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*																							
Ground Vegetation	Evergreen fern	*Dryopteris intermedia*																							
Ground Vegetation	Field Horsetail	*Equisetum arvense*																							
Ground Vegetation	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*																							
Ground Vegetation	Fowl Bluegrass	*Poa palustris*																							
Ground Vegetation	Goldthread	*Coptis trifolia*	10																						
Ground Vegetation	Hair-cap Moss	*Polytrichum sp.*									2		65												
Ground Vegetation	Hairy Willow-Herb	*Epilobium ciliatum*																							
Ground Vegetation	Hoary Sedge	*Carex canescens*		10							5	3						3							
Ground Vegetation	Indian-Pipe	*Monotropa uniflora*																							
Ground Vegetation	Interrupted Fern	*Osmunda claytoniana*																							
Ground Vegetation	Kentucky Bluegrass	*Poa pratensis*																							
Ground Vegetation	Lady-Fern	*Athyrium filix-femina*																							
Ground Vegetation	Least Spike-Rush	*Eleocharis acicularis*																							
Ground Vegetation	Little Prickly Sedge	*Carex echinata*				5																			
Ground Vegetation	Long Sedge	*Carex folliculata*																							
Ground Vegetation	Mad Dog Skullcap	*Scutellaria lateriflora*																							
Ground Vegetation	Marsh Bedstraw	*Galium palustre*																							
Ground Vegetation	Marsh Blue Violet	*Viola cucullata*																							
Ground Vegetation	Marsh St. John's-Wort	*Triadenum fraseri*																							
Ground Vegetation	Mountain -Fern	*Dryopteris campyloptera*																							
Ground Vegetation	Narrow-Leaved Cattail	*Typha angustifolia*																							
Ground Vegetation	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*																							
Ground Vegetation	Narrow-Panicled Rush	*Juncus brevicaudatus*																							

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities 249 Cut-over Coniferous Treed Swamp	249 Coniferous Treed Swamp	252 Mixed Treed Swamp	253 Cut-over Mixed Treed Swamp	253 Mixed Treed Swamp	259 Coniferous Treed Swamp	259 Mixed Treed Swamp	261 Mixed Treed Swamp	262 Mixed Treed Swamp	265 Mixed Treed Swamp	267 Mixed Treed Swamp	268 Tall Shrub Swamp	268 Mixed Treed Swamp	270 Mixed Treed Swamp	277 Moss Shallow Water	277 Mixed Treed Swamp	279 Graminoid Marsh	279 Mixed Shrub Swamp	279 Tall Shrub Swamp	279 Mixed Treed Swamp	283 Coniferous Treed Bog	285 Graminoid Marsh	285 Mixed Treed Swamp
Ground Vegetation	New Belgium American-Aster	*Symphyotrichum novi-belgii*									5	2	3												
Ground Vegetation	New York Fern	*Thelypteris noveboracensis*																							
Ground Vegetation	Northern Beech Fern	*Phegopteris connectilis*																		1					
Ground Vegetation	Northern Bugleweed	*Lycopus uniflorus*																							
Ground Vegetation	Northern Mannagrass	*Glyceria laxa*																							
Ground Vegetation	Northern Pitcher-Plant	*Sarracenia purpurea*																		3					
Ground Vegetation	Northern Starflower	*Trientalis borealis*											5	6							10	10	5		
Ground Vegetation	Parasol White-Top	*Doellingeria umbellata*										5	5									2			
Ground Vegetation	Partridge-Berry	*Mitchella repens*																							
Ground Vegetation	Peatmoss	*Sphagnum spp.*	80	30		50	30	50		30	47.5	80	33	80				65		47.5	80	65	55	70	
Ground Vegetation	Pickerel Weed	*Pontederia cordata*															1		20						
Ground Vegetation	Purple Avens	*Geum rivale*																							
Ground Vegetation	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*																							
Ground Vegetation	Red Fescue	*Festuca rubra*																							
Ground Vegetation	Red-stemmed Moss	*Pleurozium schreberi*						15		10													15		
Ground Vegetation	Reindeer Lichen	*Cladina spp.*						2																	
Ground Vegetation	Rhytidiadelphus Moss	*Rhytidiadelphus sp.*																							
Ground Vegetation	Rough Bentgrass	*Agrostis scabra*																							
Ground Vegetation	Rough Sedge	*Carex scabrata*																							
Ground Vegetation	Rough-Leaf Goldenrod	*Solidago rugosa*							1				4									2			
Ground Vegetation	Roundleaf Sundew	*Drosera rotundifolia*																							
Ground Vegetation	Royal Fern	*Osmunda regalis*																10							
Ground Vegetation	Sensitive Fern	*Onoclea sensibilis*							10									15							
Ground Vegetation	Seven-Angled Pipewort	*Eriocaulon aquaticum*															1								
Ground Vegetation	Slender Sedge	*Carex lasiocarpa*																							
Ground Vegetation	Small Enchanter's Nightshade	*Circaea alpina*																							
Ground Vegetation	Small Green Woodland Orchid	*Platanthera clavellata*																							
Ground Vegetation	Small Purple-Fringe Orchis	*Platanthera psycodes*																							
Ground Vegetation	Small-Fruit Bulrush	*Scirpus microcarpus*																							
Ground Vegetation	Smooth White Violet	*Viola macloskeyi*											10												
Ground Vegetation	Soft Rush	*Juncus effusus*		30																					
Ground Vegetation	Spinulose Shield Fern	*Dryopteris carthusiana*					0.5							5											
Ground Vegetation	Spotted Jewel-Weed	*Impatiens capensis*																							
Ground Vegetation	St. John's-Wort	*Triadenum sp.*																							
Ground Vegetation	Stair-step Moss	*Hylocomium splendens*								10															
Ground Vegetation	Stiff Clubmoss	*Lycopodium annotinum*																							
Ground Vegetation	Swamp Loosestrife	*Lysimachia terrestris*		0.5			0.5												1						
Ground Vegetation	Tawny Cotton-Grass	*Eriophorum virginicum*																							
Ground Vegetation	Teaberry	*Gaultheria procumbens*																							
Ground Vegetation	Thread Rush	*Juncus filiformis*																							
Ground Vegetation	Three-lobed Bazzania	*Bazzania trilobata*											5		15										
Ground Vegetation	Three-Seed Sedge	*Carex trisperma*	20					2		20															
Ground Vegetation	Three-Way Sedge	*Dulichium arundinaceum*																	2						
Ground Vegetation	Tussock Sedge	*Carex stricta*				20	70				75							17.5							
Ground Vegetation	Twinflower	*Linnaea borealis*																						3	
Ground Vegetation	Water Sedge	*Carex aquatilis*																							
Ground Vegetation	Water Sedge	*Carex nigra*																							
Ground Vegetation	Watershield	*Brasenia schreberi*																							
Ground Vegetation	White -Sorrel	*Oxalis montana*																							
Ground Vegetation	White Turtlehead	*Chelone glabra*																							
Ground Vegetation	Whorled Aster	*Oclemena acuminata*																							
Ground Vegetation	Wild Lily-of-The-Valley	*Maianthemum canadense*																		5		8			
Ground Vegetation	Wild Sarsaparilla	*Aralia nudicaulis*													2										
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																							
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*															1								

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																					
			288	288	290	290	292	294	296	296	296	296	303	304	306	307	312	314	314	316	316	317	317	318	321
			Graminoid Marsh	Tall Shrub Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Mixed Shrub Swamp	Non-Vegetated Shallow Water	Low Shrub Swamp	Aquatic Shallow Water	Mixed Treed Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Non-Vegetated Shallow Water	Tall Shrub Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Tall Shrub Swamp
Tree	American Larch	*Larix laricina*									2														
Tree	Balsam Fir	*Abies balsamea*				3						10	5	25	30	20	50				20	5	5	8	
Tree	Black Spruce	*Picea mariana*					5	20												30		30	30	15	5
Tree	Eastern Hemlock	*Tsuga canadensis*																	1						
Tree	Eastern White Pine	*Pinus strobus*														1									
Tree	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*																							
Tree	Paper Birch	*Betula papyrifera*							5							1						10			
Tree	Red Maple	*Acer rubrum*				10				2		20	10	5	20	5	20		10		20		8	7	2
Tree	Red Spruce	*Picea rubens*			10		55	20					10			1									
Tree	White Spruce	*Picea glauca*																							
Tree	Yellow Birch	*Betula alleghaniensis*																			5				
Shrub	a Blackberry	*Rubus sp.*																							
Shrub	a Serviceberry	*Amelanchier sp.*												0.5											
Shrub	a Willow	*Salix sp.*																							
Shrub	American Larch	*Larix laricina*									2														
Shrub	Balsam Fir	*Abies balsamea*				15	5						25	25	15	5					15	5	10	5	
Shrub	Balsam Willow	*Salix pyrifolia*				5										1	3								
Shrub	Beaked Hazelnut	*Corylus cornuta*																							
Shrub	Bebb's Willow	*Salix bebbiana*															5								
Shrub	Black Chokeberry	*Photinia melanocarpa*																							
Shrub	Black Holly	*Ilex verticillata*	2					1	1																
Shrub	Black Huckleberry	*Gaylussacia baccata*						3																	
Shrub	Black Spruce	*Picea mariana*			5			1.5								5					10	5	15		
Shrub	Bog Rosemary	*Andromeda polifolia*								1															
Shrub	Bristly Dewberry	*Rubus hispidus*	8						5		10	10													5
Shrub	Common Labrador Tea	*Ledum groenlandicum*																							
Shrub	Fire Cherry	*Prunus pensylvanica*																							
Shrub	Green Alder	*Alnus viridis*																							
Shrub	Hardhack Spiraea	*Spiraea tomentosa*																							
Shrub	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*				1																			
Shrub	Large Cranberry	*Vaccinium macrocarpon*															20								
Shrub	Late Lowbush Blueberry	*Vaccinium angustifolium*																							
Shrub	Leatherleaf	*Chamaedaphne calyculata*																	80				30		
Shrub	Mountain Fly-Honeysuckle	*Lonicera villosa*																							
Shrub	Mountain Holly	*Nemopanthus mucronatus*						1																	
Shrub	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	10	3										2		4									
Shrub	Northern Bayberry	*Morella pensylvanica*																							
Shrub	Northern Poison Oak	*Toxicodendron rydbergii*																							
Shrub	Paper Birch	*Betula papyrifera*																							
Shrub	Possum-Haw Viburnum	*Viburnum nudum*														1							15	5	5
Shrub	Prairie Willow	*Salix humilis*																							
Shrub	Quaking Aspen	*Populus tremuloides*																							
Shrub	Red Maple	*Acer rubrum*						2																	
Shrub	Red Raspberry	*Rubus idaeus*									10														
Shrub	Red Spruce	*Picea rubens*						1.5			1		10			10									
Shrub	Rhodora	*Rhododendron canadense*														2									
Shrub	Sheep-Laurel	*Kalmia angustifolia*						2								4						5			
Shrub	Shining Rose	*Rosa nitida*	2																						
Shrub	Small Cranberry	*Vaccinium oxycoccos*																							
Shrub	Smooth Blackberry	*Rubus canadensis*																	10						
Shrub	Speckled Alder	*Alnus incana*	5	40	35	5		2		0.5									30	60		25			45
Shrub	Sweet Bayberry	*Myrica gale*	10	4																					
Shrub	Velvetleaf Blueberry	*Vaccinium myrtilloides*						2														5			
Shrub	White Ash	*Fraxinus americana*											1	0.5											
Shrub	White Spruce	*Picea glauca*																							
Shrub	Yellow Birch	*Betula alleghaniensis*																							
Ground Vegetation	a Bladderwort	*Utricularia sp.*																							
Ground Vegetation	a Bur-Reed	*Sparganium sp.*																							
Ground Vegetation	a Cotton-Grass	*Eriophorum sp.*																							
Ground Vegetation	a hybrid White Panicled American-Aster	*Oclemena x blakei*																							

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																						
			288	288	290	290	292	294	296	296	296	296	303	304	306	307	312	314	314	316	316	317	317	318	321
			Graminoid Marsh	Tall Shrub Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Mixed Shrub Swamp	Non-Vegetated Shallow Water	Low Shrub Swamp	Aquatic Shallow Water	Mixed Treed Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Non-Vegetated Shallow Water	Tall Shrub Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Coniferou s Treed Swamp	Coniferous Treed Swamp	Tall Shrub Swamp
Ground Vegetation	a Manna-Grass	*Glyceria sp.*		5										35											
Ground Vegetation	a Pondweed	*Potamogeton spp.*																							
Ground Vegetation	a Rush	*Juncus sp.*																							
Ground Vegetation	A Sedge	*Carex gynandra*												2											
Ground Vegetation	A Sedge	*Carex magellanica ssp. irrigua*																							
Ground Vegetation	a Sedge	*Carex sp.*																							
Ground Vegetation	a Spikerush	*Eleocharis sp.*																							
Ground Vegetation	a Violet	*Viola sp.*																							
Ground Vegetation	a Wood Fern	*Dryopteris sp.*	3																						
Ground Vegetation	Algae	*Algae spp.*																							
Ground Vegetation	American Bur-Reed	*Sparganium americanum*																							
Ground Vegetation	American Water-Lily	*Nymphaea odorata*																							
Ground Vegetation	Bear Sedge	*Carex utriculata*																	10						
Ground Vegetation	Blueflag	*Iris versicolor*																							
Ground Vegetation	Blue-Joint Reedgrass	*Calamagrostis canadensis*	30	10					5														20		
Ground Vegetation	Blunt Manna-Grass	*Glyceria obtusa*																							
Ground Vegetation	Bog Aster	*Oclemena nemoralis*																							
Ground Vegetation	Bog Clubmoss	*Lycopodiella inundata*																							
Ground Vegetation	Bog Goldenrod	*Solidago uliginosa*																							
Ground Vegetation	Braided moss	*Hypnum spp.*																							
Ground Vegetation	Bristly-Stalk Sedge	*Carex leptalea*														5									
Ground Vegetation	Broad-Leaf Cattail	*Typha latifolia*																20	3						
Ground Vegetation	Brown-Fruited Rush	*Juncus pelocarpus*																							
Ground Vegetation	Brownish Sedge	*Carex brunnescens*								2	10														
Ground Vegetation	Canada Manna-Grass	*Glyceria canadensis*																							
Ground Vegetation	Canada Rush	*Juncus canadensis*													2										
Ground Vegetation	Christmas Fern	*Polystichum acrostichoides*																							
Ground Vegetation	Cinnamon Fern	*Osmunda cinnamomea*	5		15	5	15	65		2		2	10								35	60		20	5
Ground Vegetation	Climbing Nightshade	*Solanum dulcamara*																							
Ground Vegetation	Cottongrass Bulrush	*Scirpus cyperinus*									50														
Ground Vegetation	Creeping Butter-Cup	*Ranunculus repens*		20										40											
Ground Vegetation	Creeping Snowberry	*Gaultheria hispidula*																							
Ground Vegetation	Crested Shield-Fern	*Dryopteris cristata*														3									
Ground Vegetation	Crinkled Hairgrass	*Deschampsia flexuosa*																							
Ground Vegetation	Dwarf Dog	*Cornus canadensis*						5								3					5	5		10	
Ground Vegetation	Early Coralroot	*Corallorhiza trifida*			0.5																				
Ground Vegetation	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*																							
Ground Vegetation	Evergreen fern	*Dryopteris intermedia*								5															
Ground Vegetation	Field Horsetail	*Equisetum arvense*																							
Ground Vegetation	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*																							
Ground Vegetation	Fowl Bluegrass	*Poa palustris*																							
Ground Vegetation	Goldthread	*Coptis trifolia*																							
Ground Vegetation	Hair-cap Moss	*Polytrichum sp.*																							
Ground Vegetation	Hairy Willow-Herb	*Epilobium ciliatum*																							
Ground Vegetation	Hoary Sedge	*Carex canescens*									2							3							
Ground Vegetation	Indian-Pipe	*Monotropa uniflora*																							
Ground Vegetation	Interrupted Fern	*Osmunda claytoniana*																							
Ground Vegetation	Kentucky Bluegrass	*Poa pratensis*												10											
Ground Vegetation	Lady-Fern	*Athyrium filix-femina*																				5			
Ground Vegetation	Least Spike-Rush	*Eleocharis acicularis*																							
Ground Vegetation	Little Prickly Sedge	*Carex echinata*																							
Ground Vegetation	Long Sedge	*Carex folliculata*																							
Ground Vegetation	Mad Dog Skullcap	*Scutellaria lateriflora*		5																					
Ground Vegetation	Marsh Bedstraw	*Galium palustre*																							
Ground Vegetation	Marsh Blue Violet	*Viola cucullata*		5																					
Ground Vegetation	Marsh St. John's-Wort	*Triadenum fraseri*													1		1								
Ground Vegetation	Mountain -Fern	*Dryopteris campyloptera*																							
Ground Vegetation	Narrow-Leaved Cattail	*Typha angustifolia*																							
Ground Vegetation	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*																							
Ground Vegetation	Narrow-Panicled Rush	*Juncus brevicaudatus*																							

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities																						
			288	288	290	290	292	294	296	296	296	296	303	304	306	307	312	314	314	316	316	317	317	318	321
			Graminoid Marsh	Tall Shrub Swamp	Tall Shrub Swamp	Coniferous Treed Swamp	Tall Shrub Swamp	Mixed Shrub Swamp	Non-Vegetated Shallow Water	Low Shrub Swamp	Aquatic Shallow Water	Mixed Treed Swamp	Coniferous Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Coniferous Treed Swamp	Mixed Treed Swamp	Non-Vegetated Shallow Water	Tall Shrub Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Coniferou s Treed Swamp	Coniferous Treed Swamp	Tall Shrub Swamp
Ground Vegetation	New Belgium American-Aster	*Symphyotrichum novi-belgii*				3								2		2	1								
Ground Vegetation	New York Fern	*Thelypteris noveboracensis*																	2						
Ground Vegetation	Northern Beech Fern	*Phegopteris connectilis*																							
Ground Vegetation	Northern Bugleweed	*Lycopus uniflorus*																							
Ground Vegetation	Northern Mannagrass	*Glyceria laxa*																							
Ground Vegetation	Northern Pitcher-Plant	*Sarracenia purpurea*																							
Ground Vegetation	Northern Starflower	*Trientalis borealis*			5		5	3		5		5				3									
Ground Vegetation	Parasol White-Top	*Doellingeria umbellata*										2													
Ground Vegetation	Partridge-Berry	*Mitchella repens*																							
Ground Vegetation	Peatmoss	*Sphagnum spp.*	30	35	60	40	70	80	90	35	80	50	75			70	90	85		30	65	80	50	70	80
Ground Vegetation	Pickerel Weed	*Pontederia cordata*																							
Ground Vegetation	Purple Avens	*Geum rivale*																							
Ground Vegetation	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*																							
Ground Vegetation	Red Fescue	*Festuca rubra*																							
Ground Vegetation	Red-stemmed Moss	*Pleurozium schreberi*																							
Ground Vegetation	Reindeer Lichen	*Cladina spp.*																							
Ground Vegetation	Rhytidiadelphus Moss	*Rhytidiadelphus sp.*																							
Ground Vegetation	Rough Bentgrass	*Agrostis scabra*																							
Ground Vegetation	Rough Sedge	*Carex scabrata*																							
Ground Vegetation	Rough-Leaf Goldenrod	*Solidago rugosa*		5		5						30		1											20
Ground Vegetation	Roundleaf Sundew	*Drosera rotundifolia*																							
Ground Vegetation	Royal Fern	*Osmunda regalis*																							
Ground Vegetation	Sensitive Fern	*Onoclea sensibilis*	15	50		20								6		15									
Ground Vegetation	Seven-Angled Pipewort	*Eriocaulon aquaticum*																							
Ground Vegetation	Slender Sedge	*Carex lasiocarpa*																							
Ground Vegetation	Small Enchanter's Nightshade	*Circaea alpina*																	1						
Ground Vegetation	Small Green Woodland Orchid	*Platanthera clavellata*																							
Ground Vegetation	Small Purple-Fringe Orchis	*Platanthera psycodes*																							
Ground Vegetation	Small-Fruit Bulrush	*Scirpus microcarpus*																							
Ground Vegetation	Smooth White Violet	*Viola macloskeyi*																							
Ground Vegetation	Soft Rush	*Juncus effusus*																							
Ground Vegetation	Spinulose Shield Fern	*Dryopteris carthusiana*								15				2		3									
Ground Vegetation	Spotted Jewel-Weed	*Impatiens capensis*		2																					
Ground Vegetation	St. John's-Wort	*Triadenum sp.*																							
Ground Vegetation	Stair-step Moss	*Hylocomium splendens*					15													15					
Ground Vegetation	Stiff Clubmoss	*Lycopodium annotinum*																							
Ground Vegetation	Swamp Loosestrife	*Lysimachia terrestris*																							
Ground Vegetation	Tawny Cotton-Grass	*Eriophorum virginicum*																							
Ground Vegetation	Teaberry	*Gaultheria procumbens*																							
Ground Vegetation	Thread Rush	*Juncus filiformis*																							
Ground Vegetation	Three-lobed Bazzania	*Bazzania trilobata*													15		15						15	15	
Ground Vegetation	Three-Seed Sedge	*Carex trisperma*					3	5			5		5							0.5			30	30	
Ground Vegetation	Three-Way Sedge	*Dulichium arundinaceum*																							
Ground Vegetation	Tussock Sedge	*Carex stricta*																							
Ground Vegetation	Twinflower	*Linnaea borealis*				10																			
Ground Vegetation	Water Sedge	*Carex aquatilis*															60	1							
Ground Vegetation	Water Sedge	*Carex nigra*																							
Ground Vegetation	Watershield	*Brasenia schreberi*																							
Ground Vegetation	White -Sorrel	*Oxalis montana*											5												
Ground Vegetation	White Turtlehead	*Chelone glabra*												2											
Ground Vegetation	Whorled Aster	*Oclemena acuminata*																							
Ground Vegetation	Wild Lily-of-The-Valley	*Maianthemum canadense*																							
Ground Vegetation	Wild Sarsaparilla	*Aralia nudicaulis*												8	3								4		
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																	5						
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*																							

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities								
			324	325	325	325	327	335	335	336	336
			Mixed Treed Swamp	Cut-over Mixed Treed Swamp	Tall Shrub Swamp	Mixed Treed Swamp	Tall Shrub Swamp	Non-Vegetated Shallow Water	Tall Shrub Swamp	Graminoid Marsh	Moss Shallow Water
Tree	American Larch	*Larix laricina*									
Tree	Balsam Fir	*Abies balsamea*	25		5	25					
Tree	Black Spruce	*Picea mariana*						45	5		40
Tree	Eastern Hemlock	*Tsuga canadensis*									
Tree	Eastern White Pine	*Pinus strobus*									
Tree	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*									
Tree	Paper Birch	*Betula papyrifera*									
Tree	Red Maple	*Acer rubrum*	35	2	10	20			1		
Tree	Red Spruce	*Picea rubens*		10	10						
Tree	White Spruce	*Picea glauca*									
Tree	Yellow Birch	*Betula alleghaniensis*	10	3		15					
Shrub	a Blackberry	*Rubus sp.*									
Shrub	a Serviceberry	*Amelanchier sp.*									
Shrub	a Willow	*Salix sp.*									
Shrub	American Larch	*Larix laricina*									
Shrub	Balsam Fir	*Abies balsamea*	30	15		20	5		5		
Shrub	Balsam Willow	*Salix pyrifolia*									
Shrub	Beaked Hazelnut	*Corylus cornuta*									
Shrub	Bebb's Willow	*Salix bebbiana*									
Shrub	Black Chokeberry	*Photinia melanocarpa*									
Shrub	Black Holly	*Ilex verticillata*									
Shrub	Black Huckleberry	*Gaylussacia baccata*									
Shrub	Black Spruce	*Picea mariana*			30	0.5				1	15
Shrub	Bog Rosemary	*Andromeda polifolia*									
Shrub	Bristly Dewberry	*Rubus hispidus*				10			40	10	2
Shrub	Common Labrador Tea	*Ledum groenlandicum*	5								
Shrub	Fire Cherry	*Prunus pensylvanica*									
Shrub	Green Alder	*Alnus viridis*							3		
Shrub	Hardhack Spiraea	*Spiraea tomentosa*				2				2	
Shrub	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*						0.5			
Shrub	Large Cranberry	*Vaccinium macrocarpon*				20					
Shrub	Late Lowbush Blueberry	*Vaccinium angustifolium*									
Shrub	Leatherleaf	*Chamaedaphne calyculata*				25					
Shrub	Mountain Fly-Honeysuckle	*Lonicera villosa*									
Shrub	Mountain Holly	*Nemopanthus mucronatus*									
Shrub	Narrow-Leaved Meadow-Sweet	*Spiraea alba*							0.5	10	
Shrub	Northern Bayberry	*Morella pensylvanica*									
Shrub	Northern Poison Oak	*Toxicodendron rydbergii*									
Shrub	Paper Birch	*Betula papyrifera*									
Shrub	Possum-Haw Viburnum	*Viburnum nudum*									
Shrub	Prairie Willow	*Salix humilis*									
Shrub	Quaking Aspen	*Populus tremuloides*									
Shrub	Red Maple	*Acer rubrum*		10						1	
Shrub	Red Raspberry	*Rubus idaeus*							1		
Shrub	Red Spruce	*Picea rubens*		5							
Shrub	Rhodora	*Rhododendron canadense*									
Shrub	Sheep-Laurel	*Kalmia angustifolia*	5	5	5			0.5			5
Shrub	Shining Rose	*Rosa nitida*									
Shrub	Small Cranberry	*Vaccinium oxycoccos*									
Shrub	Smooth Blackberry	*Rubus canadensis*				5					
Shrub	Speckled Alder	*Alnus incana*			80		45				
Shrub	Sweet Bayberry	*Myrica gale*									
Shrub	Velvetleaf Blueberry	*Vaccinium myrtilloides*									
Shrub	White Ash	*Fraxinus americana*									
Shrub	White Spruce	*Picea glauca*									
Shrub	Yellow Birch	*Betula alleghaniensis*									
Ground Vegetation	a Bladderwort	*Utricularia sp.*									
Ground Vegetation	a Bur-Reed	*Sparganium sp.*								1	
Ground Vegetation	a Cotton-Grass	*Eriophorum sp.*									
Ground Vegetation	a hybrid White Panicled American-Aster	*Oclemena x blakei*									

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities 324 Mixed Treed Swamp	325 Cut-over Mixed Treed Swamp	325 Tall Shrub Swamp	325 Mixed Treed Swamp	327 Tall Shrub Swamp	335 Non-Vegetated Shallow Water	335 Tall Shrub Swamp	336 Graminoid Marsh	336 Moss Shallow Water
Ground Vegetation	a Manna-Grass	*Glyceria sp.*									
Ground Vegetation	a Pondweed	*Potamogeton spp.*									
Ground Vegetation	a Rush	*Juncus sp.*									
Ground Vegetation	A Sedge	*Carex gynandra*									
Ground Vegetation	A Sedge	*Carex magellanica ssp. irrigua*									
Ground Vegetation	a Sedge	*Carex sp.*									
Ground Vegetation	a Spikerush	*Eleocharis sp.*									
Ground Vegetation	a Violet	*Viola sp.*									
Ground Vegetation	a Wood Fern	*Dryopteris sp.*									
Ground Vegetation	Algae	*Algae spp.*						80			
Ground Vegetation	American Bur-Reed	*Sparganium americanum*									
Ground Vegetation	American Water-Lily	*Nymphaea odorata*									
Ground Vegetation	Bear Sedge	*Carex utriculata*				25	0.5				
Ground Vegetation	Blueflag	*Iris versicolor*					0.5				
Ground Vegetation	Blue-Joint Reedgrass	*Calamagrostis canadensis*				1	75				
Ground Vegetation	Blunt Manna-Grass	*Glyceria obtusa*									
Ground Vegetation	Bog Aster	*Oclemena nemoralis*									
Ground Vegetation	Bog Clubmoss	*Lycopodiella inundata*									
Ground Vegetation	Bog Goldenrod	*Solidago uliginosa*									
Ground Vegetation	Braided moss	*Hypnum spp.*									
Ground Vegetation	Bristly-Stalk Sedge	*Carex leptalea*									
Ground Vegetation	Broad-Leaf Cattail	*Typha latifolia*									
Ground Vegetation	Brown-Fruited Rush	*Juncus pelocarpus*								5	
Ground Vegetation	Brownish Sedge	*Carex brunnescens*									
Ground Vegetation	Canada Manna-Grass	*Glyceria canadensis*					1				
Ground Vegetation	Canada Rush	*Juncus canadensis*								1	
Ground Vegetation	Christmas Fern	*Polystichum acrostichoides*									
Ground Vegetation	Cinnamon Fern	*Osmunda cinnamomea*				0.5					10
Ground Vegetation	Climbing Nightshade	*Solanum dulcamara*									
Ground Vegetation	Cottongrass Bulrush	*Scirpus cyperinus*				5					
Ground Vegetation	Creeping Butter-Cup	*Ranunculus repens*									
Ground Vegetation	Creeping Snowberry	*Gaultheria hispidula*		5				0.5			
Ground Vegetation	Crested Shield-Fern	*Dryopteris cristata*								1	
Ground Vegetation	Crinkled Hairgrass	*Deschampsia flexuosa*									
Ground Vegetation	Dwarf Dog	*Cornus canadensis*	5		5						15
Ground Vegetation	Early Coralroot	*Corallorhiza trifida*									
Ground Vegetation	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*									
Ground Vegetation	Evergreen fern	*Dryopteris intermedia*							1		
Ground Vegetation	Field Horsetail	*Equisetum arvense*									
Ground Vegetation	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*									
Ground Vegetation	Fowl Bluegrass	*Poa palustris*									
Ground Vegetation	Goldthread	*Coptis trifolia*									
Ground Vegetation	Hair-cap Moss	*Polytrichum sp.*	25					2			5
Ground Vegetation	Hairy Willow-Herb	*Epilobium ciliatum*									
Ground Vegetation	Hoary Sedge	*Carex canescens*									
Ground Vegetation	Indian-Pipe	*Monotropa uniflora*									
Ground Vegetation	Interrupted Fern	*Osmunda claytoniana*									
Ground Vegetation	Kentucky Bluegrass	*Poa pratensis*									
Ground Vegetation	Lady-Fern	*Athyrium filix-femina*									
Ground Vegetation	Least Spike-Rush	*Eleocharis acicularis*									
Ground Vegetation	Little Prickly Sedge	*Carex echinata*									
Ground Vegetation	Long Sedge	*Carex folliculata*				1					
Ground Vegetation	Mad Dog Skullcap	*Scutellaria lateriflora*									
Ground Vegetation	Marsh Bedstraw	*Galium palustre*									
Ground Vegetation	Marsh Blue Violet	*Viola cucullata*					0.5				
Ground Vegetation	Marsh St. John's-Wort	*Triadenum fraseri*					0.5				
Ground Vegetation	Mountain -Fern	*Dryopteris campyloptera*									
Ground Vegetation	Narrow-Leaved Cattail	*Typha angustifolia*									
Ground Vegetation	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*									
Ground Vegetation	Narrow-Panicled Rush	*Juncus brevicaudatus*									

Table 1 Wetland Habitat Descriptions (Percent Cover Estimates for Dominant

Strata	Common Name	Scientific Name	Wetland Number and Plant Communities 324 Mixed Treed Swamp	325 Cut-over Mixed Treed Swamp	325 Tall Shrub Swamp	325 Mixed Treed Swamp	327 Tall Shrub Swamp	335 Non-Vegetated Shallow Water	335 Tall Shrub Swamp	336 Graminoid Marsh	336 Moss Shallow Water
Ground Vegetation	New Belgium American-Aster	*Symphyotrichum novi-belgii*									
Ground Vegetation	New York Fern	*Thelypteris noveboracensis*									
Ground Vegetation	Northern Beech Fern	*Phegopteris connectilis*									
Ground Vegetation	Northern Bugleweed	*Lycopus uniflorus*									
Ground Vegetation	Northern Mannagrass	*Glyceria laxa*									
Ground Vegetation	Northern Pitcher-Plant	*Sarracenia purpurea*									
Ground Vegetation	Northern Starflower	*Trientalis borealis*									
Ground Vegetation	Parasol White-Top	*Doellingeria umbellata*									
Ground Vegetation	Partridge-Berry	*Mitchella repens*									
Ground Vegetation	Peatmoss	*Sphagnum spp.*	60	90	90	90		75	70	90	65
Ground Vegetation	Pickerel Weed	*Pontederia cordata*									
Ground Vegetation	Purple Avens	*Geum rivale*									
Ground Vegetation	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*									
Ground Vegetation	Red Fescue	*Festuca rubra*									
Ground Vegetation	Red-stemmed Moss	*Pleurozium schreberi*						10			15
Ground Vegetation	Reindeer Lichen	*Cladina spp.*									
Ground Vegetation	Rhytidiadelphus Moss	*Rhytidiadelphus sp.*									
Ground Vegetation	Rough Bentgrass	*Agrostis scabra*									
Ground Vegetation	Rough Sedge	*Carex scabrata*									
Ground Vegetation	Rough-Leaf Goldenrod	*Solidago rugosa*							0.5	5	
Ground Vegetation	Roundleaf Sundew	*Drosera rotundifolia*									
Ground Vegetation	Royal Fern	*Osmunda regalis*									
Ground Vegetation	Sensitive Fern	*Onoclea sensibilis*					20				
Ground Vegetation	Seven-Angled Pipewort	*Eriocaulon aquaticum*									
Ground Vegetation	Slender Sedge	*Carex lasiocarpa*									
Ground Vegetation	Small Enchanter's Nightshade	*Circaea alpina*									
Ground Vegetation	Small Green Woodland Orchid	*Platanthera clavellata*									
Ground Vegetation	Small Purple-Fringe Orchis	*Platanthera psycodes*									
Ground Vegetation	Small-Fruit Bulrush	*Scirpus microcarpus*									
Ground Vegetation	Smooth White Violet	*Viola macloskeyi*									
Ground Vegetation	Soft Rush	*Juncus effusus*							1	10	
Ground Vegetation	Spinulose Shield Fern	*Dryopteris carthusiana*						0.5			
Ground Vegetation	Spotted Jewel-Weed	*Impatiens capensis*									
Ground Vegetation	St. John's-Wort	*Triadenum sp.*									
Ground Vegetation	Stair-step Moss	*Hylocomium splendens*									
Ground Vegetation	Stiff Clubmoss	*Lycopodium annotinum*									
Ground Vegetation	Swamp Loosestrife	*Lysimachia terrestris*									
Ground Vegetation	Tawny Cotton-Grass	*Eriophorum virginicum*	5								
Ground Vegetation	Teaberry	*Gaultheria procumbens*									
Ground Vegetation	Thread Rush	*Juncus filiformis*									
Ground Vegetation	Three-lobed Bazzania	*Bazzania trilobata*									
Ground Vegetation	Three-Seed Sedge	*Carex trisperma*	40	5	10			4	15		
Ground Vegetation	Three-Way Sedge	*Dulichium arundinaceum*				10					
Ground Vegetation	Tussock Sedge	*Carex stricta*									
Ground Vegetation	Twinflower	*Linnaea borealis*									
Ground Vegetation	Water Sedge	*Carex aquatilis*									
Ground Vegetation	Water Sedge	*Carex nigra*									
Ground Vegetation	Watershield	*Brasenia schreberi*									
Ground Vegetation	White -Sorrel	*Oxalis montana*									
Ground Vegetation	White Turtlehead	*Chelone glabra*									
Ground Vegetation	Whorled Aster	*Oclemena acuminata*									
Ground Vegetation	Wild Lily-of-The-Valley	*Maianthemum canadense*									
Ground Vegetation	Wild Sarsaparilla	*Aralia nudicaulis*				1					
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*									
Ground Vegetation	Yellow Pond-Lily	*Nuphar lutea*									

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
5	a Serviceberry	*Amelanchier sp.*	na	na		
5	American Larch	*Larix laricina*	S5	Secure		
5	Balsam Fir	*Abies balsamea*	S5	Secure		
5	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
5	Black Spruce	*Picea mariana*	S5	Secure		
5	Bladder Sedge	*Carex intumescens*	S5	Secure		
5	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
5	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
5	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
5	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
5	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
5	Goldthread	*Coptis trifolia*	S5	Secure		
5	Hairy Willow-Herb	*Epilobium ciliatum*	S5	Secure		
5	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
5	Indian-Pipe	*Monotropa uniflora*	S5	Secure		
5	Interrupted Fern	*Osmunda claytoniana*	S5	Secure		
5	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
5	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
5	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
5	Northern Red Oak	*Quercus rubra*	S5	Secure		
5	Northern Starflower	*Trientalis borealis*	S5	Secure		
5	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
5	Red Spruce	*Picea rubens*	S5	Secure		
5	Rhodora	*Rhododendron canadense*	S5	Secure		
5	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
5	Speckled Alder	*Alnus incana*	S5	Secure		
5	Striped Maple	*Acer pensylvanicum*	S5	Secure		
5	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
5	Twinflower	*Linnaea borealis*	S5	Secure		
5	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
5	Whorled Aster	*Oclemena acuminata*	S5	Secure		
5	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
5	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
6	Balsam Willow	*Salix pyrifolia*	S5	Secure		
6	Bebb's Willow	*Salix bebbiana*	S5	Secure		
6	Brownish Sedge	*Carex brunnescens*	S5	Secure		
6	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
6	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
6	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
6	Green Alder	*Alnus viridis*	S5	Secure		
6	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
6	Hoary Sedge	*Carex canescens*	S5	Secure		
6	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
6	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
6	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
6	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
6	Pussy Willow	*Salix discolor*	S5	Secure		
6	Red Maple	*Acer rubrum*	S5	Secure		
6	Royal Fern	*Osmunda regalis*	S5	Secure		
6	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
6	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
6	Soft Rush	*Juncus effusus*	S5	Secure		
6	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
8	a Serviceberry	*Amelanchier sp.*	na	na		
8	American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		
8	Balsam Fir	*Abies balsamea*	S5	Secure		
8	Black Holly	*Ilex verticillata*	S5	Secure		
8	Black Sedge	*Carex nigra*	S5	Secure		
8	Black Spruce	*Picea mariana*	S5	Secure		
8	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
8	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
8	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
8	Goldthread	*Coptis trifolia*	S5	Secure		
8	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
8	Northern Red Oak	*Quercus rubra*	S5	Secure		
8	Northern Starflower	*Trientalis borealis*	S5	Secure		
8	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
8	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
8	Red Maple	*Acer rubrum*	S5	Secure		
8	Red Spruce	*Picea rubens*	S5	Secure		
8	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
8	Speckled Alder	*Alnus incana*	S5	Secure		
8	Striped Maple	*Acer pensylvanicum*	S5	Secure		
8	Teaberry	*Gaultheria procumbens*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
8	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
8	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
8	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
8	Yellow Birch	*Betula alleghaniensis*	S5	Secure		
9	a Bur-reed	*Sparganium sp.*	na	na		
9	a Bur-reed	*Sparganium sp.*	na	na		
9	a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed		
9	a Manna-grass	*Glyceria sp.*	na	na		
9	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
9	American Mountain-Ash	*Sorbus americana*	S5	Secure		
9	Black Holly	*Ilex verticillata*	S5	Secure		
9	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
9	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
9	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
9	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
9	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
9	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
9	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
9	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
9	Least Spike-Rush	*Eleocharis acicularis*	S5	Secure		
9	Marsh Bedstraw	*Galium palustre*	S5	Secure		
9	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
9	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
9	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
9	Northern Starflower	*Trientalis borealis*	S5	Secure		
9	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
9	Purple Chokeberry	*Photinia floribunda*	S5	Secure		
9	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*	S4	Secure		
9	Quaking Aspen	*Populus tremuloides*	S5	Secure		
9	Red Maple	*Acer rubrum*	S5	Secure		
9	Red Raspberry	*Rubus idaeus*	S5	Secure		
9	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
9	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
9	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
9	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
9	Soft Rush	*Juncus effusus*	S5	Secure		
9	Speckled Alder	*Alnus incana*	S5	Secure		
9	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
9	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
9	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
9	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
9	Whorled Aster	*Oclemena acuminata*	S5	Secure		
9	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
9	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
10	a Blackberry	*Rubus sp.*	na	na		
10	a Bur-reed	*Sparganium sp.*	na	na		
10	a Bur-reed	*Sparganium sp.*	na	na		
10	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
10	a Manna-grass	*Glyceria sp.*	na	na		
10	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
10	a Serviceberry	*Amelanchier sp.*	na	na		
10	American Mountain-Ash	*Sorbus americana*	S5	Secure		
10	Balsam Fir	*Abies balsamea*	S5	Secure		
10	Balsam Willow	*Salix pyrifolia*	S5	Secure		
10	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
10	Black Holly	*Ilex verticillata*	S5	Secure		
10	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
10	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
10	Bog Fern	*Thelypteris simulata*	S4S5	Secure		
10	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
10	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
10	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
10	Brownish Sedge	*Carex brunnescens*	S5	Secure		
10	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
10	Clinton Lily	*Clintonia borealis*	S5	Secure		
10	Colt's Foot	*Tussilago farfara*	SNA	Exotic		
10	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
10	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
10	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
10	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
10	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
10	Eastern White Pine	*Pinus strobus*	S5	Secure		
10	Field Horsetail	*Equisetum arvense*	S5	Secure		
10	Fireweed	*Chamerion angustifolium*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
10	Goldthread	*Coptis trifolia*	S5	Secure		
10	Gray Birch	*Betula populifolia*	S5	Secure		
10	Hairy Willow-Herb	*Epilobium ciliatum*	S5	Secure		
10	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
10	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
10	Hoary Sedge	*Carex canescens*	S5	Secure		
10	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
10	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
10	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
10	Lesser Duckweed	*Lemna minor*	SNA	na		
10	Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Secure		
10	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
10	Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Secure		
10	Narrow-Leaved Cattail	*Typha angustifolia*	S5	Secure		
10	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*	S5	Secure		
10	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
10	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
10	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
10	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
10	Northern Mannagrass	*Glyceria laxa*	S4?	Secure		
10	Northern Red Oak	*Quercus rubra*	S5	Secure		
10	Northern Starflower	*Trientalis borealis*	S5	Secure		
10	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
10	Partridge-Berry	*Mitchella repens*	S5	Secure		
10	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
10	Prairie Willow	*Salix humilis*	S5	Secure		
10	Purple-Stem Swamp Beggar-Ticks	*Bidens connata*	S4	Secure		
10	Red Maple	*Acer rubrum*	S5	Secure		
10	Red Raspberry	*Rubus idaeus*	S5	Secure		
10	Red Spruce	*Picea rubens*	S5	Secure		
10	Rhodora	*Rhododendron canadense*	S5	Secure		
10	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
10	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
10	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
10	Small Bedstraw	*Galium trifidum*	S5	Secure		
10	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
10	Smooth Blackberry	*Rubus canadensis*	S5	Secure		
10	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
10	Soft Rush	*Juncus effusus*	S5	Secure		
10	Speckled Alder	*Alnus incana*	S5	Secure		
10	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
10	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
10	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
10	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
10	Twinflower	*Linnaea borealis*	S5	Secure		
10	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
10	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
10	Whorled Aster	*Oclemena acuminata*	S5	Secure		
10	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
10	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
12	a Blackberry	*Rubus sp.*	na	na		
12	a Bur-reed	*Sparganium sp.*	na	na		
12	a Bur-reed	*Sparganium sp.*	na	na		
12	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
12	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
12	A Sedge	*Carex gynandra*	S5	Secure		
12	a Sedge	*Carex sp.*	na	na		
12	a Serviceberry	*Amelanchier sp.*	na	na		
12	American Mannagrass	*Glyceria grandis*	S4S5	Secure		
12	American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		
12	Balsam Fir	*Abies balsamea*	S5	Secure		
12	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
12	Black Holly	*Ilex verticillata*	S5	Secure		
12	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
12	Black Sedge	*Carex nigra*	S5	Secure		
12	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
12	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
12	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
12	Brownish Sedge	*Carex brunnescens*	S5	Secure		
12	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
12	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
12	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
12	Devil's Beggar-Ticks	*Bidens frondosa*	S5	Secure		
12	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		

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Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
12	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
12	Eastern White Pine	*Pinus strobus*	S5	Secure		
12	Fire Cherry	*Prunus pensylvanica*	S5	Secure		
12	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
12	Fowl Manna-Grass	*Glyceria striata*	S5	Secure		
12	Fringed Black Bindweed	*Polygonum cilinode*	S5	Secure		
12	Goldthread	*Coptis trifolia*	S5	Secure		
12	Green Alder	*Alnus viridis*	S5	Secure		
12	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
12	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
12	Lance-Leaf Violet	*Viola lanceolata*	S5	Secure		
12	Least Spike-Rush	*Eleocharis acicularis*	S5	Secure		
12	Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Secure		
12	Little Prickly Sedge	*Carex echinata*	S5	Secure		
12	Marsh Fern	*Thelypteris palustris*	S5	Secure		
12	Marsh Willow-Herb	*Epilobium palustre*	S5	Secure		
12	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
12	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
12	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
12	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
12	Northern Mannagrass	*Glyceria laxa*	S4?	Secure		
12	Northern Red Oak	*Quercus rubra*	S5	Secure		
12	Northern Witchgrass	*Dichanthelium boreale*	S5	Secure		
12	Paper Birch	*Betula papyrifera*	S5	Secure		
12	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
12	Pointed Broom Sedge	*Carex scoparia*	S5	Secure		
12	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
12	Red Maple	*Acer rubrum*	S5	Secure		
12	Red Raspberry	*Rubus idaeus*	S5	Secure		
12	Red Spruce	*Picea rubens*	S5	Secure		
12	Rhodora	*Rhododendron canadense*	S5	Secure		
12	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
12	Rough-Leaved Aster	*Eurybia radula*	S5	Secure		
12	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
12	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
12	Smooth Blackberry	*Rubus canadensis*	S5	Secure		
12	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
12	Soft Rush	*Juncus effusus*	S5	Secure		
12	Speckled Alder	*Alnus incana*	S5	Secure		
12	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
12	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
12	Thread Rush	*Juncus filiformis*	S5	Secure		
12	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
12	White Spruce	*Picea glauca*	S5	Secure		
12	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
12	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
13	a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed		
13	American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		
13	Balsam Fir	*Abies balsamea*	S5	Secure		
13	Black Holly	*Ilex verticillata*	S5	Secure		
13	Black Spruce	*Picea mariana*	S5	Secure		
13	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
13	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
13	Goldthread	*Coptis trifolia*	S5	Secure		
13	Graceful Sedge	*Carex gracillima*	S4S5	Secure		
13	Hairy Sweet-Cicely	*Osmorhiza claytonii*	S4	Secure		
13	Interrupted Fern	*Osmunda claytoniana*	S5	Secure		
13	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
13	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
13	Northern Starflower	*Trientalis borealis*	S5	Secure		
13	Paper Birch	*Betula papyrifera*	S5	Secure		
13	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
13	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
13	Striped Maple	*Acer pensylvanicum*	S5	Secure		
13	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
13	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
13	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
13	White Spruce	*Picea glauca*	S5	Secure		
13	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
13	Whorled Aster	*Oclemena acuminata*	S5	Secure		
13	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
13	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
16	a Bur-reed	*Sparganium sp.*	na	na		
16	a Bur-reed	*Sparganium sp.*	na	na		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
16	a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed		
16	Balsam Fir	*Abies balsamea*	S5	Secure		
16	Black Holly	*Ilex verticillata*	S5	Secure		
16	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
16	Black Spruce	*Picea mariana*	S5	Secure		
16	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
16	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
16	Canada Hawkweed	*Hieracium canadense*	S4S5	Secure		
16	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
16	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
16	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
16	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
16	Eastern White Pine	*Pinus strobus*	S5	Secure		
16	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
16	Goldthread	*Coptis trifolia*	S5	Secure		
16	Gray Birch	*Betula populifolia*	S5	Secure		
16	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
16	Hoary Sedge	*Carex canescens*	S5	Secure		
16	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
16	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
16	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
16	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
16	Northern Beech Fern	*Phegopteris connectilis*	S5	Secure		
16	Northern Red Oak	*Quercus rubra*	S5	Secure		
16	Northern Starflower	*Trientalis borealis*	S5	Secure		
16	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
16	Red Maple	*Acer rubrum*	S5	Secure		
16	Red Raspberry	*Rubus idaeus*	S5	Secure		
16	Red Spruce	*Picea rubens*	S5	Secure		
16	Shadbush	*Amelanchier interior*	S4S5	Secure		
16	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
16	Soft Rush	*Juncus effusus*	S5	Secure		
16	Speckled Alder	*Alnus incana*	S5	Secure		
16	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
16	Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S5	Secure		
16	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
16	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
16	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
16	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
16	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
16	Whorled Aster	*Oclemena acuminata*	S5	Secure		
16	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
16	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
18	a Serviceberry	*Amelanchier sp.*	na	na		
18	American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		
18	Balsam Fir	*Abies balsamea*	S5	Secure		
18	Black Holly	*Ilex verticillata*	S5	Secure		
18	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
18	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
18	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
18	Goldthread	*Coptis trifolia*	S5	Secure		
18	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
18	Indian Cucumber-Root	*Medeola virginiana*	S5	Secure		
18	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
18	Northern Red Oak	*Quercus rubra*	S5	Secure		
18	Northern Starflower	*Trientalis borealis*	S5	Secure		
18	Painted Trillium	*Trillium undulatum*	S5	Secure		
18	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
18	Red Spruce	*Picea rubens*	S5	Secure		
18	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
18	Striped Maple	*Acer pensylvanicum*	S5	Secure		
18	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
18	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
18	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
18	Whorled Aster	*Oclemena acuminata*	S5	Secure		
18	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
18	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
19	a Serviceberry	*Amelanchier sp.*	na	na		
19	American Mountain-Ash	*Sorbus americana*	S5	Secure		
19	American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		
19	Balsam Fir	*Abies balsamea*	S5	Secure		
19	Black Holly	*Ilex verticillata*	S5	Secure		
19	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
19	Bracken Fern	*Pteridium aquilinum*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
19	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
19	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
19	Goldthread	*Coptis trifolia*	S5	Secure		
19	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
19	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
19	Northern Red Oak	*Quercus rubra*	S5	Secure		
19	Northern Starflower	*Trientalis borealis*	S5	Secure		
19	Painted Trillium	*Trillium undulatum*	S5	Secure		
19	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
19	Red Maple	*Acer rubrum*	S5	Secure		
19	Red Spruce	*Picea rubens*	S5	Secure		
19	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
19	Speckled Alder	*Alnus incana*	S5	Secure		
19	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
19	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
19	Whorled Aster	*Oclemena acuminata*	S5	Secure		
22	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
22	Farewell-Summer	*Symphyotrichum lateriflorum*	S5	Secure		
22	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
22	Fowl Bluegrass	*Poa palustris*	S5	Secure		
22	Green Alder	*Alnus viridis*	S5	Secure		
22	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
22	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
22	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
22	Pussy Willow	*Salix discolor*	S5	Secure		
22	Quaking Aspen	*Populus tremuloides*	S5	Secure		
22	Red Fescue	*Festuca rubra*	S5	Secure		
22	Red Maple	*Acer rubrum*	S5	Secure		
22	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
22	Slender Rush	*Juncus tenuis*	S5	Secure		
22	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
22	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
25	Balsam Fir	*Abies balsamea*	S5	Secure		
25	Black Holly	*Ilex verticillata*	S5	Secure		
25	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
25	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
25	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
25	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
25	Goldthread	*Coptis trifolia*	S5	Secure		
25	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
25	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
25	Northern Red Oak	*Quercus rubra*	S5	Secure		
25	Painted Trillium	*Trillium undulatum*	S5	Secure		
25	Partridge-Berry	*Mitchella repens*	S5	Secure		
25	Pink Lady's-Slipper	*Cypripedium acaule*	S5	Secure		
25	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
25	Red Maple	*Acer rubrum*	S5	Secure		
25	Red Spruce	*Picea rubens*	S5	Secure		
25	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
25	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
25	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
25	Whorled Aster	*Oclemena acuminata*	S5	Secure		
25	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
25	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
26	Allegheny Service-Berry	*Amelanchier laevis*	S5	Secure		
26	Balsam Fir	*Abies balsamea*	S5	Secure		
26	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
26	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
26	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
26	Goldthread	*Coptis trifolia*	S5	Secure		
26	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
26	Northern Starflower	*Trientalis borealis*	S5	Secure		
26	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
26	Red Maple	*Acer rubrum*	S5	Secure		
26	Red Spruce	*Picea rubens*	S5	Secure		
26	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
26	Speckled Alder	*Alnus incana*	S5	Secure		
26	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
26	Whorled Aster	*Oclemena acuminata*	S5	Secure		
26	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
26	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
31	a Serviceberry	*Amelanchier sp.*	na	na		
31	Balsam Fir	*Abies balsamea*	S5	Secure		
31	Black Holly	*Ilex verticillata*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
31	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
31	Canada Lettuce	*Lactuca canadensis*	S5	Secure		
31	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
31	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
31	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
31	Eastern White Pine	*Pinus strobus*	S5	Secure		
31	Goldthread	*Coptis trifolia*	S5	Secure		
31	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
31	Indian-Pipe	*Monotropa uniflora*	S5	Secure		
31	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
31	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
31	Northern Starflower	*Trientalis borealis*	S5	Secure		
31	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
31	Red Maple	*Acer rubrum*	S5	Secure		
31	Red Spruce	*Picea rubens*	S5	Secure		
31	Soft Rush	*Juncus effusus*	S5	Secure		
31	Speckled Alder	*Alnus incana*	S5	Secure		
31	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
31	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
31	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
31	Whorled Aster	*Oclemena acuminata*	S5	Secure		
31	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
34	Balsam Willow	*Salix pyrifolia*	S5	Secure		
34	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
34	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
34	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
34	Northern Starflower	*Trientalis borealis*	S5	Secure		
34	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
34	Red Maple	*Acer rubrum*	S5	Secure		
34	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
34	Soft Rush	*Juncus effusus*	S5	Secure		
34	Speckled Alder	*Alnus incana*	S5	Secure		
34	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
39	a Bur-reed	*Sparganium sp.*	na	na		
39	a Bur-reed	*Sparganium sp.*	na	na		
39	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
39	a Rush	*Juncus sp.*	na	na		
39	a Sedge	*Carex sp.*	na	na		
39	American Bur-Reed	*Sparganium americanum*	S5	Secure		
39	American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		
39	Balsam Fir	*Abies balsamea*	S5	Secure		
39	Bear Sedge	*Carex utriculata*	S5	Secure		
39	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
39	Black Holly	*Ilex verticillata*	S5	Secure		
39	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
39	Black Spruce	*Picea mariana*	S5	Secure		
39	Blueflag	*Iris versicolor*	S5	Secure		
39	Blunt Manna-Grass	*Glyceria obtusa*	S4	Secure		
39	Bog Aster	*Oclemena nemoralis*	S5	Secure		
39	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
39	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
39	Brownish Sedge	*Carex brunnescens*	S5	Secure		
39	Canada Rush	*Juncus canadensis*	S5	Secure		
39	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
39	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
39	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
39	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
39	Eastern White Pine	*Pinus strobus*	S5	Secure		
39	Green Alder	*Alnus viridis*	S5	Secure		
39	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
39	Hidden-Fruited Bladderwort	*Utricularia geminiscapa*	S4	Secure		
39	Hoary Sedge	*Carex canescens*	S5	Secure		
39	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
39	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
39	Little Prickly Sedge	*Carex echinata*	S5	Secure		
39	Marsh St. John's Wort	*Triadenum virginicum*	S5	Secure		
39	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
39	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
39	Northern Pitcher-Plant	*Sarracenia purpurea*	S5	Secure		
39	Northern Starflower	*Trientalis borealis*	S5	Secure		
39	Pale Laurel	*Kalmia polifolia*	S5	Secure		
39	Paper Birch	*Betula papyrifera*	S5	Secure		
39	Pickerel Weed	*Pontederia cordata*	S5	Secure		
39	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
39	Red Maple	*Acer rubrum*	S5	Secure		
39	Rhodora	*Rhododendron canadense*	S5	Secure		
39	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
39	Shadbush	*Amelanchier interior*	S4S5	Secure		
39	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
39	Slender Sedge	*Carex lasiocarpa*	S5	Secure		
39	Soft Rush	*Juncus effusus*	S5	Secure		
39	Speckled Alder	*Alnus incana*	S5	Secure		
39	Spoon-Leaved Sundew	*Drosera intermedia*	S5	Secure		
39	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
39	Sweet Bayberry	*Myrica gale*	S5	Secure		
39	Teaberry	*Gaultheria procumbens*	S5	Secure		
39	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
39	Three-Way Sedge	*Dulichium arundinaceum*	S5	Secure		
39	Tussock Sedge	*Carex stricta*	S5	Secure		
39	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
39	Water Bulrush	*Schoenoplectus subterminalis*	S5	Secure		
39	Watershield	*Brasenia schreberi*	S5	Secure		
39	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
39	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
40	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
40	a Manna-grass	*Glyceria sp.*	na	na		
40	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
40	A Sedge	*Carex gynandra*	S5	Secure		
40	a Serviceberry	*Amelanchier sp.*	na	na		
40	American Bur-Reed	*Sparganium americanum*	S5	Secure		
40	American Larch	*Larix laricina*	S5	Secure		
40	Balsam Fir	*Abies balsamea*	S5	Secure		
40	Black Holly	*Ilex verticillata*	S5	Secure		
40	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
40	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
40	Bog Aster	*Oclemena nemoralis*	S5	Secure		
40	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
40	Bristly-Stalk Sedge	*Carex leptalea*	S5	Secure		
40	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
40	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
40	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
40	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
40	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
40	Eastern White Pine	*Pinus strobus*	S5	Secure		
40	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
40	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
40	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
40	Little Prickly Sedge	*Carex echinata*	S5	Secure		
40	Long Sedge	*Carex folliculata*	S5	Secure		
40	Marsh Bedstraw	*Galium palustre*	S5	Secure		
40	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
40	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
40	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
40	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
40	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
40	Northern Pitcher-Plant	*Sarracenia purpurea*	S5	Secure		
40	Northern Starflower	*Trientalis borealis*	S5	Secure		
40	Paper Birch	*Betula papyrifera*	S5	Secure		
40	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
40	Pickerel Weed	*Pontederia cordata*	S5	Secure		
40	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
40	Purple Chokeberry	*Photinia floribunda*	S5	Secure		
40	Red Maple	*Acer rubrum*	S5	Secure		
40	Rhodora	*Rhododendron canadense*	S5	Secure		
40	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
40	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
40	Small Bedstraw	*Galium trifidum*	S5	Secure		
40	Smooth Blackberry	*Rubus canadensis*	S5	Secure		
40	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
40	Soft Rush	*Juncus effusus*	S5	Secure		
40	Speckled Alder	*Alnus incana*	S5	Secure		
40	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
40	Spotted Jewel-Weed	*Impatiens capensis*	S5	Secure		
40	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
40	Sweet Bayberry	*Myrica gale*	S5	Secure		
40	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
40	Three-Way Sedge	*Dulichium arundinaceum*	S5	Secure		
40	White Turtlehead	*Chelone glabra*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
40	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
40	Whorled Aster	*Oclemena acuminata*	S5	Secure		
40	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
40	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
49	a Bedstraw	*Galium sp.*	na	na		
49	a Blackberry	*Rubus sp.*	na	na		
49	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
49	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
49	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
49	a Pondweed	*Potamogeton sp.*	na	na		
49	A Sedge	*Carex gynandra*	S5	Secure		
49	a Sedge	*Carex sp.*	na	na		
49	a Serviceberry	*Amelanchier sp.*	na	na		
49	a Spikerush	*Eleocharis sp.*	na	na		
49	American Bur-Reed	*Sparganium americanum*	S5	Secure		
49	American Water-Lily	*Nymphaea odorata*	S5	Secure		
49	an Orchid	*Platanthera sp.*	na	na		
49	Balsam Fir	*Abies balsamea*	S5	Secure		
49	Bear Sedge	*Carex utriculata*	S5	Secure		
49	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
49	Black Holly	*Ilex verticillata*	S5	Secure		
49	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
49	Black Sedge	*Carex nigra*	S5	Secure		
49	Black Spruce	*Picea mariana*	S5	Secure		
49	Blueflag	*Iris versicolor*	S5	Secure		
49	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
49	Blunt Manna-Grass	*Glyceria obtusa*	S4	Secure		
49	Bog Aster	*Oclemena nemoralis*	S5	Secure		
49	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
49	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
49	Bristly-Stalk Sedge	*Carex leptalea*	S5	Secure		
49	Broadleaf Arrowhead	*Sagittaria latifolia*	S5	Secure		
49	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
49	Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure		
49	Brownish Sedge	*Carex brunnescens*	S5	Secure		
49	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
49	Canada Rush	*Juncus canadensis*	S5	Secure		
49	Canadian St. John's-Wort	*Hypericum canadense*	S5	Secure		
49	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
49	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
49	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
49	Creeping Spike-Rush	*Eleocharis palustris*	S5	Secure		
49	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
49	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
49	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
49	Eastern White Pine	*Pinus strobus*	S5	Secure		
49	Few-Seeded Sedge	*Carex oligosperma*	S5	Secure		
49	Fowl Manna-Grass	*Glyceria striata*	S5	Secure		
49	Fringed Sedge	*Carex crinita*	S5	Secure		
49	Goldthread	*Coptis trifolia*	S5	Secure		
49	Grass-Leaved Goldenrod	*Euthamia caroliniana*	S4	Secure		
49	Greater Bladder-Wort	*Utricularia macrorhiza*	S5	Secure		
49	Green Alder	*Alnus viridis*	S5	Secure		
49	Green-fruited Burreed	*Sparganium emersum*	S5	Secure		
49	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
49	Hidden-Fruited Bladderwort	*Utricularia geminiscapa*	S4	Secure		
49	Hoary Sedge	*Carex canescens*	S5	Secure		
49	Lake-Bank Sedge	*Carex lacustris*	S4	Secure		
49	Large Bur-Reed	*Sparganium eurycarpum*	S4	Secure		
49	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
49	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
49	Long Sedge	*Carex folliculata*	S5	Secure		
49	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
49	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
49	Narrow-Leaf Burreed	*Sparganium angustifolium*	S5	Secure		
49	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
49	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
49	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
49	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
49	Northern Pitcher-Plant	*Sarracenia purpurea*	S5	Secure		
49	Northern St. John's-Wort	*Hypericum boreale*	S5	Secure		
49	Northern Starflower	*Trientalis borealis*	S5	Secure		
49	Paper Birch	*Betula papyrifera*	S5	Secure		
49	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
49	Pickerel Weed	*Pontederia cordata*	S5	Secure		
49	Pointed Broom Sedge	*Carex scoparia*	S5	Secure		
49	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
49	Red Maple	*Acer rubrum*	S5	Secure		
49	Red Raspberry	*Rubus idaeus*	S5	Secure		
49	Red Spruce	*Picea rubens*	S5	Secure		
49	Rhodora	*Rhododendron canadense*	S5	Secure		
49	Rough Bentgrass	*Agrostis scabra*	S5	Secure		
49	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
49	Rough-Leaved Aster	*Eurybia radula*	S5	Secure		
49	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
49	Royal Fern	*Osmunda regalis*	S5	Secure		
49	Running Serviceberry	*Amelanchier x intermedia*	SNA	Not Assessed		
49	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
49	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
49	Shining Rose	*Rosa nitida*	S4	Secure		
49	Slender Sedge	*Carex lasiocarpa*	S5	Secure		
49	Small Bristleberry	*Rubus setosus*	S4?	Secure		
49	Small Floating Manna-Grass	*Glyceria borealis*	S5	Secure		
49	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
49	Speckled Alder	*Alnus incana*	S5	Secure		
49	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
49	Spoon-Leaved Sundew	*Drosera intermedia*	S5	Secure		
49	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
49	Sweet Bayberry	*Myrica gale*	S5	Secure		
49	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
49	Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S5	Secure		
49	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
49	Three-Way Sedge	*Dulichium arundinaceum*	S5	Secure		
49	Twinflower	*Linnaea borealis*	S5	Secure		
49	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
49	Water Bulrush	*Schoenoplectus subterminalis*	S5	Secure		
49	Water Sedge	*Carex aquatilis*	S5	Secure		
49	Watershield	*Brasenia schreberi*	S5	Secure		
49	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
49	Whorled Aster	*Oclemena acuminata*	S5	Secure		
49	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
49	Yellow Pond-Lily	*Nuphar lutea*	S5	Secure		
55	a Bedstraw	*Galium sp.*	na	na		
55	A Sedge	*Carex gynandra*	S5	Secure		
55	Balsam Fir	*Abies balsamea*	S5	Secure		
55	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
55	Brownish Sedge	*Carex brunnescens*	S5	Secure		
55	Colonial Bentgrass	*Agrostis capillaris*	SNA	Exotic		
55	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
55	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
55	Eastern White Pine	*Pinus strobus*	S5	Secure		
55	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
55	Goldthread	*Coptis trifolia*	S5	Secure		
55	Hoary Sedge	*Carex canescens*	S5	Secure		
55	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
55	Marsh Blue Violet	*Viola cucullata*	S5	Secure		
55	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
55	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
55	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
55	Northern Starflower	*Trientalis borealis*	S5	Secure		
55	Painted Trillium	*Trillium undulatum*	S5	Secure		
55	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
55	Red Maple	*Acer rubrum*	S5	Secure		
55	Red Spruce	*Picea rubens*	S5	Secure		
55	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
55	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
55	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
55	Speckled Alder	*Alnus incana*	S5	Secure		
55	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
55	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
55	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
55	Whorled Aster	*Oclemena acuminata*	S5	Secure		
55	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
55	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
63	a Blackberry	*Rubus sp.*	na	na		
63	a Serviceberry	*Amelanchier sp.*	na	na		
63	American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		
63	Balsam Fir	*Abies balsamea*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
63	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
63	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
63	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
63	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
63	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
63	Goldthread	*Coptis trifolia*	S5	Secure		
63	Indian Cucumber-Root	*Medeola virginiana*	S5	Secure		
63	Interrupted Fern	*Osmunda claytoniana*	S5	Secure		
63	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
63	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
63	Northern Starflower	*Trientalis borealis*	S5	Secure		
63	Painted Trillium	*Trillium undulatum*	S5	Secure		
63	Red Maple	*Acer rubrum*	S5	Secure		
63	Red Spruce	*Picea rubens*	S5	Secure		
63	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
63	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
63	Trailing Arbutus	*Epigaea repens*	S5	Secure		
63	Tree Clubmoss	*Lycopodium obscurum*	S4S5	Secure		
63	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
63	Whorled Aster	*Oclemena acuminata*	S5	Secure		
63	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
65	a Sedge	*Carex sp.*	na	na		
65	a Willow	*Salix sp.*	na	na		
65	Balsam Fir	*Abies balsamea*	S5	Secure		
65	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
65	Canada Hawkweed	*Hieracium canadense*	S4S5	Secure		
65	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
65	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
65	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
65	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
65	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
65	Northern Starflower	*Trientalis borealis*	S5	Secure		
65	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
65	Quaking Aspen	*Populus tremuloides*	S5	Secure		
65	Red Maple	*Acer rubrum*	S5	Secure		
65	Red Spruce	*Picea rubens*	S5	Secure		
65	Rhodora	*Rhododendron canadense*	S5	Secure		
65	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
65	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
65	Soft Rush	*Juncus effusus*	S5	Secure		
65	Speckled Alder	*Alnus incana*	S5	Secure		
65	Sweet Fern	*Comptonia peregrina*	S5	Secure		
65	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
65	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
68	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
68	a Serviceberry	*Amelanchier sp.*	na	na		
68	American Mountain-Ash	*Sorbus americana*	S5	Secure		
68	Balsam Fir	*Abies balsamea*	S5	Secure		
68	Black Spruce	*Picea mariana*	S5	Secure		
68	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
68	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
68	Brownish Sedge	*Carex brunnescens*	S5	Secure		
68	Canada Rush	*Juncus canadensis*	S5	Secure		
68	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
68	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
68	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
68	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
68	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
68	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
68	Eastern White Pine	*Pinus strobus*	S5	Secure		
68	Goldthread	*Coptis trifolia*	S5	Secure		
68	Hoary Sedge	*Carex canescens*	S5	Secure		
68	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
68	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
68	Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Secure		
68	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
68	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
68	Northern Starflower	*Trientalis borealis*	S5	Secure		
68	Pale Laurel	*Kalmia polifolia*	S5	Secure		
68	Partridge-Berry	*Mitchella repens*	S5	Secure		
68	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
68	Red Maple	*Acer rubrum*	S5	Secure		
68	Red Spruce	*Picea rubens*	S5	Secure		
68	Rhodora	*Rhododendron canadense*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
68	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
68	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
68	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
68	Soft Rush	*Juncus effusus*	S5	Secure		
68	Speckled Alder	*Alnus incana*	S5	Secure		
68	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
68	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
68	Teaberry	*Gaultheria procumbens*	S5	Secure		
68	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
68	Twinflower	*Linnaea borealis*	S5	Secure		
68	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
68	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
68	Whorled Aster	*Oclemena acuminata*	S5	Secure		
68	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
68	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
80	a Blackberry	*Rubus sp.*	na	na		
80	a Cotton-grass	*Eriophorum sp.*	na	na		
80	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
80	a Spikerush	*Eleocharis sp.*	na	na		
80	a Willow	*Salix sp.*	na	na		
80	Balsam Fir	*Abies balsamea*	S5	Secure		
80	Balsam Willow	*Salix pyrifolia*	S5	Secure		
80	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
80	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
80	Black Spruce	*Picea mariana*	S5	Secure		
80	Bog Clubmoss	*Lycopodiella inundata*	S5	Secure		
80	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
80	Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure		
80	Brownish Sedge	*Carex brunnescens*	S5	Secure		
80	Canada Rush	*Juncus canadensis*	S5	Secure		
80	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
80	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
80	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
80	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
80	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
80	Eastern White Pine	*Pinus strobus*	S5	Secure		
80	Field Horsetail	*Equisetum arvense*	S5	Secure		
80	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
80	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
80	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
80	Hidden-Fruited Bladderwort	*Utricularia geminiscapa*	S4	Secure		
80	Hoary Sedge	*Carex canescens*	S5	Secure		
80	Ladies'-Tresses	*Spiranthes lacera*	S5	Secure		
80	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
80	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
80	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
80	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
80	Narrow-Panicled Rush	*Juncus brevicaudatus*	S5	Secure		
80	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
80	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
80	Pale Laurel	*Kalmia polifolia*	S5	Secure		
80	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
80	Red Maple	*Acer rubrum*	S5	Secure		
80	Red Spruce	*Picea rubens*	S5	Secure		
80	Rhodora	*Rhododendron canadense*	S5	Secure		
80	Rose Pogonia	*Pogonia ophioglossoides*	S4	Secure		
80	Rough Bentgrass	*Agrostis scabra*	S5	Secure		
80	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
80	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
80	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
80	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
80	Speckled Alder	*Alnus incana*	S5	Secure		
80	Spoon-Leaved Sundew	*Drosera intermedia*	S5	Secure		
80	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
80	Sweet Fern	*Comptonia peregrina*	S5	Secure		
80	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
80	Teaberry	*Gaultheria procumbens*	S5	Secure		
80	Thread Rush	*Juncus filiformis*	S5	Secure		
80	Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S5	Secure		
80	Trailing Arbutus	*Epigaea repens*	S5	Secure		
80	Tuberous Grass-Pink	*Calopogon tuberosus*	S4	Secure		
80	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
80	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
82	a Serviceberry	*Amelanchier sp.*	na	na		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
82	a Willow	*Salix sp.*	na	na		
82	Balsam Fir	*Abies balsamea*	S5	Secure		
82	Black Spruce	*Picea mariana*	S5	Secure		
82	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
82	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
82	Brownish Sedge	*Carex brunnescens*	S5	Secure		
82	Canada Hawkweed	*Hieracium canadense*	S4S5	Secure		
82	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
82	Canada Rush	*Juncus canadensis*	S5	Secure		
82	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
82	Clinton Lily	*Clintonia borealis*	S5	Secure		
82	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
82	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
82	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
82	Goldthread	*Coptis trifolia*	S5	Secure		
82	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
82	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
82	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*	S5	Secure		
82	Narrow-Panicled Rush	*Juncus brevicaudatus*	S5	Secure		
82	Northern Starflower	*Trientalis borealis*	S5	Secure		
82	One-Side Wintergreen	*Orthilia secunda*	S5	Secure		
82	Paper Birch	*Betula papyrifera*	S5	Secure		
82	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
82	Red Maple	*Acer rubrum*	S5	Secure		
82	Red Raspberry	*Rubus idaeus*	S5	Secure		
82	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
82	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
82	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
82	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
82	Thread Rush	*Juncus filiformis*	S5	Secure		
82	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
82	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
82	Twinflower	*Linnaea borealis*	S5	Secure		
82	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
82	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
82	Whorled Aster	*Oclemena acuminata*	S5	Secure		
82	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
82	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
82	Woodland Horsetail	*Equisetum sylvaticum*	S5	Secure		
84	a Blackberry	*Rubus sp.*	na	na		
84	a Goldenrod	*Solidago sp.*	na	na		
84	a Rush	*Juncus sp.*	na	na		
84	a Sedge	*Carex sp.*	na	na		
84	Balsam Willow	*Salix pyrifolia*	S5	Secure		
84	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
84	Black Holly	*Ilex verticillata*	S5	Secure		
84	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
84	Black Spruce	*Picea mariana*	S5	Secure		
84	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
84	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
84	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
84	Clinton Lily	*Clintonia borealis*	S5	Secure		
84	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
84	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
84	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
84	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
84	Field Horsetail	*Equisetum arvense*	S5	Secure		
84	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
84	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
84	Hoary Sedge	*Carex canescens*	S5	Secure		
84	Interrupted Fern	*Osmunda claytoniana*	S5	Secure		
84	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
84	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
84	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
84	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
84	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
84	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
84	Northern Mannagrass	*Glyceria laxa*	S4?	Secure		
84	Northern Starflower	*Trientalis borealis*	S5	Secure		
84	Paper Birch	*Betula papyrifera*	S5	Secure		
84	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
84	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
84	Prairie Willow	*Salix humilis*	S5	Secure		
84	Red Maple	*Acer rubrum*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
84	Red Raspberry	*Rubus idaeus*	S5	Secure		
84	Red Spruce	*Picea rubens*	S5	Secure		
84	Rhodora	*Rhododendron canadense*	S5	Secure		
84	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
84	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
84	Soft Rush	*Juncus effusus*	S5	Secure		
84	Speckled Alder	*Alnus incana*	S5	Secure		
84	Teaberry	*Gaultheria procumbens*	S5	Secure		
84	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
84	Trailing Arbutus	*Epigaea repens*	S5	Secure		
84	Twinflower	*Linnaea borealis*	S5	Secure		
84	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
84	Whorled Aster	*Oclemena acuminata*	S5	Secure		
84	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
88	a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed		
88	A Sedge	*Carex magellanica ssp. irrigua*	S5	Secure		
88	a Serviceberry	*Amelanchier sp.*	na	na		
88	a Willow	*Salix sp.*	na	na		
88	Balsam Fir	*Abies balsamea*	S5	Secure		
88	Black Holly	*Ilex verticillata*	S5	Secure		
88	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
88	Black Spruce	*Picea mariana*	S5	Secure		
88	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
88	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
88	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
88	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
88	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
88	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
88	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
88	Indian-Pipe	*Monotropa uniflora*	S5	Secure		
88	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
88	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
88	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
88	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
88	Northern Mannagrass	*Glyceria laxa*	S4?	Secure		
88	Northern Starflower	*Trientalis borealis*	S5	Secure		
88	Red Maple	*Acer rubrum*	S5	Secure		
88	Rhodora	*Rhododendron canadense*	S5	Secure		
88	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
88	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
88	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
88	Southern Twayblade	*Listera australis*	S2	May Be At Risk		
88	Speckled Alder	*Alnus incana*	S5	Secure		
88	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
88	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
88	Twinflower	*Linnaea borealis*	S5	Secure		
88	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
88	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
91	a Rush	*Juncus sp.*	na	na		
91	A Sedge	*Carex magellanica ssp. irrigua*	S5	Secure		
91	a Spikerush	*Eleocharis sp.*	na	na		
91	an Orchid	*Platanthera sp.*	na	na		
91	Balsam Willow	*Salix pyrifolia*	S5	Secure		
91	Black Crowberry	*Empetrum nigrum*	S5	Secure		
91	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
91	Black Sedge	*Carex nigra*	S5	Secure		
91	Black Spruce	*Picea mariana*	S5	Secure		
91	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
91	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
91	Brownish Sedge	*Carex brunnescens*	S5	Secure		
91	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
91	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
91	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
91	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
91	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
91	Eastern White Pine	*Pinus strobus*	S5	Secure		
91	Green Alder	*Alnus viridis*	S5	Secure		
91	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
91	Hoary Sedge	*Carex canescens*	S5	Secure		
91	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
91	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
91	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
91	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
91	Northern Bayberry	*Morella pensylvanica*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
91	Northern Starflower	*Trientalis borealis*	S5	Secure		
91	Pale Laurel	*Kalmia polifolia*	S5	Secure		
91	Paper Birch	*Betula papyrifera*	S5	Secure		
91	Prairie Willow	*Salix humilis*	S5	Secure		
91	Red Maple	*Acer rubrum*	S5	Secure		
91	Rhodora	*Rhododendron canadense*	S5	Secure		
91	Rough Bentgrass	*Agrostis scabra*	S5	Secure		
91	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
91	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
91	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
91	Soft Rush	*Juncus effusus*	S5	Secure		
91	Speckled Alder	*Alnus incana*	S5	Secure		
91	Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S5	Secure		
91	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
91	Trailing Arbutus	*Epigaea repens*	S5	Secure		
91	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
92	Balsam Fir	*Abies balsamea*	S5	Secure		
92	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
92	Black Spruce	*Picea mariana*	S5	Secure		
92	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
92	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
92	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
92	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
92	Goldthread	*Coptis trifolia*	S5	Secure		
92	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
92	Northern Starflower	*Trientalis borealis*	S5	Secure		
92	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
92	Red Maple	*Acer rubrum*	S5	Secure		
92	Red Spruce	*Picea rubens*	S5	Secure		
92	Speckled Alder	*Alnus incana*	S5	Secure		
92	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
92	Whorled Aster	*Oclemena acuminata*	S5	Secure		
92	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
92	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
93	Black Spruce	*Picea mariana*	S5	Secure		
93	Canada Rush	*Juncus canadensis*	S5	Secure		
93	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
93	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
93	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
93	Paper Birch	*Betula papyrifera*	S5	Secure		
93	Rhodora	*Rhododendron canadense*	S5	Secure		
93	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
94	a Blackberry	*Rubus sp.*	na	na		
94	a Serviceberry	*Amelanchier sp.*	na	na		
94	Balsam Fir	*Abies balsamea*	S5	Secure		
94	Black Holly	*Ilex verticillata*	S5	Secure		
94	Black Spruce	*Picea mariana*	S5	Secure		
94	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
94	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
94	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
94	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
94	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
94	Interrupted Fern	*Osmunda claytoniana*	S5	Secure		
94	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
94	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
94	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
94	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
94	Northern Starflower	*Trientalis borealis*	S5	Secure		
94	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
94	Red Maple	*Acer rubrum*	S5	Secure		
94	Rhodora	*Rhododendron canadense*	S5	Secure		
94	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
94	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
94	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
94	Twinflower	*Linnaea borealis*	S5	Secure		
94	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
94	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
94	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
99	a Blackberry	*Rubus sp.*	na	na		
99	a Rush	*Juncus sp.*	na	na		
99	Balsam Fir	*Abies balsamea*	S5	Secure		
99	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
99	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
99	Black Spruce	*Picea mariana*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
99	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
99	Canada Rush	*Juncus canadensis*	S5	Secure		
99	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
99	Clinton Lily	*Clintonia borealis*	S5	Secure		
99	Coast Sedge	*Carex exilis*	S4	Secure		
99	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
99	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
99	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
99	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
99	Eastern White Pine	*Pinus strobus*	S5	Secure		
99	Fall Dropseed Muhly	*Muhlenbergia uniflora*	S5	Secure		
99	Green Alder	*Alnus viridis*	S5	Secure		
99	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
99	Hoary Sedge	*Carex canescens*	S5	Secure		
99	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
99	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
99	Least Spike-Rush	*Eleocharis acicularis*	S5	Secure		
99	Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Secure		
99	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
99	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
99	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
99	Northern Starflower	*Trientalis borealis*	S5	Secure		
99	Pale Laurel	*Kalmia polifolia*	S5	Secure		
99	Paper Birch	*Betula papyrifera*	S5	Secure		
99	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
99	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
99	Red Maple	*Acer rubrum*	S5	Secure		
99	Red Raspberry	*Rubus idaeus*	S5	Secure		
99	Rhodora	*Rhododendron canadense*	S5	Secure		
99	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
99	Royal Fern	*Osmunda regalis*	S5	Secure		
99	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
99	Teaberry	*Gaultheria procumbens*	S5	Secure		
99	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
99	Twinflower	*Linnaea borealis*	S5	Secure		
99	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
99	Whorled Aster	*Oclemena acuminata*	S5	Secure		
99	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
102	A Sedge	*Carex magellanica ssp. irrigua*	S5	Secure		
102	a Serviceberry	*Amelanchier sp.*	na	na		
102	American Mountain-Ash	*Sorbus americana*	S5	Secure		
102	Balsam Fir	*Abies balsamea*	S5	Secure		
102	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
102	Black Holly	*Ilex verticillata*	S5	Secure		
102	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
102	Black Spruce	*Picea mariana*	S5	Secure		
102	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
102	Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure		
102	Canada Rush	*Juncus canadensis*	S5	Secure		
102	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
102	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
102	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
102	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
102	Eastern White Pine	*Pinus strobus*	S5	Secure		
102	Field Horsetail	*Equisetum arvense*	S5	Secure		
102	Fire Cherry	*Prunus pensylvanica*	S5	Secure		
102	Gray Birch	*Betula populifolia*	S5	Secure		
102	Ground Juniper	*Juniperus communis*	S5	Secure		
102	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
102	Hoary Sedge	*Carex canescens*	S5	Secure		
102	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
102	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
102	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
102	Narrow-Panicled Rush	*Juncus brevicaudatus*	S5	Secure		
102	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
102	Northern Starflower	*Trientalis borealis*	S5	Secure		
102	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
102	Red Maple	*Acer rubrum*	S5	Secure		
102	Red Raspberry	*Rubus idaeus*	S5	Secure		
102	Red Spruce	*Picea rubens*	S5	Secure		
102	Rhodora	*Rhododendron canadense*	S5	Secure		
102	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
102	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
102	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
102	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
102	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
102	Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S5	Secure		
102	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
102	Trailing Arbutus	*Epigaea repens*	S5	Secure		
102	Twinflower	*Linnaea borealis*	S5	Secure		
102	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
102	Whorled Aster	*Oclemena acuminata*	S5	Secure		
103	a Rush	*Juncus sp.*	na	na		
103	Balsam Fir	*Abies balsamea*	S5	Secure		
103	Balsam Willow	*Salix pyrifolia*	S5	Secure		
103	Black Spruce	*Picea mariana*	S5	Secure		
103	Canada Rush	*Juncus canadensis*	S5	Secure		
103	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
103	Clinton Lily	*Clintonia borealis*	S5	Secure		
103	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
103	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
103	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
103	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
103	Goldthread	*Coptis trifolia*	S5	Secure		
103	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
103	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
103	Hoary Sedge	*Carex canescens*	S5	Secure		
103	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
103	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
103	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
103	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
103	Northern Starflower	*Trientalis borealis*	S5	Secure		
103	Paper Birch	*Betula papyrifera*	S5	Secure		
103	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
103	Rhodora	*Rhododendron canadense*	S5	Secure		
103	Royal Fern	*Osmunda regalis*	S5	Secure		
103	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
103	Soft Rush	*Juncus effusus*	S5	Secure		
103	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
103	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
107	a Rush	*Juncus sp.*	na	na		
107	a Sedge	*Carex sp.*	na	na		
107	Balsam Fir	*Abies balsamea*	S5	Secure		
107	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
107	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
107	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
107	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
107	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
107	Brownish Sedge	*Carex brunnescens*	S5	Secure		
107	Canada Rush	*Juncus canadensis*	S5	Secure		
107	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
107	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
107	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
107	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
107	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
107	Fall Dropseed Muhly	*Muhlenbergia uniflora*	S5	Secure		
107	Green Alder	*Alnus viridis*	S5	Secure		
107	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
107	Hoary Sedge	*Carex canescens*	S5	Secure		
107	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
107	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
107	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
107	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
107	Northern Starflower	*Trientalis borealis*	S5	Secure		
107	Pale Laurel	*Kalmia polifolia*	S5	Secure		
107	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
107	Red Maple	*Acer rubrum*	S5	Secure		
107	Rough-Leaved Aster	*Eurybia radula*	S5	Secure		
107	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
107	Royal Fern	*Osmunda regalis*	S5	Secure		
107	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
107	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
107	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
107	Soft Rush	*Juncus effusus*	S5	Secure		
107	Speckled Alder	*Alnus incana*	S5	Secure		
107	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
107	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
107	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
107	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
109	Balsam Willow	*Salix pyrifolia*	S5	Secure		
109	Black Spruce	*Picea mariana*	S5	Secure		
109	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
109	Gray Birch	*Betula populifolia*	S5	Secure		
109	Rhodora	*Rhododendron canadense*	S5	Secure		
109	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
114	a Goldenrod	*Euthamia sp.*	na	na		
114	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
114	a Rush	*Juncus sp.*	na	na		
114	a Serviceberry	*Amelanchier sp.*	na	na		
114	American Bur-Reed	*Sparganium americanum*	S5	Secure		
114	Balsam Fir	*Abies balsamea*	S5	Secure		
114	Balsam Willow	*Salix pyrifolia*	S5	Secure		
114	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
114	Black Holly	*Ilex verticillata*	S5	Secure		
114	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
114	Black Sedge	*Carex nigra*	S5	Secure		
114	Black Spruce	*Picea mariana*	S5	Secure		
114	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
114	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
114	Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure		
114	Brownish Sedge	*Carex brunnescens*	S5	Secure		
114	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
114	Clinton Lily	*Clintonia borealis*	S5	Secure		
114	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
114	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
114	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
114	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
114	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
114	Green Alder	*Alnus viridis*	S5	Secure		
114	Ground Juniper	*Juniperus communis*	S5	Secure		
114	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
114	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
114	Hoary Sedge	*Carex canescens*	S5	Secure		
114	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
114	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
114	Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Secure		
114	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
114	Mountain Fly-Honeysuckle	*Lonicera villosa*	S4S5	Secure		
114	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
114	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
114	Narrow-Panicled Rush	*Juncus brevicaudatus*	S5	Secure		
114	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
114	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
114	Northern Mountain-Ash	*Sorbus decora*	S4	Secure		
114	Northern Starflower	*Trientalis borealis*	S5	Secure		
114	Pale Laurel	*Kalmia polifolia*	S5	Secure		
114	Paper Birch	*Betula papyrifera*	S5	Secure		
114	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
114	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
114	Red Maple	*Acer rubrum*	S5	Secure		
114	Rhodora	*Rhododendron canadense*	S5	Secure		
114	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
114	Royal Fern	*Osmunda regalis*	S5	Secure		
114	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
114	Small Bedstraw	*Galium trifidum*	S5	Secure		
114	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
114	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
114	Soft Rush	*Juncus effusus*	S5	Secure		
114	Speckled Alder	*Alnus incana*	S5	Secure		
114	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
114	Spoon-Leaved Sundew	*Drosera intermedia*	S5	Secure		
114	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
114	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
114	Tussock Cotton-Grass	*Eriophorum vaginatum*	S5	Secure		
114	Twinflower	*Linnaea borealis*	S5	Secure		
114	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
114	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
114	Whorled Aster	*Oclemena acuminata*	S5	Secure		
114	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
114	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
118	a Serviceberry	*Amelanchier sp.*	na	na		
118	Balsam Fir	*Abies balsamea*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
118	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
118	Clinton Lily	*Clintonia borealis*	S5	Secure		
118	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
118	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
118	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
118	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
118	Northern Starflower	*Trientalis borealis*	S5	Secure		
118	Red Maple	*Acer rubrum*	S5	Secure		
118	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
118	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
118	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
118	Twinflower	*Linnaea borealis*	S5	Secure		
118	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
118	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
118	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
122	a Blackberry	*Rubus sp.*	na	na		
122	Balsam Fir	*Abies balsamea*	S5	Secure		
122	Black Spruce	*Picea mariana*	S5	Secure		
122	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
122	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
122	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
122	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
122	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
122	Crinkled Hairgrass	*Deschampsia flexuosa*	S5	Secure		
122	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
122	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
122	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
122	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
122	New England Sedge	*Carex novae-angliae*	S5	Secure		
122	Northern Starflower	*Trientalis borealis*	S5	Secure		
122	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
122	Red Maple	*Acer rubrum*	S5	Secure		
122	Red Raspberry	*Rubus idaeus*	S5	Secure		
122	Rough Bentgrass	*Agrostis scabra*	S5	Secure		
122	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
122	Smooth Blackberry	*Rubus canadensis*	S5	Secure		
122	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
122	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
122	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
122	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
125	Balsam Fir	*Abies balsamea*	S5	Secure		
125	Black Spruce	*Picea mariana*	S5	Secure		
125	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
125	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
125	Brownish Sedge	*Carex brunnescens*	S5	Secure		
125	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
125	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
125	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
125	Crinkled Hairgrass	*Deschampsia flexuosa*	S5	Secure		
125	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
125	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
125	Eastern White Pine	*Pinus strobus*	S5	Secure		
125	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
125	Hoary Sedge	*Carex canescens*	S5	Secure		
125	New England Sedge	*Carex novae-angliae*	S5	Secure		
125	Northern Starflower	*Trientalis borealis*	S5	Secure		
125	Red Raspberry	*Rubus idaeus*	S5	Secure		
125	Red Spruce	*Picea rubens*	S5	Secure		
125	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
125	Soft Rush	*Juncus effusus*	S5	Secure		
125	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
125	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
125	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
125	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
125	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
126	a Rush	*Juncus sp.*	na	na		
126	Balsam Fir	*Abies balsamea*	S5	Secure		
126	Black Holly	*Ilex verticillata*	S5	Secure		
126	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
126	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
126	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
126	Brownish Sedge	*Carex brunnescens*	S5	Secure		
126	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
126	Clinton Lily	*Clintonia borealis*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
126	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
126	Crinkled Hairgrass	*Deschampsia flexuosa*	S5	Secure		
126	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
126	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
126	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
126	Goldthread	*Coptis trifolia*	S5	Secure		
126	Interrupted Fern	*Osmunda claytoniana*	S5	Secure		
126	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
126	New England Sedge	*Carex novae-angliae*	S5	Secure		
126	Northern Starflower	*Trientalis borealis*	S5	Secure		
126	Red Maple	*Acer rubrum*	S5	Secure		
126	Red Spruce	*Picea rubens*	S5	Secure		
126	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
126	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
126	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
126	Smooth Blackberry	*Rubus canadensis*	S5	Secure		
126	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
126	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
126	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
126	Whorled Aster	*Oclemena acuminata*	S5	Secure		
126	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
126	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
127	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
127	A Sedge	*Carex gynandra*	S5	Secure		
127	Balsam Fir	*Abies balsamea*	S5	Secure		
127	Black Spruce	*Picea mariana*	S5	Secure		
127	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
127	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
127	Brownish Sedge	*Carex brunnescens*	S5	Secure		
127	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
127	Common Mouse-Ear Chickweed	*Cerastium fontanum*	SNA	Exotic		
127	Common Woodrush	*Luzula multiflora*	S5	Secure		
127	Devil's Beggar-Ticks	*Bidens frondosa*	S5	Secure		
127	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
127	Farewell-Summer	*Symphyotrichum lateriflorum*	S5	Secure		
127	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
127	Marsh Bedstraw	*Galium palustre*	S5	Secure		
127	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
127	Northern Starflower	*Trientalis borealis*	S5	Secure		
127	Old-Field Cinquefoil	*Potentilla simplex*	S5	Secure		
127	Paper Birch	*Betula papyrifera*	S5	Secure		
127	Red Maple	*Acer rubrum*	S5	Secure		
127	Red Raspberry	*Rubus idaeus*	S5	Secure		
127	Red Spruce	*Picea rubens*	S5	Secure		
127	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
127	Scribner Bluegrass	*Poa trivialis*	SNA	Exotic		
127	Self-Heal	*Prunella vulgaris*	S5	Secure		
127	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
127	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
127	Skunk Currant	*Ribes glandulosum*	S5	Secure		
127	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
127	Speckled Alder	*Alnus incana*	S5	Secure		
127	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
127	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
127	Twinflower	*Linnaea borealis*	S5	Secure		
127	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
127	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
127	Whorled Aster	*Oclemena acuminata*	S5	Secure		
127	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
127	Woodland Horsetail	*Equisetum sylvaticum*	S5	Secure		
129	a Manna-grass	*Glyceria sp.*	na	na		
129	a Rush	*Juncus sp.*	na	na		
129	A Sedge	*Carex magellanica ssp. irrigua*	S5	Secure		
129	a Serviceberry	*Amelanchier sp.*	na	na		
129	American Mountain-Ash	*Sorbus americana*	S5	Secure		
129	American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		
129	Balsam Fir	*Abies balsamea*	S5	Secure		
129	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
129	Black Spruce	*Picea mariana*	S5	Secure		
129	Bog Aster	*Oclemena nemoralis*	S5	Secure		
129	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
129	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
129	Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure		
129	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
129	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
129	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
129	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
129	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
129	Eastern White Pine	*Pinus strobus*	S5	Secure		
129	Fall Dropseed Muhly	*Muhlenbergia uniflora*	S5	Secure		
129	Goldthread	*Coptis trifolia*	S5	Secure		
129	Gray Birch	*Betula populifolia*	S5	Secure		
129	Green Alder	*Alnus viridis*	S5	Secure		
129	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
129	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
129	Hoary Sedge	*Carex canescens*	S5	Secure		
129	Indian-Pipe	*Monotropa uniflora*	S5	Secure		
129	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
129	Least Spike-Rush	*Eleocharis acicularis*	S5	Secure		
129	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
129	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
129	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
129	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
129	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
129	Northern Starflower	*Trientalis borealis*	S5	Secure		
129	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
129	Partridge-Berry	*Mitchella repens*	S5	Secure		
129	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
129	Red Maple	*Acer rubrum*	S5	Secure		
129	Red Raspberry	*Rubus idaeus*	S5	Secure		
129	Red Spruce	*Picea rubens*	S5	Secure		
129	Rhodora	*Rhododendron canadense*	S5	Secure		
129	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
129	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
129	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
129	Soft Rush	*Juncus effusus*	S5	Secure		
129	Speckled Alder	*Alnus incana*	S5	Secure		
129	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
129	Spreading Bentgrass	*Agrostis stolonifera*	S5	Secure		
129	Teaberry	*Gaultheria procumbens*	S5	Secure		
129	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
129	Trailing Arbutus	*Epigaea repens*	S5	Secure		
129	Twinflower	*Linnaea borealis*	S5	Secure		
129	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
129	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
129	Whorled Aster	*Oclemena acuminata*	S5	Secure		
129	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
131	a Serviceberry	*Amelanchier sp.*	na	na		
131	American Mountain-Ash	*Sorbus americana*	S5	Secure		
131	Balsam Fir	*Abies balsamea*	S5	Secure		
131	Black Holly	*Ilex verticillata*	S5	Secure		
131	Black Spruce	*Picea mariana*	S5	Secure		
131	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
131	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
131	Clinton Lily	*Clintonia borealis*	S5	Secure		
131	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
131	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
131	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
131	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
131	Goldthread	*Coptis trifolia*	S5	Secure		
131	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
131	Interrupted Fern	*Osmunda claytoniana*	S5	Secure		
131	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
131	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
131	Northern Starflower	*Trientalis borealis*	S5	Secure		
131	Painted Trillium	*Trillium undulatum*	S5	Secure		
131	Partridge-Berry	*Mitchella repens*	S5	Secure		
131	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
131	Red Maple	*Acer rubrum*	S5	Secure		
131	Red Spruce	*Picea rubens*	S5	Secure		
131	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
131	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
131	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
131	Teaberry	*Gaultheria procumbens*	S5	Secure		
131	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
131	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
131	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
131	Whorled Aster	*Oclemena acuminata*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
131	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
131	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
135	a Manna-grass	*Glyceria sp.*	na	na		
135	a Serviceberry	*Amelanchier sp.*	na	na		
135	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
135	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
135	Black Spruce	*Picea mariana*	S5	Secure		
135	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
135	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
135	Brownish Sedge	*Carex brunnescens*	S5	Secure		
135	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
135	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
135	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
135	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
135	Goldthread	*Coptis trifolia*	S5	Secure		
135	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
135	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
135	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
135	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
135	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
135	Northern Starflower	*Trientalis borealis*	S5	Secure		
135	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
135	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
135	Quaking Aspen	*Populus tremuloides*	S5	Secure		
135	Red Maple	*Acer rubrum*	S5	Secure		
135	Red Pine	*Pinus resinosa*	S4S5	Secure		
135	Rhodora	*Rhododendron canadense*	S5	Secure		
135	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
135	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
135	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
135	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
135	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
135	Trailing Arbutus	*Epigaea repens*	S5	Secure		
135	Twinflower	*Linnaea borealis*	S5	Secure		
135	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
135	Whorled Aster	*Oclemena acuminata*	S5	Secure		
135	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
135	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
138	Balsam Fir	*Abies balsamea*	S5	Secure		
138	Black Spruce	*Picea mariana*	S5	Secure		
138	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
138	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
138	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
138	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
138	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
138	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
138	Jack Pine	*Pinus banksiana*	S4	Secure		
138	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
138	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
138	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
138	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
138	Purple Chokeberry	*Photinia floribunda*	S5	Secure		
138	Red Maple	*Acer rubrum*	S5	Secure		
138	Red Pine	*Pinus resinosa*	S4S5	Secure		
138	Rhodora	*Rhododendron canadense*	S5	Secure		
138	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
138	Soft Rush	*Juncus effusus*	S5	Secure		
138	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
138	Twinflower	*Linnaea borealis*	S5	Secure		
138	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
138	Whorled Aster	*Oclemena acuminata*	S5	Secure		
138	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
138	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
141	a Bedstraw	*Galium sp.*	na	na		
141	Balsam Fir	*Abies balsamea*	S5	Secure		
141	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
141	Black Holly	*Ilex verticillata*	S5	Secure		
141	Black Spruce	*Picea mariana*	S5	Secure		
141	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
141	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
141	Brownish Sedge	*Carex brunnescens*	S5	Secure		
141	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
141	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
141	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
141	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
141	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
141	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
141	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
141	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
141	Goldthread	*Coptis trifolia*	S5	Secure		
141	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
141	Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Secure		
141	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
141	New England Sedge	*Carex novae-angliae*	S5	Secure		
141	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
141	Northern Beech Fern	*Phegopteris connectilis*	S5	Secure		
141	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
141	Northern Starflower	*Trientalis borealis*	S5	Secure		
141	Pale Laurel	*Kalmia polifolia*	S5	Secure		
141	Paper Birch	*Betula papyrifera*	S5	Secure		
141	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
141	Red Chokeberry	*Photinia pyrifolia*	S4?	Secure		
141	Red Spruce	*Picea rubens*	S5	Secure		
141	Rhodora	*Rhododendron canadense*	S5	Secure		
141	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
141	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
141	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
141	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
141	Speckled Alder	*Alnus incana*	S5	Secure		
141	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
141	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
141	Sweet Bayberry	*Myrica gale*	S5	Secure		
141	Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S5	Secure		
141	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
141	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
141	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
141	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
141	Whorled Aster	*Oclemena acuminata*	S5	Secure		
142	a Blackberry	*Rubus sp.*	na	na		
142	a Bur-reed	*Sparganium sp.*	na	na		
142	a Bur-reed	*Sparganium sp.*	na	na		
142	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
142	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
142	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
142	a Panic-grass	*Panicum sp.*	na	na		
142	a Sedge	*Carex sp.*	na	na		
142	Balsam Fir	*Abies balsamea*	S5	Secure		
142	Black Spruce	*Picea mariana*	S5	Secure		
142	Blueflag	*Iris versicolor*	S5	Secure		
142	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
142	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
142	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
142	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
142	Field Horsetail	*Equisetum arvense*	S5	Secure		
142	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
142	Goldthread	*Coptis trifolia*	S5	Secure		
142	Gray Birch	*Betula populifolia*	S5	Secure		
142	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
142	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
142	Hoary Sedge	*Carex canescens*	S5	Secure		
142	Interrupted Fern	*Osmunda claytoniana*	S5	Secure		
142	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
142	Long Sedge	*Carex folliculata*	S5	Secure		
142	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
142	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
142	Narrow-Panicled Rush	*Juncus brevicaudatus*	S5	Secure		
142	New England Sedge	*Carex novae-angliae*	S5	Secure		
142	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
142	Northern Starflower	*Trientalis borealis*	S5	Secure		
142	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
142	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
142	Red Maple	*Acer rubrum*	S5	Secure		
142	Red Raspberry	*Rubus idaeus*	S5	Secure		
142	Red Spruce	*Picea rubens*	S5	Secure		
142	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
142	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
142	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
142	Speckled Alder	*Alnus incana*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
142	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
142	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
142	Twinflower	*Linnaea borealis*	S5	Secure		
142	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
142	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
142	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
145	a Bedstraw	*Galium sp.*	na	na		
145	a Bur-reed	*Sparganium sp.*	na	na		
145	a Bur-reed	*Sparganium sp.*	na	na		
145	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
145	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
145	a Pondweed	*Potamogeton sp.*	na	na		
145	A Sedge	*Carex gynandra*	S5	Secure		
145	a Sedge	*Carex sp.*	na	na		
145	Balsam Fir	*Abies balsamea*	S5	Secure		
145	Bearded Short-Husk	*Brachyelytrum septentrionale*	S5	Secure		
145	Black Holly	*Ilex verticillata*	S5	Secure		
145	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
145	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
145	Canada Rush	*Juncus canadensis*	S5	Secure		
145	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
145	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
145	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
145	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
145	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
145	Hoary Sedge	*Carex canescens*	S5	Secure		
145	Hooded Skullcap	*Scutellaria galericulata*	S5	Secure		
145	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
145	Marsh Bedstraw	*Galium palustre*	S5	Secure		
145	Marsh Blue Violet	*Viola cucullata*	S5	Secure		
145	Marsh Hedge-Nettle	*Stachys palustris*	SNA	Exotic		
145	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
145	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
145	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
145	Red Maple	*Acer rubrum*	S5	Secure		
145	Red Raspberry	*Rubus idaeus*	S5	Secure		
145	Red Spruce	*Picea rubens*	S5	Secure		
145	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
145	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
145	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
145	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
145	Soft Rush	*Juncus effusus*	S5	Secure		
145	Speckled Alder	*Alnus incana*	S5	Secure		
145	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
145	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
145	Sweet Bayberry	*Myrica gale*	S5	Secure		
145	Tall Meadow-Rue	*Thalictrum pubescens*	S5	Secure		
145	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
145	White Turtlehead	*Chelone glabra*	S5	Secure		
145	Whorled Aster	*Oclemena acuminata*	S5	Secure		
146	A Sedge	*Carex gynandra*	S5	Secure		
146	American Bur-Reed	*Sparganium americanum*	S5	Secure		
146	American Larch	*Larix laricina*	S5	Secure		
146	Balsam Fir	*Abies balsamea*	S5	Secure		
146	Bear Sedge	*Carex utriculata*	S5	Secure		
146	Black Holly	*Ilex verticillata*	S5	Secure		
146	Black Spruce	*Picea mariana*	S5	Secure		
146	Blueflag	*Iris versicolor*	S5	Secure		
146	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
146	Bog Aster	*Oclemena nemoralis*	S5	Secure		
146	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
146	Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure		
146	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
146	Canada Rush	*Juncus canadensis*	S5	Secure		
146	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
146	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
146	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
146	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
146	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
146	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
146	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
146	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
146	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
146	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
146	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
146	Long Sedge	*Carex folliculata*	S5	Secure		
146	Marsh Bedstraw	*Galium palustre*	S5	Secure		
146	Marsh Blue Violet	*Viola cucullata*	S5	Secure		
146	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
146	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
146	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
146	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
146	Northern Starflower	*Trientalis borealis*	S5	Secure		
146	Pale St. John's-Wort	*Hypericum ellipticum*	S5	Secure		
146	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
146	Purple Chokeberry	*Photinia floribunda*	S5	Secure		
146	Red Maple	*Acer rubrum*	S5	Secure		
146	Red Raspberry	*Rubus idaeus*	S5	Secure		
146	Red Spruce	*Picea rubens*	S5	Secure		
146	Rhodora	*Rhododendron canadense*	S5	Secure		
146	Rough Bentgrass	*Agrostis scabra*	S5	Secure		
146	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
146	Royal Fern	*Osmunda regalis*	S5	Secure		
146	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
146	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
146	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
146	Soft Rush	*Juncus effusus*	S5	Secure		
146	Speckled Alder	*Alnus incana*	S5	Secure		
146	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
146	Sweet Bayberry	*Myrica gale*	S5	Secure		
146	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
146	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
146	Three-Way Sedge	*Dulichium arundinaceum*	S5	Secure		
146	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
146	White Beakrush	*Rhynchospora alba*	S5	Secure		
146	Whorled Aster	*Oclemena acuminata*	S5	Secure		
148	a Bedstraw	*Galium sp.*	na	na		
148	a Bur-reed	*Sparganium sp.*	na	na		
148	Balsam Fir	*Abies balsamea*	S5	Secure		
148	Black Holly	*Ilex verticillata*	S5	Secure		
148	Black Spruce	*Picea mariana*	S5	Secure		
148	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
148	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
148	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
148	Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure		
148	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
148	Canada Rush	*Juncus canadensis*	S5	Secure		
148	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
148	Colonial Bentgrass	*Agrostis capillaris*	SNA	Exotic		
148	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
148	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
148	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
148	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
148	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
148	Hoary Sedge	*Carex canescens*	S5	Secure		
148	Marsh Blue Violet	*Viola cucullata*	S5	Secure		
148	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
148	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
148	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
148	Northern Starflower	*Trientalis borealis*	S5	Secure		
148	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
148	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
148	Rough Bentgrass	*Agrostis scabra*	S5	Secure		
148	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
148	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
148	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
148	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
148	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
148	Soft Rush	*Juncus effusus*	S5	Secure		
148	Speckled Alder	*Alnus incana*	S5	Secure		
148	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
148	Spreading Bentgrass	*Agrostis stolonifera*	S5	Secure		
148	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
148	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
148	Twinflower	*Linnaea borealis*	S5	Secure		
148	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
148	Whorled Aster	*Oclemena acuminata*	S5	Secure		
149	a Bedstraw	*Galium sp.*	na	na		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
149	a Bur-reed	*Sparganium sp.*	na	na		
149	a Bur-reed	*Sparganium sp.*	na	na		
149	Balsam Fir	*Abies balsamea*	S5	Secure		
149	Black Spruce	*Picea mariana*	S5	Secure		
149	Brownish Sedge	*Carex brunnescens*	S5	Secure		
149	Canada Hawkweed	*Hieracium canadense*	S4S5	Secure		
149	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
149	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
149	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
149	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
149	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
149	Northern Oak Fern	*Gymnocarpium dryopteris*	S5	Secure		
149	Northern Starflower	*Trientalis borealis*	S5	Secure		
149	Rhodora	*Rhododendron canadense*	S5	Secure		
149	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
149	Skunk Currant	*Ribes glandulosum*	S5	Secure		
149	Speckled Alder	*Alnus incana*	S5	Secure		
149	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
149	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
149	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
149	Twinflower	*Linnaea borealis*	S5	Secure		
149	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
149	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
149	Whorled Aster	*Oclemena acuminata*	S5	Secure		
149	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
150	Balsam Fir	*Abies balsamea*	S5	Secure		
150	Bebb's Willow	*Salix bebbiana*	S5	Secure		
150	Black Spruce	*Picea mariana*	S5	Secure		
150	Blueflag	*Iris versicolor*	S5	Secure		
150	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
150	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
150	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
150	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
150	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
150	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
150	Green Alder	*Alnus viridis*	S5	Secure		
150	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
150	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
150	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
150	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
150	Northern Starflower	*Trientalis borealis*	S5	Secure		
150	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
150	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
150	Red Maple	*Acer rubrum*	S5	Secure		
150	Royal Fern	*Osmunda regalis*	S5	Secure		
150	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
150	Speckled Alder	*Alnus incana*	S5	Secure		
150	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
150	Twinflower	*Linnaea borealis*	S5	Secure		
150	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
150	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
153	A Sedge	*Carex gynandra*	S5	Secure		
153	Balsam Fir	*Abies balsamea*	S5	Secure		
153	Balsam Willow	*Salix pyrifolia*	S5	Secure		
153	Black Spruce	*Picea mariana*	S5	Secure		
153	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
153	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
153	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
153	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
153	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
153	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
153	Green Alder	*Alnus viridis*	S5	Secure		
153	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
153	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
153	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
153	Little Prickly Sedge	*Carex echinata*	S5	Secure		
153	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
153	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
153	Northern Starflower	*Trientalis borealis*	S5	Secure		
153	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
153	Prairie Willow	*Salix humilis*	S5	Secure		
153	Quaking Aspen	*Populus tremuloides*	S5	Secure		
153	Red Maple	*Acer rubrum*	S5	Secure		
153	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
153	Speckled Alder	*Alnus incana*	S5	Secure		
153	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
153	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
153	Twinflower	*Linnaea borealis*	S5	Secure		
153	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
154	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
154	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
154	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
154	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
154	Indian-Pipe	*Monotropa uniflora*	S5	Secure		
154	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
154	Paper Birch	*Betula papyrifera*	S5	Secure		
154	Quaking Aspen	*Populus tremuloides*	S5	Secure		
154	Red Maple	*Acer rubrum*	S5	Secure		
154	Red Spruce	*Picea rubens*	S5	Secure		
154	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
154	Twinflower	*Linnaea borealis*	S5	Secure		
154	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
154	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
158	American Mountain-Ash	*Sorbus americana*	S5	Secure		
158	Balsam Fir	*Abies balsamea*	S5	Secure		
158	Black Spruce	*Picea mariana*	S5	Secure		
158	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
158	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
158	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
158	Northern Starflower	*Trientalis borealis*	S5	Secure		
158	Paper Birch	*Betula papyrifera*	S5	Secure		
158	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
158	Red Maple	*Acer rubrum*	S5	Secure		
158	Red Spruce	*Picea rubens*	S5	Secure		
158	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
158	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
158	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
158	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
158	Twinflower	*Linnaea borealis*	S5	Secure		
158	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
158	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
167	Balsam Fir	*Abies balsamea*	S5	Secure		
167	Black Holly	*Ilex verticillata*	S5	Secure		
167	Brownish Sedge	*Carex brunnescens*	S5	Secure		
167	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
167	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
167	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
167	Northern Starflower	*Trientalis borealis*	S5	Secure		
167	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
167	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
167	Red Spruce	*Picea rubens*	S5	Secure		
167	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
167	Speckled Alder	*Alnus incana*	S5	Secure		
167	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
167	Tree Clubmoss	*Lycopodium obscurum*	S4S5	Secure		
167	Twinflower	*Linnaea borealis*	S5	Secure		
167	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
167	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
167	Whorled Aster	*Oclemena acuminata*	S5	Secure		
167	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
168	Balsam Fir	*Abies balsamea*	S5	Secure		
168	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
168	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
168	Green Alder	*Alnus viridis*	S5	Secure		
168	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
168	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
168	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
168	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
168	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
168	Purple Chokeberry	*Photinia floribunda*	S5	Secure		
168	Red Maple	*Acer rubrum*	S5	Secure		
168	Red Spruce	*Picea rubens*	S5	Secure		
168	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
168	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
168	Soft Rush	*Juncus effusus*	S5	Secure		
168	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
168	Whorled Aster	*Oclemena acuminata*	S5	Secure		
169	a Serviceberry	*Amelanchier sp.*	na	na		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
169	American Mountain-Ash	*Sorbus americana*	S5	Secure		
169	Balsam Fir	*Abies balsamea*	S5	Secure		
169	Black Spruce	*Picea mariana*	S5	Secure		
169	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
169	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
169	Eastern White Pine	*Pinus strobus*	S5	Secure		
169	Goldthread	*Coptis trifolia*	S5	Secure		
169	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
169	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
169	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
169	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
169	Red Maple	*Acer rubrum*	S5	Secure		
169	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
169	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
169	Twinflower	*Linnaea borealis*	S5	Secure		
169	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
169	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
169	Whorled Aster	*Oclemena acuminata*	S5	Secure		
169	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
172	a Rush	*Juncus sp.*	na	na		
172	Black Spruce	*Picea mariana*	S5	Secure		
172	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
172	Brownish Sedge	*Carex brunnescens*	S5	Secure		
172	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
172	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
172	Ground Juniper	*Juniperus communis*	S5	Secure		
172	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
172	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
172	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
172	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
172	Narrow-Leaf Burreed	*Sparganium angustifolium*	S5	Secure		
172	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
172	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
172	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
172	Red Chokeberry	*Photinia pyrifolia*	S4?	Secure		
172	Red Maple	*Acer rubrum*	S5	Secure		
172	Red Spruce	*Picea rubens*	S5	Secure		
172	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
172	Speckled Alder	*Alnus incana*	S5	Secure		
172	Teaberry	*Gaultheria procumbens*	S5	Secure		
172	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
176	Black Spruce	*Picea mariana*	S5	Secure		
176	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
176	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
176	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
176	Eastern White Pine	*Pinus strobus*	S5	Secure		
176	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
176	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
176	Purple Chokeberry	*Photinia floribunda*	S5	Secure		
176	Red Maple	*Acer rubrum*	S5	Secure		
176	Rhodora	*Rhododendron canadense*	S5	Secure		
176	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
176	Speckled Alder	*Alnus incana*	S5	Secure		
176	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
178	a Willow	*Salix sp.*	na	na		
178	Balsam Fir	*Abies balsamea*	S5	Secure		
178	Black Spruce	*Picea mariana*	S5	Secure		
178	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
178	Brownish Sedge	*Carex brunnescens*	S5	Secure		
178	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
178	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
178	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
178	Northern Starflower	*Trientalis borealis*	S5	Secure		
178	Red Maple	*Acer rubrum*	S5	Secure		
178	Red Spruce	*Picea rubens*	S5	Secure		
178	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
178	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
178	Speckled Alder	*Alnus incana*	S5	Secure		
178	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
178	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
178	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
178	Whorled Aster	*Oclemena acuminata*	S5	Secure		
178	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
183	a Marsh St. John's Wort	*Triadenum sp.*	na	na		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
183	a Rush	*Juncus sp.*	na	na		
183	a Spikerush	*Eleocharis sp.*	na	na		
183	a Willow	*Salix sp.*	na	na		
183	Black Spruce	*Picea mariana*	S5	Secure		
183	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
183	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
183	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
183	Brownish Sedge	*Carex brunnescens*	S5	Secure		
183	Canada Hawkweed	*Hieracium canadense*	S4S5	Secure		
183	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
183	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
183	Field Horsetail	*Equisetum arvense*	S5	Secure		
183	Green Alder	*Alnus viridis*	S5	Secure		
183	Hoary Sedge	*Carex canescens*	S5	Secure		
183	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
183	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
183	Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Secure		
183	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
183	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
183	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
183	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
183	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
183	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
183	Purple Chokeberry	*Photinia floribunda*	S5	Secure		
183	Red Maple	*Acer rubrum*	S5	Secure		
183	Rhodora	*Rhododendron canadense*	S5	Secure		
183	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
183	Royal Fern	*Osmunda regalis*	S5	Secure		
183	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
183	Speckled Alder	*Alnus incana*	S5	Secure		
183	Tussock Sedge	*Carex stricta*	S5	Secure		
183	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
185	a Blackberry	*Rubus sp.*	na	na		
185	a Serviceberry	*Amelanchier sp.*	na	na		
185	American Larch	*Larix laricina*	S5	Secure		
185	Balsam Fir	*Abies balsamea*	S5	Secure		
185	Black Spruce	*Picea mariana*	S5	Secure		
185	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
185	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
185	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
185	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
185	Eastern White Pine	*Pinus strobus*	S5	Secure		
185	Goldthread	*Coptis trifolia*	S5	Secure		
185	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
185	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
185	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
185	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
185	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
185	Northern Starflower	*Trientalis borealis*	S5	Secure		
185	Pale Laurel	*Kalmia polifolia*	S5	Secure		
185	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
185	Purple Chokeberry	*Photinia floribunda*	S5	Secure		
185	Red Maple	*Acer rubrum*	S5	Secure		
185	Rhodora	*Rhododendron canadense*	S5	Secure		
185	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
185	Shining Rose	*Rosa nitida*	S4	Secure		
185	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
185	Speckled Alder	*Alnus incana*	S5	Secure		
185	Sweet Bayberry	*Myrica gale*	S5	Secure		
185	Teaberry	*Gaultheria procumbens*	S5	Secure		
185	Tussock Sedge	*Carex stricta*	S5	Secure		
185	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
186	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
186	a Serviceberry	*Amelanchier sp.*	na	na		
186	Balsam Fir	*Abies balsamea*	S5	Secure		
186	Black Spruce	*Picea mariana*	S5	Secure		
186	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
186	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
186	Brownish Sedge	*Carex brunnescens*	S5	Secure		
186	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
186	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
186	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
186	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
186	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
186	Northern Starflower	*Trientalis borealis*	S5	Secure		
186	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
186	Red Raspberry	*Rubus idaeus*	S5	Secure		
186	Rhodora	*Rhododendron canadense*	S5	Secure		
186	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
186	Speckled Alder	*Alnus incana*	S5	Secure		
186	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
186	Sweet Bayberry	*Myrica gale*	S5	Secure		
186	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
186	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
186	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
193	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
193	Balsam Fir	*Abies balsamea*	S5	Secure		
193	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
193	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
193	Brownish Sedge	*Carex brunnescens*	S5	Secure		
193	Canadian St. John's-Wort	*Hypericum canadense*	S5	Secure		
193	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
193	Climbing Nightshade	*Solanum dulcamara*	SNA	Exotic		
193	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
193	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
193	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
193	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
193	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
193	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
193	Green Alder	*Alnus viridis*	S5	Secure		
193	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
193	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
193	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
193	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
193	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
193	Leafy Northern Green Orchid	*Platanthera hyperborea*	SNA	na		
193	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
193	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
193	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
193	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
193	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
193	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
193	Old-Field Cinquefoil	*Potentilla simplex*	S5	Secure		
193	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
193	Red Maple	*Acer rubrum*	S5	Secure		
193	Red Spruce	*Picea rubens*	S5	Secure		
193	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
193	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
193	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
193	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
193	Soft Rush	*Juncus effusus*	S5	Secure		
193	Spoon-Leaved Sundew	*Drosera intermedia*	S5	Secure		
193	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
193	Twinflower	*Linnaea borealis*	S5	Secure		
193	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
193	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
202	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
202	a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed		
202	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
202	American Larch	*Larix laricina*	S5	Secure		
202	Balsam Fir	*Abies balsamea*	S5	Secure		
202	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
202	Black Holly	*Ilex verticillata*	S5	Secure		
202	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
202	Black Spruce	*Picea mariana*	S5	Secure		
202	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
202	Bog Rosemary	*Andromeda polifolia*	S5	Secure		
202	Brownish Sedge	*Carex brunnescens*	S5	Secure		
202	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
202	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
202	Common Woodrush	*Luzula multiflora*	S5	Secure		
202	Crawford Sedge	*Carex crawfordii*	S5	Secure		
202	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
202	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
202	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
202	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
202	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
202	Goldthread	*Coptis trifolia*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
202	Green Alder	*Alnus viridis*	S5	Secure		
202	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
202	Indian-Pipe	*Monotropa uniflora*	S5	Secure		
202	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
202	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
202	Little Prickly Sedge	*Carex echinata*	S5	Secure		
202	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
202	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
202	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
202	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
202	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
202	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
202	Northern Pitcher-Plant	*Sarracenia purpurea*	S5	Secure		
202	Northern Starflower	*Trientalis borealis*	S5	Secure		
202	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
202	Pickerel Weed	*Pontederia cordata*	S5	Secure		
202	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
202	Red Maple	*Acer rubrum*	S5	Secure		
202	Red Raspberry	*Rubus idaeus*	S5	Secure		
202	Rhodora	*Rhododendron canadense*	S5	Secure		
202	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
202	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
202	Seven-Angled Pipewort	*Eriocaulon aquaticum*	S5	Secure		
202	Shadbush	*Amelanchier interior*	S4S5	Secure		
202	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
202	Smooth Blackberry	*Rubus canadensis*	S5	Secure		
202	Soft Rush	*Juncus effusus*	S5	Secure		
202	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
202	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
202	Sweet Bayberry	*Myrica gale*	S5	Secure		
202	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
202	Teaberry	*Gaultheria procumbens*	S5	Secure		
202	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
202	Tussock Sedge	*Carex stricta*	S5	Secure		
202	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
202	Virginia Rose	*Rosa virginiana*	S5	Secure		
202	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
202	Water Lobelia	*Lobelia dortmanna*	S5	Secure		
202	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
202	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
202	Yellow Pond-Lily	*Nuphar lutea*	S5	Secure		
207	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
207	a Willow	*Salix sp.*	na	na		
207	American Larch	*Larix laricina*	S5	Secure		
207	Balsam Fir	*Abies balsamea*	S5	Secure		
207	Balsam Willow	*Salix pyrifolia*	S5	Secure		
207	Black Holly	*Ilex verticillata*	S5	Secure		
207	Black Spruce	*Picea mariana*	S5	Secure		
207	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
207	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
207	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
207	Brownish Sedge	*Carex brunnescens*	S5	Secure		
207	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
207	Field Horsetail	*Equisetum arvense*	S5	Secure		
207	Green Alder	*Alnus viridis*	S5	Secure		
207	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
207	Hoary Sedge	*Carex canescens*	S5	Secure		
207	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
207	Marsh Fern	*Thelypteris palustris*	S5	Secure		
207	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
207	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
207	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
207	Quaking Aspen	*Populus tremuloides*	S5	Secure		
207	Red Maple	*Acer rubrum*	S5	Secure		
207	Red Spruce	*Picea rubens*	S5	Secure		
207	Rhodora	*Rhododendron canadense*	S5	Secure		
207	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
207	Royal Fern	*Osmunda regalis*	S5	Secure		
207	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
207	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
207	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
207	Smooth Blackberry	*Rubus canadensis*	S5	Secure		
207	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
207	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
207	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
207	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
207	Woolly Blue Violet	*Viola sororia*	S5	Secure		
208	American Fly-Honeysuckle	*Lonicera canadensis*	S5	Secure		
208	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
208	Black Spruce	*Picea mariana*	S5	Secure		
208	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
208	Brownish Sedge	*Carex brunnescens*	S5	Secure		
208	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
208	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
208	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
208	Fire Cherry	*Prunus pensylvanica*	S5	Secure		
208	Goldthread	*Coptis trifolia*	S5	Secure		
208	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
208	Hoary Sedge	*Carex canescens*	S5	Secure		
208	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
208	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
208	Northern Starflower	*Trientalis borealis*	S5	Secure		
208	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
208	Red Maple	*Acer rubrum*	S5	Secure		
208	Red Raspberry	*Rubus idaeus*	S5	Secure		
208	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
208	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
208	Speckled Alder	*Alnus incana*	S5	Secure		
208	Thread Rush	*Juncus filiformis*	S5	Secure		
208	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
208	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
208	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
210	Balsam Fir	*Abies balsamea*	S5	Secure		
210	Black Spruce	*Picea mariana*	S5	Secure		
210	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
210	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
210	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
210	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
210	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
210	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
210	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
210	Eastern White Pine	*Pinus strobus*	S5	Secure		
210	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
210	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
210	Indian-Pipe	*Monotropa uniflora*	S5	Secure		
210	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
210	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
210	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
210	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
210	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
210	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
210	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
210	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
210	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
210	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
210	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
211	a Violet	*Viola sp.*	na	na		
211	Black Holly	*Ilex verticillata*	S5	Secure		
211	Black Spruce	*Picea mariana*	S5	Secure		
211	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
211	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
211	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
211	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
211	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
211	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
211	Goldthread	*Coptis trifolia*	S5	Secure		
211	Northern Starflower	*Trientalis borealis*	S5	Secure		
211	Northern Starflower	*Trientalis borealis*	S5	Secure		
211	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
211	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
211	Red Maple	*Acer rubrum*	S5	Secure		
211	Red Spruce	*Picea rubens*	S5	Secure		
211	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
211	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
211	Speckled Alder	*Alnus incana*	S5	Secure		
211	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
211	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
211	Whorled Aster	*Oclemena acuminata*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
215	a Serviceberry	*Amelanchier sp.*	na	na		
215	American Larch	*Larix laricina*	S5	Secure		
215	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
215	Black Holly	*Ilex verticillata*	S5	Secure		
215	Black Sedge	*Carex nigra*	S5	Secure		
215	Black Spruce	*Picea mariana*	S5	Secure		
215	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
215	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
215	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
215	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
215	Canada Rush	*Juncus canadensis*	S5	Secure		
215	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
215	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
215	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
215	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
215	Eastern White Pine	*Pinus strobus*	S5	Secure		
215	Field Horsetail	*Equisetum arvense*	S5	Secure		
215	Goldthread	*Coptis trifolia*	S5	Secure		
215	Gray Birch	*Betula populifolia*	S5	Secure		
215	Green Alder	*Alnus viridis*	S5	Secure		
215	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
215	Hoary Sedge	*Carex canescens*	S5	Secure		
215	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
215	Least Spike-Rush	*Eleocharis acicularis*	S5	Secure		
215	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
215	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
215	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
215	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
215	Paper Birch	*Betula papyrifera*	S5	Secure		
215	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
215	Pink Lady's-Slipper	*Cypripedium acaule*	S5	Secure		
215	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
215	Rhodora	*Rhododendron canadense*	S5	Secure		
215	Royal Fern	*Osmunda regalis*	S5	Secure		
215	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
215	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
215	Teaberry	*Gaultheria procumbens*	S5	Secure		
215	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
215	White Spruce	*Picea glauca*	S5	Secure		
215	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
219	a Bur-reed	*Sparganium sp.*	na	na		
219	a Serviceberry	*Amelanchier sp.*	na	na		
219	American Larch	*Larix laricina*	S5	Secure		
219	Balsam Fir	*Abies balsamea*	S5	Secure		
219	Black Spruce	*Picea mariana*	S5	Secure		
219	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
219	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
219	Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure		
219	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
219	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
219	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
219	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
219	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
219	Goldthread	*Coptis trifolia*	S5	Secure		
219	Hoary Sedge	*Carex canescens*	S5	Secure		
219	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
219	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
219	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
219	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
219	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
219	Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Secure		
219	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
219	Narrow-Panicled Rush	*Juncus brevicaudatus*	S5	Secure		
219	Pale Laurel	*Kalmia polifolia*	S5	Secure		
219	Perennial Bentgrass	*Agrostis perennans*	S4S5	Secure		
219	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
219	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
219	Purple Chokeberry	*Photinia floribunda*	S5	Secure		
219	Red Spruce	*Picea rubens*	S5	Secure		
219	Rhodora	*Rhododendron canadense*	S5	Secure		
219	Rough Bentgrass	*Agrostis scabra*	S5	Secure		
219	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
219	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
219	Soft Rush	*Juncus effusus*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
219	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
219	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
219	Teaberry	*Gaultheria procumbens*	S5	Secure		
219	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
219	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
219	Whorled Aster	*Oclemena acuminata*	S5	Secure		
220	a Blackberry	*Rubus sp.*	na	na		
220	American Larch	*Larix laricina*	S5	Secure		
220	American Mountain-Ash	*Sorbus americana*	S5	Secure		
220	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
220	Black Sedge	*Carex nigra*	S5	Secure		
220	Black Spruce	*Picea mariana*	S5	Secure		
220	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
220	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
220	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
220	Brownish Sedge	*Carex brunnescens*	S5	Secure		
220	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
220	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
220	Eastern White Pine	*Pinus strobus*	S5	Secure		
220	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
220	Green Alder	*Alnus viridis*	S5	Secure		
220	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
220	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
220	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
220	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
220	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
220	Rhodora	*Rhododendron canadense*	S5	Secure		
220	Rose Pogonia	*Pogonia ophioglossoides*	S4	Secure		
220	Royal Fern	*Osmunda regalis*	S5	Secure		
220	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
220	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
220	Speckled Alder	*Alnus incana*	S5	Secure		
220	Thread Rush	*Juncus filiformis*	S5	Secure		
220	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
220	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
220	Twinflower	*Linnaea borealis*	S5	Secure		
220	Water Sedge	*Carex aquatilis*	S5	Secure		
220	Whorled Aster	*Oclemena acuminata*	S5	Secure		
220	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
220	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
221	a Blackberry	*Rubus sp.*	na	na		
221	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
221	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
221	Black Spruce	*Picea mariana*	S5	Secure		
221	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
221	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
221	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
221	Canada Rush	*Juncus canadensis*	S5	Secure		
221	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
221	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
221	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
221	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
221	Fall Dropseed Muhly	*Muhlenbergia uniflora*	S5	Secure		
221	Green Alder	*Alnus viridis*	S5	Secure		
221	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
221	Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Secure		
221	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
221	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
221	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
221	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
221	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
221	Northern Starflower	*Trientalis borealis*	S5	Secure		
221	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
221	Red Maple	*Acer rubrum*	S5	Secure		
221	Rhodora	*Rhododendron canadense*	S5	Secure		
221	Royal Fern	*Osmunda regalis*	S5	Secure		
221	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
221	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
221	Speckled Alder	*Alnus incana*	S5	Secure		
221	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
221	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
221	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
221	Whorled Aster	*Oclemena acuminata*	S5	Secure		
221	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
222	a Blackberry	*Rubus sp.*	na	na		
222	a Sedge	*Carex sp.*	na	na		
222	a Spikerush	*Eleocharis sp.*	na	na		
222	Balsam Fir	*Abies balsamea*	S5	Secure		
222	Black Sedge	*Carex nigra*	S5	Secure		
222	Black Spruce	*Picea mariana*	S5	Secure		
222	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
222	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
222	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
222	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
222	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
222	Field Horsetail	*Equisetum arvense*	S5	Secure		
222	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
222	Green Alder	*Alnus viridis*	S5	Secure		
222	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
222	Hoary Sedge	*Carex canescens*	S5	Secure		
222	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
222	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
222	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
222	Little Prickly Sedge	*Carex echinata*	S5	Secure		
222	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
222	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
222	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
222	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
222	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
222	Northern Bush-Honeysuckle	*Diervilla lonicera*	S5	Secure		
222	Northern Pitcher-Plant	*Sarracenia purpurea*	S5	Secure		
222	Northern Starflower	*Trientalis borealis*	S5	Secure		
222	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
222	Prairie Willow	*Salix humilis*	S5	Secure		
222	Red Maple	*Acer rubrum*	S5	Secure		
222	Rhodora	*Rhododendron canadense*	S5	Secure		
222	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
222	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
222	Royal Fern	*Osmunda regalis*	S5	Secure		
222	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
222	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
222	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
222	Speckled Alder	*Alnus incana*	S5	Secure		
222	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
222	Thread Rush	*Juncus filiformis*	S5	Secure		
223	a Bur-reed	*Sparganium sp.*	na	na		
223	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
223	Balsam Fir	*Abies balsamea*	S5	Secure		
223	Black Spruce	*Picea mariana*	S5	Secure		
223	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
223	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
223	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
223	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
223	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
223	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
223	Fowl Manna-Grass	*Glyceria striata*	S5	Secure		
223	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
223	Northern Pitcher-Plant	*Sarracenia purpurea*	S5	Secure		
223	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
223	Purple Chokeberry	*Photinia floribunda*	S5	Secure		
223	Red Maple	*Acer rubrum*	S5	Secure		
223	Rhodora	*Rhododendron canadense*	S5	Secure		
223	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
223	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
223	Speckled Alder	*Alnus incana*	S5	Secure		
223	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
223	Sweet Bayberry	*Myrica gale*	S5	Secure		
223	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
223	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
223	Yellow Pond-Lily	*Nuphar lutea*	S5	Secure		
224	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
224	a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed		
224	a Serviceberry	*Amelanchier sp.*	na	na		
224	American Larch	*Larix laricina*	S5	Secure		
224	Balsam Fir	*Abies balsamea*	S5	Secure		
224	Black Spruce	*Picea mariana*	S5	Secure		
224	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
224	Bracken Fern	*Pteridium aquilinum*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
224	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
224	Brownish Sedge	*Carex brunnescens*	S5	Secure		
224	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
224	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
224	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
224	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
224	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
224	Goldthread	*Coptis trifolia*	S5	Secure		
224	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
224	Hoary Sedge	*Carex canescens*	S5	Secure		
224	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
224	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
224	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
224	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
224	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
224	Northern Starflower	*Trientalis borealis*	S5	Secure		
224	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
224	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
224	Red Chokeberry	*Photinia pyrifolia*	S4?	Secure		
224	Red Raspberry	*Rubus idaeus*	S5	Secure		
224	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
224	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
224	Speckled Alder	*Alnus incana*	S5	Secure		
224	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
224	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
224	Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S5	Secure		
224	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
224	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
224	Twinflower	*Linnaea borealis*	S5	Secure		
224	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
224	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
224	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
224	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
226	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
226	Black Spruce	*Picea mariana*	S5	Secure		
226	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
226	Clinton Lily	*Clintonia borealis*	S5	Secure		
226	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
226	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
226	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
226	Goldthread	*Coptis trifolia*	S5	Secure		
226	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
226	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
226	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
226	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
226	Northern Pitcher-Plant	*Sarracenia purpurea*	S5	Secure		
226	Northern Starflower	*Trientalis borealis*	S5	Secure		
226	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
226	Red Maple	*Acer rubrum*	S5	Secure		
226	Rhodora	*Rhododendron canadense*	S5	Secure		
226	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
226	Speckled Alder	*Alnus incana*	S5	Secure		
226	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
226	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
226	Sweet Bayberry	*Myrica gale*	S5	Secure		
226	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
226	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
227	Balsam Fir	*Abies balsamea*	S5	Secure		
227	Blueflag	*Iris versicolor*	S5	Secure		
227	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
227	Brownish Sedge	*Carex brunnescens*	S5	Secure		
227	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
227	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
227	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
227	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
227	Northern Starflower	*Trientalis borealis*	S5	Secure		
227	Red Maple	*Acer rubrum*	S5	Secure		
227	Red Spruce	*Picea rubens*	S5	Secure		
227	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
227	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
227	Skunk Currant	*Ribes glandulosum*	S5	Secure		
227	Speckled Alder	*Alnus incana*	S5	Secure		
227	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
227	Spotted Jewel-Weed	*Impatiens capensis*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
227	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
227	Tussock Sedge	*Carex stricta*	S5	Secure		
227	Whorled Aster	*Oclemena acuminata*	S5	Secure		
227	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
227	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
233	a Serviceberry	*Amelanchier sp.*	na	na		
233	American Mountain-Ash	*Sorbus americana*	S5	Secure		
233	Balsam Fir	*Abies balsamea*	S5	Secure		
233	Black Spruce	*Picea mariana*	S5	Secure		
233	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
233	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
233	Eastern White Pine	*Pinus strobus*	S5	Secure		
233	Goldthread	*Coptis trifolia*	S5	Secure		
233	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
233	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
233	Northern Starflower	*Trientalis borealis*	S5	Secure		
233	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
233	Red Maple	*Acer rubrum*	S5	Secure		
233	Red Spruce	*Picea rubens*	S5	Secure		
233	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
233	Teaberry	*Gaultheria procumbens*	S5	Secure		
233	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
233	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
233	Whorled Aster	*Oclemena acuminata*	S5	Secure		
233	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
234	Balsam Fir	*Abies balsamea*	S5	Secure		
234	Black Spruce	*Picea mariana*	S5	Secure		
234	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
234	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
234	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
234	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
234	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
234	Goldthread	*Coptis trifolia*	S5	Secure		
234	Indian-Pipe	*Monotropa uniflora*	S5	Secure		
234	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
234	Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Secure		
234	Northern Red Oak	*Quercus rubra*	S5	Secure		
234	Northern Starflower	*Trientalis borealis*	S5	Secure		
234	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
234	Red Maple	*Acer rubrum*	S5	Secure		
234	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
234	Teaberry	*Gaultheria procumbens*	S5	Secure		
234	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
234	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
234	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
244	American Mountain-Ash	*Sorbus americana*	S5	Secure		
244	American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		
244	Balsam Fir	*Abies balsamea*	S5	Secure		
244	Black Spruce	*Picea mariana*	S5	Secure		
244	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
244	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
244	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
244	Goldthread	*Coptis trifolia*	S5	Secure		
244	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
244	Northern Red Oak	*Quercus rubra*	S5	Secure		
244	Northern Starflower	*Trientalis borealis*	S5	Secure		
244	Paper Birch	*Betula papyrifera*	S5	Secure		
244	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
244	Red Maple	*Acer rubrum*	S5	Secure		
244	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
244	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
244	Striped Maple	*Acer pensylvanicum*	S5	Secure		
244	Teaberry	*Gaultheria procumbens*	S5	Secure		
244	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
244	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
244	Whorled Aster	*Oclemena acuminata*	S5	Secure		
248	a Blackberry	*Rubus sp.*	na	na		
248	a Serviceberry	*Amelanchier sp.*	na	na		
248	American Mountain-Ash	*Sorbus americana*	S5	Secure		
248	Balsam Fir	*Abies balsamea*	S5	Secure		
248	Black Spruce	*Picea mariana*	S5	Secure		
248	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
248	Brownish Sedge	*Carex brunnescens*	S5	Secure		
248	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
248	Clinton Lily	*Clintonia borealis*	S5	Secure		
248	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
248	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
248	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
248	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
248	Eastern Hay-Scented Fern	*Dennstaedtia punctilobula*	S5	Secure		
248	Goldthread	*Coptis trifolia*	S5	Secure		
248	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
248	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
248	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
248	Paper Birch	*Betula papyrifera*	S5	Secure		
248	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
248	Red Maple	*Acer rubrum*	S5	Secure		
248	Red Raspberry	*Rubus idaeus*	S5	Secure		
248	Red Spruce	*Picea rubens*	S5	Secure		
248	Rough Bentgrass	*Agrostis scabra*	S5	Secure		
248	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
248	Smooth Blackberry	*Rubus canadensis*	S5	Secure		
248	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
248	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
248	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
248	Whorled Aster	*Oclemena acuminata*	S5	Secure		
248	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
249	a Blackberry	*Rubus sp.*	na	na		
249	a Bullrush	*Scirpus sp.*	na	na		
249	a Bur-reed	*Sparganium sp.*	na	na		
249	a Bur-reed	*Sparganium sp.*	na	na		
249	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
249	American Larch	*Larix laricina*	S5	Secure		
249	American Mountain-Ash	*Sorbus americana*	S5	Secure		
249	Balsam Fir	*Abies balsamea*	S5	Secure		
249	Black Holly	*Ilex verticillata*	S5	Secure		
249	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
249	Black Spruce	*Picea mariana*	S5	Secure		
249	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
249	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
249	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
249	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
249	Goldthread	*Coptis trifolia*	S5	Secure		
249	Gray Birch	*Betula populifolia*	S5	Secure		
249	Ground Juniper	*Juniperus communis*	S5	Secure		
249	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
249	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
249	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
249	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*	S5	Secure		
249	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
249	Northern Starflower	*Trientalis borealis*	S5	Secure		
249	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
249	Red Maple	*Acer rubrum*	S5	Secure		
249	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
249	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
249	Southern Twayblade	*Listera australis*	S2	May Be At Risk		
249	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
249	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
249	Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S5	Secure		
249	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
249	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
249	White Spruce	*Picea glauca*	S5	Secure		
249	Whorled Aster	*Oclemena acuminata*	S5	Secure		
252	a Sedge	*Carex sp.*	na	na		
252	a Serviceberry	*Amelanchier sp.*	na	na		
252	Balsam Fir	*Abies balsamea*	S5	Secure		
252	Black Holly	*Ilex verticillata*	S5	Secure		
252	Black Spruce	*Picea mariana*	S5	Secure		
252	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
252	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
252	Brownish Sedge	*Carex brunnescens*	S5	Secure		
252	Canada Hawkweed	*Hieracium canadense*	S4S5	Secure		
252	Kentucky Bluegrass	*Poa pratensis*	S5	Secure		
252	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
252	Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Secure		
252	New England Sedge	*Carex novae-angliae*	S5	Secure		
252	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
252	Northern Starflower	*Trientalis borealis*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
252	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
252	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
252	Red Maple	*Acer rubrum*	S5	Secure		
252	Red Raspberry	*Rubus idaeus*	S5	Secure		
252	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
252	Speckled Alder	*Alnus incana*	S5	Secure		
252	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
252	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
252	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
252	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
252	Whorled Aster	*Oclemena acuminata*	S5	Secure		
252	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
252	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
253	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
253	American Larch	*Larix laricina*	S5	Secure		
253	Balsam Fir	*Abies balsamea*	S5	Secure		
253	Black Spruce	*Picea mariana*	S5	Secure		
253	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
253	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
253	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
253	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
253	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
253	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
253	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
253	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
253	Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Secure		
253	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
253	Northern Starflower	*Trientalis borealis*	S5	Secure		
253	Paper Birch	*Betula papyrifera*	S5	Secure		
253	Partridge-Berry	*Mitchella repens*	S5	Secure		
253	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
253	Red Maple	*Acer rubrum*	S5	Secure		
253	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
253	Three-Leaf Solomon's-Plume	*Maianthemum trifolium*	S5	Secure		
253	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
253	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
253	White Spruce	*Picea glauca*	S5	Secure		
253	Whorled Aster	*Oclemena acuminata*	S5	Secure		
253	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
253	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
259	a Serviceberry	*Amelanchier sp.*	na	na		
259	American Larch	*Larix laricina*	S5	Secure		
259	American Mountain-Ash	*Sorbus americana*	S5	Secure		
259	Balsam Fir	*Abies balsamea*	S5	Secure		
259	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
259	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
259	Black Spruce	*Picea mariana*	S5	Secure		
259	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
259	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
259	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
259	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
259	Eastern White Pine	*Pinus strobus*	S5	Secure		
259	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
259	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
259	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
259	Northern Starflower	*Trientalis borealis*	S5	Secure		
259	One-Flower Wintergreen	*Moneses uniflora*	S5	Secure		
259	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
259	Red Maple	*Acer rubrum*	S5	Secure		
259	Rhodora	*Rhododendron canadense*	S5	Secure		
259	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
259	Teaberry	*Gaultheria procumbens*	S5	Secure		
259	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
259	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
261	a Serviceberry	*Amelanchier sp.*	na	na		
261	Balsam Fir	*Abies balsamea*	S5	Secure		
261	Black Spruce	*Picea mariana*	S5	Secure		
261	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
261	Goldthread	*Coptis trifolia*	S5	Secure		
261	Interrupted Fern	*Osmunda claytoniana*	S5	Secure		
261	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
261	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
261	Northern Starflower	*Trientalis borealis*	S5	Secure		
261	Red Maple	*Acer rubrum*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
261	Red Spruce	*Picea rubens*	S5	Secure		
261	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
261	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
262	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
262	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
262	a Serviceberry	*Amelanchier sp.*	na	na		
262	American Larch	*Larix laricina*	S5	Secure		
262	Balsam Fir	*Abies balsamea*	S5	Secure		
262	Black Holly	*Ilex verticillata*	S5	Secure		
262	Black Spruce	*Picea mariana*	S5	Secure		
262	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
262	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
262	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
262	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
262	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
262	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
262	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
262	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
262	Eastern White Pine	*Pinus strobus*	S5	Secure		
262	Hoary Sedge	*Carex canescens*	S5	Secure		
262	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
262	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
262	Linear-Leaved Willow-Herb	*Epilobium leptophyllum*	S5	Secure		
262	Little Prickly Sedge	*Carex echinata*	S5	Secure		
262	Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Secure		
262	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*	S5	Secure		
262	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
262	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
262	Northern Red Oak	*Quercus rubra*	S5	Secure		
262	Northern Starflower	*Trientalis borealis*	S5	Secure		
262	Partridge-Berry	*Mitchella repens*	S5	Secure		
262	Red Maple	*Acer rubrum*	S5	Secure		
262	Red Spruce	*Picea rubens*	S5	Secure		
262	Rhodora	*Rhododendron canadense*	S5	Secure		
262	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
262	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
262	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
262	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
262	Soft Rush	*Juncus effusus*	S5	Secure		
262	Speckled Alder	*Alnus incana*	S5	Secure		
262	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
262	Teaberry	*Gaultheria procumbens*	S5	Secure		
262	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
262	Twinflower	*Linnaea borealis*	S5	Secure		
262	Whorled Aster	*Oclemena acuminata*	S5	Secure		
262	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
262	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
267	American Mountain-Ash	*Sorbus americana*	S5	Secure		
267	Balsam Fir	*Abies balsamea*	S5	Secure		
267	Black Holly	*Ilex verticillata*	S5	Secure		
267	Black Spruce	*Picea mariana*	S5	Secure		
267	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
267	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
267	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
267	Eastern White Pine	*Pinus strobus*	S5	Secure		
267	Goldthread	*Coptis trifolia*	S5	Secure		
267	Gray Birch	*Betula populifolia*	S5	Secure		
267	Indian Cucumber-Root	*Medeola virginiana*	S5	Secure		
267	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
267	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
267	Northern Red Oak	*Quercus rubra*	S5	Secure		
267	Northern Starflower	*Trientalis borealis*	S5	Secure		
267	Paper Birch	*Betula papyrifera*	S5	Secure		
267	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
267	Red Maple	*Acer rubrum*	S5	Secure		
267	Red Spruce	*Picea rubens*	S5	Secure		
267	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
267	Speckled Alder	*Alnus incana*	S5	Secure		
267	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
267	Whorled Aster	*Oclemena acuminata*	S5	Secure		
267	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
267	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
268	a Goldenrod	*Solidago sp.*	na	na		
268	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
268	a Manna-grass	*Glyceria sp.*	na	na		
268	American Larch	*Larix laricina*	S5	Secure		
268	American Mountain-Ash	*Sorbus americana*	S5	Secure		
268	Balsam Fir	*Abies balsamea*	S5	Secure		
268	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
268	Black Holly	*Ilex verticillata*	S5	Secure		
268	Black Spruce	*Picea mariana*	S5	Secure		
268	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
268	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
268	Brownish Sedge	*Carex brunnescens*	S5	Secure		
268	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
268	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
268	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
268	Goldthread	*Coptis trifolia*	S5	Secure		
268	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
268	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
268	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
268	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
268	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
268	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
268	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
268	Northern Red Oak	*Quercus rubra*	S5	Secure		
268	Old-Field Cinquefoil	*Potentilla simplex*	S5	Secure		
268	One-Flower Wintergreen	*Moneses uniflora*	S5	Secure		
268	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
268	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
268	Red Maple	*Acer rubrum*	S5	Secure		
268	Red Spruce	*Picea rubens*	S5	Secure		
268	Royal Fern	*Osmunda regalis*	S5	Secure		
268	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
268	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
268	Speckled Alder	*Alnus incana*	S5	Secure		
268	Teaberry	*Gaultheria procumbens*	S5	Secure		
268	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
268	Whorled Aster	*Oclemena acuminata*	S5	Secure		
268	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
270	a Bur-reed	*Sparganium sp.*	na	na		
270	a Bur-reed	*Sparganium sp.*	na	na		
270	a Manna-grass	*Glyceria sp.*	na	na		
270	a Serviceberry	*Amelanchier sp.*	na	na		
270	American Larch	*Larix laricina*	S5	Secure		
270	Balsam Fir	*Abies balsamea*	S5	Secure		
270	Black Spruce	*Picea mariana*	S5	Secure		
270	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
270	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
270	Brownish Sedge	*Carex brunnescens*	S5	Secure		
270	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
270	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
270	Field Horsetail	*Equisetum arvense*	S5	Secure		
270	Little Prickly Sedge	*Carex echinata*	S5	Secure		
270	Mountain Wood-Fern	*Dryopteris campyloptera*	S5	Secure		
270	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
270	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
270	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
270	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
270	Northern Starflower	*Trientalis borealis*	S5	Secure		
270	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
270	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
270	Quaking Aspen	*Populus tremuloides*	S5	Secure		
270	Red Maple	*Acer rubrum*	S5	Secure		
270	Red Spruce	*Picea rubens*	S5	Secure		
270	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
270	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
270	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
270	Speckled Alder	*Alnus incana*	S5	Secure		
270	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
270	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
270	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
270	White-Edge Sedge	*Carex debilis*	S5	Secure		
270	Whorled Aster	*Oclemena acuminata*	S5	Secure		
270	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
270	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
270	Woodland Horsetail	*Equisetum sylvaticum*	S5	Secure		
277	a Blackberry	*Rubus sp.*	na	na		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
277	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
277	A Sedge	*Carex gynandra*	S5	Secure		
277	a Spikerush	*Eleocharis sp.*	na	na		
277	American Larch	*Larix laricina*	S5	Secure		
277	American Mountain-Ash	*Sorbus americana*	S5	Secure		
277	Balsam Fir	*Abies balsamea*	S5	Secure		
277	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
277	Black Holly	*Ilex verticillata*	S5	Secure		
277	Black Spruce	*Picea mariana*	S5	Secure		
277	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
277	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
277	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
277	Clinton Lily	*Clintonia borealis*	S5	Secure		
277	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
277	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
277	Eastern White Pine	*Pinus strobus*	S5	Secure		
277	Hoary Sedge	*Carex canescens*	S5	Secure		
277	Indian-Pipe	*Monotropa uniflora*	S5	Secure		
277	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
277	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
277	Little Prickly Sedge	*Carex echinata*	S5	Secure		
277	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
277	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
277	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
277	Red Maple	*Acer rubrum*	S5	Secure		
277	Red Spruce	*Picea rubens*	S5	Secure		
277	Rhodora	*Rhododendron canadense*	S5	Secure		
277	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
277	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
277	Speckled Alder	*Alnus incana*	S5	Secure		
277	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
277	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
277	Tussock Sedge	*Carex stricta*	S5	Secure		
277	Twinflower	*Linnaea borealis*	S5	Secure		
277	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
277	Whorled Aster	*Oclemena acuminata*	S5	Secure		
283	a Serviceberry	*Amelanchier sp.*	na	na		
283	American Larch	*Larix laricina*	S5	Secure		
283	Balsam Fir	*Abies balsamea*	S5	Secure		
283	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
283	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
283	Black Spruce	*Picea mariana*	S5	Secure		
283	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
283	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
283	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
283	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
283	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
283	Eastern White Pine	*Pinus strobus*	S5	Secure		
283	Goldthread	*Coptis trifolia*	S5	Secure		
283	Hoary Sedge	*Carex canescens*	S5	Secure		
283	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
283	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
283	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
283	Mountain Cranberry	*Vaccinium vitis-idaea*	S5	Secure		
283	Narrow-Leaved Cotton-Grass	*Eriophorum angustifolium*	S5	Secure		
283	Northern Starflower	*Trientalis borealis*	S5	Secure		
283	Pale Laurel	*Kalmia polifolia*	S5	Secure		
283	Pink Lady's-Slipper	*Cypripedium acaule*	S5	Secure		
283	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
283	Red Maple	*Acer rubrum*	S5	Secure		
283	Red Spruce	*Picea rubens*	S5	Secure		
283	Rhodora	*Rhododendron canadense*	S5	Secure		
283	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
283	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
283	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
283	Speckled Alder	*Alnus incana*	S5	Secure		
283	Tawny Cotton-Grass	*Eriophorum virginicum*	S5	Secure		
283	Teaberry	*Gaultheria procumbens*	S5	Secure		
283	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
283	Tussock Sedge	*Carex stricta*	S5	Secure		
283	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
283	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
283	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
285	a Blackberry	*Rubus sp.*	na	na		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
285	a Serviceberry	*Amelanchier sp.*	na	na		
285	a Willow	*Salix sp.*	na	na		
285	American Larch	*Larix laricina*	S5	Secure		
285	Balsam Fir	*Abies balsamea*	S5	Secure		
285	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
285	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
285	Black Spruce	*Picea mariana*	S5	Secure		
285	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
285	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
285	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
285	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
285	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
285	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
285	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
285	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
285	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
285	Dwarf Red Raspberry	*Rubus pubescens*	S5	Secure		
285	Field Horsetail	*Equisetum arvense*	S5	Secure		
285	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
285	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
285	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
285	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
285	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
285	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
285	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
285	Northern Starflower	*Trientalis borealis*	S5	Secure		
285	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
285	Quaking Aspen	*Populus tremuloides*	S5	Secure		
285	Red Maple	*Acer rubrum*	S5	Secure		
285	Red Raspberry	*Rubus idaeus*	S5	Secure		
285	Rough Horsetail	*Equisetum hyemale*	S3S4	Secure		
285	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
285	Royal Fern	*Osmunda regalis*	S5	Secure		
285	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
285	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
285	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
285	Speckled Alder	*Alnus incana*	S5	Secure		
285	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
285	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
285	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
285	Tussock Sedge	*Carex stricta*	S5	Secure		
285	Twinflower	*Linnaea borealis*	S5	Secure		
285	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
285	Whorled Aster	*Oclemena acuminata*	S5	Secure		
285	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
288	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
288	a Manna-grass	*Glyceria sp.*	na	na		
288	a Marsh St. John's Wort	*Triadenum sp.*	na	na		
288	A Sedge	*Carex gynandra*	S5	Secure		
288	American Larch	*Larix laricina*	S5	Secure		
288	Balsam Willow	*Salix pyrifolia*	S5	Secure		
288	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
288	Black Holly	*Ilex verticillata*	S5	Secure		
288	Black Spruce	*Picea mariana*	S5	Secure		
288	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
288	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
288	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
288	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
288	Brownish Sedge	*Carex brunnescens*	S5	Secure		
288	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
288	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
288	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
288	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
288	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
288	Gray Birch	*Betula populifolia*	S5	Secure		
288	Greater Bladder-Wort	*Utricularia macrorhiza*	S5	Secure		
288	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
288	Hidden-Fruited Bladderwort	*Utricularia geminiscapa*	S4	Secure		
288	Hoary Sedge	*Carex canescens*	S5	Secure		
288	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
288	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
288	Little Prickly Sedge	*Carex echinata*	S5	Secure		
288	Marsh Bedstraw	*Galium palustre*	S5	Secure		
288	Marsh Willow-Herb	*Epilobium palustre*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
288	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
288	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
288	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
288	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
288	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
288	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
288	Pussy Willow	*Salix discolor*	S5	Secure		
288	Red Maple	*Acer rubrum*	S5	Secure		
288	Rhodora	*Rhododendron canadense*	S5	Secure		
288	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
288	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
288	Shadbush	*Amelanchier interior*	S4S5	Secure		
288	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
288	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
288	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
288	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
288	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
288	Tussock Sedge	*Carex stricta*	S5	Secure		
290	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
290	a Manna-grass	*Glyceria sp.*	na	na		
290	a Sedge	*Carex sp.*	na	na		
290	a Serviceberry	*Amelanchier sp.*	na	na		
290	American Larch	*Larix laricina*	S5	Secure		
290	Balsam Fir	*Abies balsamea*	S5	Secure		
290	Balsam Willow	*Salix pyrifolia*	S5	Secure		
290	Black Holly	*Ilex verticillata*	S5	Secure		
290	Black Spruce	*Picea mariana*	S5	Secure		
290	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
290	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
290	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
290	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
290	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
290	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
290	Green Alder	*Alnus viridis*	S5	Secure		
290	Large-Tooth Aspen	*Populus grandidentata*	S5	Secure		
290	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
290	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
290	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
290	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
290	Northern Starflower	*Trientalis borealis*	S5	Secure		
290	Paper Birch	*Betula papyrifera*	S5	Secure		
290	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
290	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
290	Red Maple	*Acer rubrum*	S5	Secure		
290	Red Spruce	*Picea rubens*	S5	Secure		
290	Rhodora	*Rhododendron canadense*	S5	Secure		
290	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
290	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
290	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
290	Speckled Alder	*Alnus incana*	S5	Secure		
290	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
290	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
290	Twinflower	*Linnaea borealis*	S5	Secure		
290	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
290	Whorled Aster	*Oclemena acuminata*	S5	Secure		
290	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
292	Black Holly	*Ilex verticillata*	S5	Secure		
292	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
292	Brownish Sedge	*Carex brunnescens*	S5	Secure		
292	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
292	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
292	Hoary Sedge	*Carex canescens*	S5	Secure		
292	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
292	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
292	Northern Starflower	*Trientalis borealis*	S5	Secure		
292	Red Maple	*Acer rubrum*	S5	Secure		
292	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
292	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
292	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
292	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
292	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
294	a Blackberry	*Rubus sp.*	na	na		
294	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
294	American Bur-Reed	*Sparganium americanum*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
294	American Larch	*Larix laricina*	S5	Secure		
294	Balsam Willow	*Salix pyrifolia*	S5	Secure		
294	Blueflag	*Iris versicolor*	S5	Secure		
294	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
294	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
294	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
294	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
294	Eastern White Pine	*Pinus strobus*	S5	Secure		
294	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
294	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
294	Narrow-Leaf Burreed	*Sparganium angustifolium*	S5	Secure		
294	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
294	Red Maple	*Acer rubrum*	S5	Secure		
294	Rhodora	*Rhododendron canadense*	S5	Secure		
294	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
294	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
294	Speckled Alder	*Alnus incana*	S5	Secure		
294	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
294	Sweet Bayberry	*Myrica gale*	S5	Secure		
294	Tussock Sedge	*Carex stricta*	S5	Secure		
296	a Blackberry	*Rubus sp.*	na	na		
296	a Bur-reed	*Sparganium sp.*	na	na		
296	a Bur-reed	*Sparganium sp.*	na	na		
296	a hybrid White Panicled American-Aste	*Oclemena x blakei*	S4S5	Secure		
296	a Sedge	*Carex sp.*	na	na		
296	a Spikerush	*Eleocharis sp.*	na	na		
296	a Water-milfoil	*Myriophyllum sp.*	na	na		
296	Algae-Like Pondweed	*Potamogeton confervoides*	S4S5	Secure		
296	American Groundnut	*Apios americana*	S5	Secure		
296	American Larch	*Larix laricina*	S5	Secure		
296	American Water-Lily	*Nymphaea odorata*	S5	Secure		
296	Balsam Fir	*Abies balsamea*	S5	Secure		
296	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
296	Black Holly	*Ilex verticillata*	S5	Secure		
296	Blueflag	*Iris versicolor*	S5	Secure		
296	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
296	Bog Aster	*Oclemena nemoralis*	S5	Secure		
296	Bog Fern	*Thelypteris simulata*	S4S5	Secure		
296	Bog Rosemary	*Andromeda polifolia*	S5	Secure		
296	Brown-Fruited Rush	*Juncus pelocarpus*	S5	Secure		
296	Canada Goldenrod	*Solidago canadensis*	S5	Secure		
296	Canada Manna-Grass	*Glyceria canadensis*	S5	Secure		
296	Canada Rush	*Juncus canadensis*	S5	Secure		
296	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
296	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
296	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
296	Creeping Butter-Cup	*Ranunculus repens*	SNA	Exotic		
296	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
296	Eastern Poison Ivy	*Toxicodendron radicans*	S4	Secure		
296	Eastern White Pine	*Pinus strobus*	S5	Secure		
296	Field Horsetail	*Equisetum arvense*	S5	Secure		
296	Fringed Sedge	*Carex crinita*	S5	Secure		
296	Goldthread	*Coptis trifolia*	S5	Secure		
296	Hemlock Water-Parsnip	*Sium suave*	S5	Secure		
296	Hoary Sedge	*Carex canescens*	S5	Secure		
296	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
296	Least Spike-Rush	*Eleocharis acicularis*	S5	Secure		
296	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
296	Marsh St. John's Wort	*Triadenum virginicum*	S5	Secure		
296	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
296	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
296	Narrow-Leaf Burreed	*Sparganium angustifolium*	S5	Secure		
296	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
296	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
296	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
296	Northern Pitcher-Plant	*Sarracenia purpurea*	S5	Secure		
296	Northern Poison Oak	*Toxicodendron rydbergii*	S5	Secure		
296	Nuttall Pondweed	*Potamogeton epihydrus*	S5	Secure		
296	Oakes Pondweed	*Potamogeton oakesianus*	S4S5	Secure		
296	Panic Grass	*Dichanthelium acuminatum*	S5	Secure		
296	Pickerel Weed	*Pontederia cordata*	S5	Secure		
296	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
296	Purple Bladderwort	*Utricularia purpurea*	S5	Secure		
296	Red Maple	*Acer rubrum*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
296	Rhodora	*Rhododendron canadense*	S5	Secure		
296	Rice Cutgrass	*Leersia oryzoides*	S5	Secure		
296	Rough Bedstraw	*Galium asprellum*	S5	Secure		
296	Rough Bentgrass	*Agrostis scabra*	S5	Secure		
296	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
296	Roundleaf Sundew	*Drosera rotundifolia*	S5	Secure		
296	Royal Fern	*Osmunda regalis*	S5	Secure		
296	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
296	Seven-Angled Pipewort	*Eriocaulon aquaticum*	S5	Secure		
296	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
296	Shining Rose	*Rosa nitida*	S4	Secure		
296	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
296	Small Swollen Bladderwort	*Utricularia radiata*	S3	Secure		
296	Speckled Alder	*Alnus incana*	S5	Secure		
296	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
296	Sweet Bayberry	*Myrica gale*	S5	Secure		
296	Thread Rush	*Juncus filiformis*	S5	Secure		
296	Three-Leaved Rattlesnake-root	*Prenanthes trifoliolata*	S5	Secure		
296	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
296	Three-Way Sedge	*Dulichium arundinaceum*	S5	Secure		
296	Tussock Sedge	*Carex stricta*	S5	Secure		
296	Virginia Chainfern	*Woodwardia virginica*	S4	Secure		
296	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
296	Water Lobelia	*Lobelia dortmanna*	S5	Secure		
296	Water Sedge	*Carex aquatilis*	S5	Secure		
296	Watershield	*Brasenia schreberi*	S5	Secure		
296	Whorled Aster	*Oclemena acuminata*	S5	Secure		
296	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
296	Woods-Rush	*Juncus subcaudatus*	S3	Sensitive		
296	Yellow Birch	*Betula alleghaniensis*	S5	Secure		
296	Yellow Pond-Lily	*Nuphar lutea*	S5	Secure		
303	a Hybrid Wood-fern	*Dryopteris x boottii*	SNA	Not Assessed		
303	a Sedge	*Carex sp.*	na	na		
303	Balsam Fir	*Abies balsamea*	S5	Secure		
303	Bartram Shadbush	*Amelanchier bartramiana*	S5	Secure		
303	Black Holly	*Ilex verticillata*	S5	Secure		
303	Black Spruce	*Picea mariana*	S5	Secure		
303	Blueflag	*Iris versicolor*	S5	Secure		
303	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
303	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
303	Brownish Sedge	*Carex brunnescens*	S5	Secure		
303	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
303	Climbing Nightshade	*Solanum dulcamara*	SNA	Exotic		
303	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
303	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
303	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
303	Dwarf Red Raspberry	*Rubus pubescens*	S5	Secure		
303	Eastern White Pine	*Pinus strobus*	S5	Secure		
303	Goldthread	*Coptis trifolia*	S5	Secure		
303	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
303	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
303	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
303	Marsh Bedstraw	*Galium palustre*	S5	Secure		
303	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
303	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
303	Northern Red Oak	*Quercus rubra*	S5	Secure		
303	Northern Starflower	*Trientalis borealis*	S5	Secure		
303	Paper Birch	*Betula papyrifera*	S5	Secure		
303	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
303	Red Maple	*Acer rubrum*	S5	Secure		
303	Red Spruce	*Picea rubens*	S5	Secure		
303	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
303	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
303	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
303	Speckled Alder	*Alnus incana*	S5	Secure		
303	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
303	Spreading Bentgrass	*Agrostis stolonifera*	S5	Secure		
303	Twinflower	*Linnaea borealis*	S5	Secure		
303	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
303	Virginia Rose	*Rosa virginiana*	S5	Secure		
303	Whorled Aster	*Oclemena acuminata*	S5	Secure		
303	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
303	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
304	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
304	a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed		
304	a Serviceberry	*Amelanchier sp.*	na	na		
304	American Fly-Honeysuckle	*Lonicera canadensis*	S5	Secure		
304	Balsam Fir	*Abies balsamea*	S5	Secure		
304	Black Holly	*Ilex verticillata*	S5	Secure		
304	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
304	Canada Hawkweed	*Hieracium canadense*	S4S5	Secure		
304	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
304	Creeping Butter-Cup	*Ranunculus repens*	SNA	Exotic		
304	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
304	Eastern White Pine	*Pinus strobus*	S5	Secure		
304	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
304	Farewell-Summer	*Symphyotrichum lateriflorum*	S5	Secure		
304	Hairy Sweet-Cicely	*Osmorhiza claytonii*	S4	Secure		
304	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
304	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
304	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
304	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
304	Northern Red Oak	*Quercus rubra*	S5	Secure		
304	Northern Starflower	*Trientalis borealis*	S5	Secure		
304	Paper Birch	*Betula papyrifera*	S5	Secure		
304	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
304	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
304	Red Maple	*Acer rubrum*	S5	Secure		
304	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
304	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
304	Spotted Jewel-Weed	*Impatiens capensis*	S5	Secure		
304	Stalk-Grain Sedge	*Carex stipata*	S5	Secure		
304	Tall Meadow-Rue	*Thalictrum pubescens*	S5	Secure		
304	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
304	White Turtlehead	*Chelone glabra*	S5	Secure		
304	Whorled Aster	*Oclemena acuminata*	S5	Secure		
304	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
304	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
306	American Fly-Honeysuckle	*Lonicera canadensis*	S5	Secure		
306	Balsam Fir	*Abies balsamea*	S5	Secure		
306	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
306	Black Spruce	*Picea mariana*	S5	Secure		
306	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
306	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
306	Brownish Sedge	*Carex brunnescens*	S5	Secure		
306	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
306	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
306	Eastern White Pine	*Pinus strobus*	S5	Secure		
306	Goldthread	*Coptis trifolia*	S5	Secure		
306	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
306	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
306	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
306	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
306	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
306	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
306	Northern Beech Fern	*Phegopteris connectilis*	S5	Secure		
306	Northern Red Oak	*Quercus rubra*	S5	Secure		
306	Northern Starflower	*Trientalis borealis*	S5	Secure		
306	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
306	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
306	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
306	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
306	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
306	Twinflower	*Linnaea borealis*	S5	Secure		
306	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
307	a Serviceberry	*Amelanchier sp.*	na	na		
307	American Fly-Honeysuckle	*Lonicera canadensis*	S5	Secure		
307	Balsam Fir	*Abies balsamea*	S5	Secure		
307	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
307	Goldthread	*Coptis trifolia*	S5	Secure		
307	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
307	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
307	Partridge-Berry	*Mitchella repens*	S5	Secure		
307	Red Maple	*Acer rubrum*	S5	Secure		
307	Robin Runaway	*Dalibarda repens*	S5	Secure		
307	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
307	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
307	Twinflower	*Linnaea borealis*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
312	Balsam Fir	*Abies balsamea*	S5	Secure		
312	Black Spruce	*Picea mariana*	S5	Secure		
312	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
312	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
312	Red Maple	*Acer rubrum*	S5	Secure		
312	Striped Maple	*Acer pensylvanicum*	S5	Secure		
312	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
312	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
314	a hybrid White Panicled American-Aster	*Oclemena x blakei*	S4S5	Secure		
314	a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed		
314	A Rush	*Juncus effusus var. solutus*	S5	Secure		
314	a Sedge	*Carex sp.*	na	na		
314	a Serviceberry	*Amelanchier sp.*	na	na		
314	American Water-Lily	*Nymphaea odorata*	S5	Secure		
314	Black Holly	*Ilex verticillata*	S5	Secure		
314	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
314	Bog Aster	*Oclemena nemoralis*	S5	Secure		
314	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
314	Bristly-Stalk Sedge	*Carex leptalea*	S5	Secure		
314	Brownish Sedge	*Carex brunnescens*	S5	Secure		
314	Canada Goldenrod	*Solidago canadensis*	S5	Secure		
314	Canada Hawkweed	*Hieracium canadense*	S4S5	Secure		
314	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
314	Climbing Nightshade	*Solanum dulcamara*	SNA	Exotic		
314	Common Dandelion	*Taraxacum officinale*	SNA	Exotic		
314	Creeping Butter-Cup	*Ranunculus repens*	SNA	Exotic		
314	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
314	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
314	Dwarf Red Raspberry	*Rubus pubescens*	S5	Secure		
314	Eastern White Pine	*Pinus strobus*	S5	Secure		
314	Field Horsetail	*Equisetum arvense*	S5	Secure		
314	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
314	Fowl Bluegrass	*Poa palustris*	S5	Secure		
314	Fowl Manna-Grass	*Glyceria striata*	S5	Secure		
314	Fringed Loosestrife	*Lysimachia ciliata*	S4	Secure		
314	Green-fruited Burreed	*Sparganium emersum*	S5	Secure		
314	Guelder-Rose Viburnum	*Viburnum opulus*	S5	Secure		
314	Hairy Willow-Herb	*Epilobium ciliatum*	S5	Secure		
314	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
314	Hoary Sedge	*Carex canescens*	S5	Secure		
314	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
314	Marsh Bedstraw	*Galium palustre*	S5	Secure		
314	Marsh Willow-Herb	*Epilobium palustre*	S5	Secure		
314	Meadow Hawkweed	*Hieracium caespitosum*	SNA	Exotic		
314	Narrow-Leaf Burreed	*Sparganium angustifolium*	S5	Secure		
314	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
314	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
314	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
314	Northern Starflower	*Trientalis borealis*	S5	Secure		
314	Nova Scotia False-Foxglove	*Agalinis neoscotica*	S3	Secure		
314	Pearly Everlasting	*Anaphalis margaritacea*	S5	Secure		
314	Pickerel Weed	*Pontederia cordata*	S5	Secure		
314	Red Maple	*Acer rubrum*	S5	Secure		
314	Red Raspberry	*Rubus idaeus*	S5	Secure		
314	Red Spruce	*Picea rubens*	S5	Secure		
314	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
314	Royal Fern	*Osmunda regalis*	S5	Secure		
314	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
314	Seven-Angled Pipewort	*Eriocaulon aquaticum*	S5	Secure		
314	Smooth Blackberry	*Rubus canadensis*	S5	Secure		
314	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
314	Speckled Alder	*Alnus incana*	S5	Secure		
314	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
314	Spreading Bentgrass	*Agrostis stolonifera*	S5	Secure		
314	Stalk-Grain Sedge	*Carex stipata*	S5	Secure		
314	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
314	Swamp Rose	*Rosa palustris*	S3	Secure		
314	Sweet Bayberry	*Myrica gale*	S5	Secure		
314	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
314	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
314	Virginia Rose	*Rosa virginiana*	S5	Secure		
314	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
314	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
314	Yellow Pond-Lily	*Nuphar lutea*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
316	a Bur-reed	*Sparganium sp.*	na	na		
316	a Bur-reed	*Sparganium sp.*	na	na		
316	a Serviceberry	*Amelanchier sp.*	na	na		
316	American Fly-Honeysuckle	*Lonicera canadensis*	S5	Secure		
316	Balsam Fir	*Abies balsamea*	S5	Secure		
316	Bebb's Willow	*Salix bebbiana*	S5	Secure		
316	Blueflag	*Iris versicolor*	S5	Secure		
316	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
316	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
316	Bristly-Stalk Sedge	*Carex leptalea*	S5	Secure		
316	Brittle-Stem Hempnettle	*Galeopsis tetrahit*	SNA	Exotic		
316	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
316	Broad-Leaved Twayblade	*Listera convallarioides*	S4	Secure		
316	Brownish Sedge	*Carex brunnescens*	S5	Secure		
316	Canada Goldenrod	*Solidago canadensis*	S5	Secure		
316	Climbing Nightshade	*Solanum dulcamara*	SNA	Exotic		
316	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
316	Creeping Butter-Cup	*Ranunculus repens*	SNA	Exotic		
316	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
316	Dwarf Red Raspberry	*Rubus pubescens*	S5	Secure		
316	Early Coralroot	*Corallorhiza trifida*	S3	Secure		
316	Field Horsetail	*Equisetum arvense*	S5	Secure		
316	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
316	Fowl Manna-Grass	*Glyceria striata*	S5	Secure		
316	Green Alder	*Alnus viridis*	S5	Secure		
316	Hairy Willow-Herb	*Epilobium ciliatum*	S5	Secure		
316	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
316	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
316	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
316	Mad Dog Skullcap	*Scutellaria lateriflora*	S5	Secure		
316	Marsh Blue Violet	*Viola cucullata*	S5	Secure		
316	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
316	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
316	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
316	Northern Mannagrass	*Glyceria laxa*	S4?	Secure		
316	Northern Red Oak	*Quercus rubra*	S5	Secure		
316	Northern Starflower	*Trientalis borealis*	S5	Secure		
316	Paper Birch	*Betula papyrifera*	S5	Secure		
316	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
316	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
316	Prairie Willow	*Salix humilis*	S5	Secure		
316	Pussy Willow	*Salix discolor*	S5	Secure		
316	Red Maple	*Acer rubrum*	S5	Secure		
316	Red Raspberry	*Rubus idaeus*	S5	Secure		
316	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
316	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
316	Small Bedstraw	*Galium trifidum*	S5	Secure		
316	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
316	Soft Rush	*Juncus effusus*	S5	Secure		
316	Spotted Jewel-Weed	*Impatiens capensis*	S5	Secure		
316	Swamp Loosestrife	*Lysimachia terrestris*	S5	Secure		
316	Sweet Bayberry	*Myrica gale*	S5	Secure		
316	Twinflower	*Linnaea borealis*	S5	Secure		
316	White Spruce	*Picea glauca*	S5	Secure		
316	White Turtlehead	*Chelone glabra*	S5	Secure		
316	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
316	Yellow Birch	*Betula alleghaniensis*	S5	Secure		
317	a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed		
317	Balsam Willow	*Salix pyrifolia*	S5	Secure		
317	Bebb's Willow	*Salix bebbiana*	S5	Secure		
317	Blueflag	*Iris versicolor*	S5	Secure		
317	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
317	Climbing Nightshade	*Solanum dulcamara*	SNA	Exotic		
317	Creeping Butter-Cup	*Ranunculus repens*	SNA	Exotic		
317	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
317	Dwarf Red Raspberry	*Rubus pubescens*	S5	Secure		
317	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
317	Field Horsetail	*Equisetum arvense*	S5	Secure		
317	Hairy Willow-Herb	*Epilobium ciliatum*	S5	Secure		
317	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
317	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
317	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
317	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
317	Northern Starflower	*Trientalis borealis*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
317	Oblong-Leaf Serviceberry	*Amelanchier canadensis*	S4?	Secure		
317	Paper Birch	*Betula papyrifera*	S5	Secure		
317	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
317	Prairie Willow	*Salix humilis*	S5	Secure		
317	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
317	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
317	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
317	Small Enchanter's Nightshade	*Circaea alpina*	S5	Secure		
317	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
317	Softleaf Sedge	*Carex disperma*	S5	Secure		
317	Speckled Alder	*Alnus incana*	S5	Secure		
317	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
317	Striped Maple	*Acer pensylvanicum*	S5	Secure		
317	Tall Meadow-Rue	*Thalictrum pubescens*	S5	Secure		
317	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
317	Twinflower	*Linnaea borealis*	S5	Secure		
317	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
317	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
317	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
317	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
318	a Serviceberry	*Amelanchier sp.*	na	na		
318	American Witch-Hazel	*Hamamelis virginiana*	S5	Secure		
318	Balsam Fir	*Abies balsamea*	S5	Secure		
318	Black Chokeberry	*Photinia melanocarpa*	S5	Secure		
318	Black Holly	*Ilex verticillata*	S5	Secure		
318	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
318	Black Spruce	*Picea mariana*	S5	Secure		
318	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
318	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
318	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
318	Eastern White Pine	*Pinus strobus*	S5	Secure		
318	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
318	Northern Red Oak	*Quercus rubra*	S5	Secure		
318	Northern Starflower	*Trientalis borealis*	S5	Secure		
318	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
318	Red Maple	*Acer rubrum*	S5	Secure		
318	Red Spruce	*Picea rubens*	S5	Secure		
318	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
318	Striped Maple	*Acer pensylvanicum*	S5	Secure		
318	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
318	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
318	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
321	A Sedge	*Carex gynandra*	S5	Secure		
321	Balsam Fir	*Abies balsamea*	S5	Secure		
321	Black Holly	*Ilex verticillata*	S5	Secure		
321	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
321	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
321	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
321	Gray Birch	*Betula populifolia*	S5	Secure		
321	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
321	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
321	Northern Starflower	*Trientalis borealis*	S5	Secure		
321	Paper Birch	*Betula papyrifera*	S5	Secure		
321	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
321	Red Maple	*Acer rubrum*	S5	Secure		
321	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
321	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
321	Speckled Alder	*Alnus incana*	S5	Secure		
321	White Spruce	*Picea glauca*	S5	Secure		
321	Whorled Aster	*Oclemena acuminata*	S5	Secure		
324	a Hybrid Wood-fern	*Dryopteris x triploidea*	SNA	Not Assessed		
324	Balsam Fir	*Abies balsamea*	S5	Secure		
324	Black Holly	*Ilex verticillata*	S5	Secure		
324	Bog Fern	*Thelypteris simulata*	S4S5	Secure		
324	Brownish Sedge	*Carex brunnescens*	S5	Secure		
324	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
324	Evergreen Woodfern	*Dryopteris intermedia*	S5	Secure		
324	Little Prickly Sedge	*Carex echinata*	S5	Secure		
324	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
324	Northern Starflower	*Trientalis borealis*	S5	Secure		
324	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
324	Red Maple	*Acer rubrum*	S5	Secure		
324	Speckled Alder	*Alnus incana*	S5	Secure		
324	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
324	Striped Maple	*Acer pensylvanicum*	S5	Secure		
324	Twinflower	*Linnaea borealis*	S5	Secure		
324	Whorled Aster	*Oclemena acuminata*	S5	Secure		
324	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
324	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
324	Yellow Birch	*Betula alleghaniensis*	S5	Secure		
325	a Bur-reed	*Sparganium sp.*	na	na		
325	a Bur-reed	*Sparganium sp.*	na	na		
325	A Sedge	*Carex gynandra*	S5	Secure		
325	a Serviceberry	*Amelanchier sp.*	na	na		
325	American Larch	*Larix laricina*	S5	Secure		
325	Balsam Fir	*Abies balsamea*	S5	Secure		
325	Black Spruce	*Picea mariana*	S5	Secure		
325	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
325	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
325	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
325	Brownish Sedge	*Carex brunnescens*	S5	Secure		
325	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
325	Cottongrass Bulrush	*Scirpus cyperinus*	S5	Secure		
325	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
325	Eastern White Pine	*Pinus strobus*	S5	Secure		
325	Emmons Sedge	*Carex albicans var. emmonsii*	S4	Secure		
325	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
325	Gray Birch	*Betula populifolia*	S5	Secure		
325	Green Alder	*Alnus viridis*	S5	Secure		
325	Hoary Sedge	*Carex canescens*	S5	Secure		
325	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
325	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
325	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
325	New England Sedge	*Carex novae-angliae*	S5	Secure		
325	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
325	Northern Starflower	*Trientalis borealis*	S5	Secure		
325	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
325	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
325	Quaking Aspen	*Populus tremuloides*	S5	Secure		
325	Red Raspberry	*Rubus idaeus*	S5	Secure		
325	Red Spruce	*Picea rubens*	S5	Secure		
325	Rhodora	*Rhododendron canadense*	S5	Secure		
325	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
325	Smooth Blackberry	*Rubus canadensis*	S5	Secure		
325	Smooth White Violet	*Viola macloskeyi*	S5	Secure		
325	Softleaf Sedge	*Carex disperma*	S5	Secure		
325	Speckled Alder	*Alnus incana*	S5	Secure		
325	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
325	Swamp Aster	*Symphyotrichum puniceum*	S5	Secure		
325	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
325	Twinflower	*Linnaea borealis*	S5	Secure		
325	White Ash	*Fraxinus americana*	S5	Secure		
325	White Turtlehead	*Chelone glabra*	S5	Secure		
325	White Wood-Sorrel	*Oxalis montana*	S5	Secure		
325	Whorled Aster	*Oclemena acuminata*	S5	Secure		
325	Wild Sarsaparilla	*Aralia nudicaulis*	S5	Secure		
325	Yellow Birch	*Betula alleghaniensis*	S5	Secure		
327	a Manna-grass	*Glyceria sp.*	na	na		
327	A Sedge	*Carex gynandra*	S5	Secure		
327	Allegheny Service-Berry	*Amelanchier laevis*	S5	Secure		
327	Balsam Fir	*Abies balsamea*	S5	Secure		
327	Black Holly	*Ilex verticillata*	S5	Secure		
327	Blue-Joint Reedgrass	*Calamagrostis canadensis*	S5	Secure		
327	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
327	Bristly Black Currant	*Ribes lacustre*	S5	Secure		
327	Bristly Dewberry	*Rubus hispidus*	S5	Secure		
327	Bristly-Stalk Sedge	*Carex leptalea*	S5	Secure		
327	Brownish Sedge	*Carex brunnescens*	S5	Secure		
327	Canada Goldenrod	*Solidago canadensis*	S5	Secure		
327	Climbing Nightshade	*Solanum dulcamara*	SNA	Exotic		
327	Common Woodrush	*Luzula multiflora*	S5	Secure		
327	Creeping Butter-Cup	*Ranunculus repens*	SNA	Exotic		
327	Dwarf Red Raspberry	*Rubus pubescens*	S5	Secure		
327	Field Horsetail	*Equisetum arvense*	S5	Secure		
327	Flat-Top Fragrant-Golden-Rod	*Euthamia graminifolia*	S5	Secure		
327	Fowl Bluegrass	*Poa palustris*	S5	Secure		
327	Green Alder	*Alnus viridis*	S5	Secure		
327	Hairy Willow-Herb	*Epilobium ciliatum*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
327	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
327	Hoary Sedge	*Carex canescens*	S5	Secure		
327	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
327	Little Prickly Sedge	*Carex echinata*	S5	Secure		
327	Marsh Bedstraw	*Galium palustre*	S5	Secure		
327	Meadow Hawkweed	*Hieracium caespitosum*	SNA	Exotic		
327	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
327	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
327	New York Fern	*Thelypteris noveboracensis*	S5	Secure		
327	Northern Red Oak	*Quercus rubra*	S5	Secure		
327	Northern Starflower	*Trientalis borealis*	S5	Secure		
327	Orchard Grass	*Dactylis glomerata*	SNA	Exotic		
327	Paper Birch	*Betula papyrifera*	S5	Secure		
327	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
327	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
327	Red Clover	*Trifolium pratense*	SNA	Exotic		
327	Red Maple	*Acer rubrum*	S5	Secure		
327	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
327	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
327	Soft Rush	*Juncus effusus*	S5	Secure		
327	Speckled Alder	*Alnus incana*	S5	Secure		
327	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
327	Spotted Jewel-Weed	*Impatiens capensis*	S5	Secure		
327	Sweet Vernal Grass	*Anthoxanthum odoratum*	SNA	Exotic		
327	Tall Meadow-Rue	*Thalictrum pubescens*	S5	Secure		
327	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
327	Virginia Strawberry	*Fragaria virginiana*	S5	Secure		
327	White Ash	*Fraxinus americana*	S5	Secure		
327	White Clover	*Trifolium repens*	SNA	Exotic		
327	White Spruce	*Picea glauca*	S5	Secure		
327	White Turtlehead	*Chelone glabra*	S5	Secure		
327	Whorled Aster	*Oclemena acuminata*	S5	Secure		
327	Wild Black Cherry	*Prunus serotina*	S5	Secure		
327	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		
335	Balsam Willow	*Salix pyrifolia*	S5	Secure		
335	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
335	Bristly-Stalk Sedge	*Carex leptalea*	S5	Secure		
335	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
335	Brownish Sedge	*Carex brunnescens*	S5	Secure		
335	Canada Hawkweed	*Hieracium canadense*	S4S5	Secure		
335	Canada Rush	*Juncus canadensis*	S5	Secure		
335	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
335	Common Labrador Tea	*Ledum groenlandicum*	S5	Secure		
335	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
335	Crested Shield-Fern	*Dryopteris cristata*	S5	Secure		
335	Dwarf Dogwood	*Cornus canadensis*	S5	Secure		
335	Eastern White Pine	*Pinus strobus*	S5	Secure		
335	Green Alder	*Alnus viridis*	S5	Secure		
335	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
335	Hoary Sedge	*Carex canescens*	S5	Secure		
335	Lady-Fern	*Athyrium filix-femina*	S5	Secure		
335	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
335	Marsh Cinquefoil	*Comarum palustre*	S5	Secure		
335	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
335	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
335	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
335	Northern Bugleweed	*Lycopus uniflorus*	S5	Secure		
335	Paper Birch	*Betula papyrifera*	S5	Secure		
335	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
335	Pickerel Weed	*Pontederia cordata*	S5	Secure		
335	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
335	Quaking Aspen	*Populus tremuloides*	S5	Secure		
335	Red Maple	*Acer rubrum*	S5	Secure		
335	Red Spruce	*Picea rubens*	S5	Secure		
335	Rhodora	*Rhododendron canadense*	S5	Secure		
335	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
335	Royal Fern	*Osmunda regalis*	S5	Secure		
335	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
335	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
335	Small Green Woodland Orchid	*Platanthera clavellata*	S5	Secure		
335	Spinulose Shield Fern	*Dryopteris carthusiana*	S5	Secure		
335	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
335	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
335	Wild Lily-of-The-Valley	*Maianthemum canadense*	S5	Secure		

Table 2 Vascular Plants Recorded Within Wetlands and Information on their Provincial Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
335	Yellow Pond-Lily	*Nuphar lutea*	S5	Secure		
336	a Serviceberry	*Amelanchier sp.*	na	na		
336	Balsam Fir	*Abies balsamea*	S5	Secure		
336	Balsam Willow	*Salix pyrifolia*	S5	Secure		
336	Bebb's Willow	*Salix bebbiana*	S5	Secure		
336	Black Holly	*Ilex verticillata*	S5	Secure		
336	Black Huckleberry	*Gaylussacia baccata*	S5	Secure		
336	Black Spruce	*Picea mariana*	S5	Secure		
336	Bog Goldenrod	*Solidago uliginosa*	S5	Secure		
336	Bracken Fern	*Pteridium aquilinum*	S5	Secure		
336	Broad-Leaf Cattail	*Typha latifolia*	S5	Secure		
336	Cinnamon Fern	*Osmunda cinnamomea*	S5	Secure		
336	Creeping Snowberry	*Gaultheria hispidula*	S5	Secure		
336	Eastern White Pine	*Pinus strobus*	S5	Secure		
336	Green Alder	*Alnus viridis*	S5	Secure		
336	Hardhack Spiraea	*Spiraea tomentosa*	S5	Secure		
336	Heart-Leaved Paper Birch	*Betula papyrifera var. cordifolia*	S5	Secure		
336	Hoary Sedge	*Carex canescens*	S5	Secure		
336	Large Cranberry	*Vaccinium macrocarpon*	S5	Secure		
336	Late Lowbush Blueberry	*Vaccinium angustifolium*	S5	Secure		
336	Leatherleaf	*Chamaedaphne calyculata*	S5	Secure		
336	Marsh St. John's-Wort	*Triadenum fraseri*	S5	Secure		
336	Mountain Holly	*Nemopanthus mucronatus*	S5	Secure		
336	Narrow-Leaved Meadow-Sweet	*Spiraea alba*	S5	Secure		
336	New Belgium American-Aster	*Symphyotrichum novi-belgii*	S5	Secure		
336	Northern Bayberry	*Morella pensylvanica*	S5	Secure		
336	Parasol White-Top	*Doellingeria umbellata*	S5	Secure		
336	Possum-Haw Viburnum	*Viburnum nudum*	S5	Secure		
336	Pussy Willow	*Salix discolor*	S5	Secure		
336	Quaking Aspen	*Populus tremuloides*	S5	Secure		
336	Red Maple	*Acer rubrum*	S5	Secure		
336	Rhodora	*Rhododendron canadense*	S5	Secure		
336	Rough-Leaf Goldenrod	*Solidago rugosa*	S5	Secure		
336	Royal Fern	*Osmunda regalis*	S5	Secure		
336	Sensitive Fern	*Onoclea sensibilis*	S5	Secure		
336	Sheep-Laurel	*Kalmia angustifolia*	S5	Secure		
336	Shining Willow	*Salix lucida*	S5	Secure		
336	Small Cranberry	*Vaccinium oxycoccos*	S5	Secure		
336	Soft Rush	*Juncus effusus*	S5	Secure		
336	Three-Seed Sedge	*Carex trisperma*	S5	Secure		
336	Velvetleaf Blueberry	*Vaccinium myrtilloides*	S5	Secure		
336	Water Sedge	*Carex aquatilis*	S5	Secure		

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Wetland Class	# of Plant Communities	Plant Community 1	Plant Community 2	Plant Community 3	Plant Community 4	Plant Community 5	Plant Community 6	Plant Species Richness	Plant Species At Risk or of Conservation Concern?	Dominant Exotic Plants?	Potential Invasive Plants?	Intensity of Disturbance	H	He	SI	G	M	D	I	Oh	II	IN	SD	S	E	Comments	Stressed Vegetation
5	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	33	No	No	No	M	Yes													Push off field off one side by high school, a few cut lines associated with moved [?]	
6	Swamp / Marsh	2	Graminoid Marsh	Medium Shrub Swamp	n/a	n/a	n/a	n/a	20	No	No	No	L								Yes						No obvious outflow, relatively stable now, away from road, very prone to drying in a absence of rain.	
8	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	25	No	No	No	L								Yes						Receives some subterrean flow from WL9 which is near to HWY 103	
9	Swamp	2	Mixed Treed Swamp	Tall Shrub Swamp	n/a	n/a	n/a	n/a	40	No	No	No	M							Yes	Yes						Receives runoff from HWY103, outflow of WL10 touches on one end its channelized and its berm may in part impound WL9	Dw
10	Swamp / Marsh	4	Coniferous Treed Swamp	Mixed Treed Swamp	Graminoid Marsh	Tall Shrub Swamp	n/a	n/a	80	No	No	No	H	Yes						Yes						Yes	Impounded by HWY, Infilling	Dw
12	Swamp	1	Cut-Over Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	70	No	No	No	H-M	Yes													Fed by drainage streamlet from WL9 and WL10	
13	Swamp	1	Deciduous Treed Swamp	n/a	n/a	n/a	n/a	n/a	26	No	No	No	L								Yes						May be receiving a bit more seepage and runoff from steep HWY 103 slope.	
16	Swamp	2	Mixed Treed Swamp	Cut-Over Mixed Treed Swamp	n/a	n/a	n/a	n/a	45	No	No	No	M	Yes													Upper North East end has past cutting, now young reginerafcon(?) - bit wetter, more diversity	Dw
18	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	24	No	No	No	L														No evidence of disturbance. Secondary albeit mature nature of trees suggests distant past cutting or other perturbance.	Dw
19	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	23	No	No	No	L														No evidence of disturbance.	
22	Marsh	1	Graminoid Marsh	n/a	n/a	n/a	n/a	n/a	16	No	No	No	M	Yes				Yes									in cut zone off the HWY, receives ditch flow from SI	
25	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	22	No	No	No	L														None other than poss. Distant past cutting.	Dw
26	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	17	No	No	No	M														In part receives surface seepage from push off area off the HWY.	
31	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	25	No	No	No	L							Yes							May have partly been formed by impoundment via HWY toc and poss. channel	Dw
34	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	11	No	No	No	M														Poss. Anth.	Dw
39	Swamp / Shallow Water	2	Aquatic Shallow Water	Tall Shrub Swamp	n/a	n/a	n/a	n/a	61	No	No	No	M							Yes							Pond shallow likely created by impoundment due to HWY 103	
40	Swamp	2	Coniferous Treed Swamp	Tall Shrub Swamp	n/a	n/a	n/a	n/a	58	No	No	No	L														Not much present disturbance	
49	Swamp / Shallow Water / Fen	5	Aquatic Shallow Water	Low Shrub Swamp	Tall Shrub Swamp	Graminoid Fen	Coniferous Treed Swamp	n/a	108	No	No	No	M	M		Yes				Yes					Yes		Infilling by HWY, old dam (not functioning), sedimentation from ditch, probably receives road salt inputs.	Dw
55	Swamp	2	Tall Shrub Swamp	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	32	No	No	No	M								Yes			Yes			Partially infilled by HWY (possibly created by HWY). Ditch drainage has altered hydrology.	
63	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	25	No	No	No	L														No evidence of disturbance.	
65	Swamp / Marsh	2	Mixed Shrub Swamp	Graminoid Marsh	n/a	n/a	n/a	n/a	23	No	No	No	H						Yes		Yes						Dug - out	

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Wetland Class	# of Plant Communities	Plant Community 1	Plant Community 2	Plant Community 3	Plant Community 4	Plant Community 5	Plant Community 6	Plant Species Richness	Plant Species At Risk or of Conservation Concern?	Dominant Exotic Plants?	Potential Invasive Plants?	Intensity of Disturbance	H	He	SI	G	M	D	I	Oh	II	IN	SD	S	E	Comments	Stressed Vegetation
68	Swamp / Shallow Water	2	Coniferous Treed Swamp	Moss Shallow Water	n/a	n/a	n/a	n/a	45	No	No	No	M	Yes					Yes	Yes							Partially cut, shallow water due to impoundment of HWY103	
80	Swamp	2	Low Shrub Swamp	Tall Shrub Swamp	n/a	n/a	n/a	n/a	58	No	No	No	H								Yes						Anthropogenic - dug out oit but well vegetated.	
82	Swamp	3	Cut-Over Mixed Treed Swamp	Coniferous Treed Swamp	Moss Swamp	n/a	n/a	n/a	40	No	No	No	H	Yes						Yes							HWY stops drainage - marsh caused by lack of drainage here.	
84	Swamp	2	Mixed Treed Swamp	Moss Swamp	n/a	n/a	n/a	n/a	49	No	No	No	H	Yes					Yes	Yes				Yes			Wetland partially infilled by HWY	
88	Swamp	3	Coniferous Treed Swamp	Coniferous Treed Bog	Tall Shrub Swamp	n/a	n/a	n/a	34	Yes	No	No	M							Yes							Wetland probably partially infilled by highway hydrology somewhat altered.	Dw
91	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	42	No	No	No	M														Western end of wetland crossed by old s road, Eastern end crossed by skidder trail.	
92	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	18	No	No	No	M	Yes													Wetland partially infilled on west side. Entire wetland harvested ~20 years ago	
93	Shallow Water / Marsh	2	Non-Vegetated Shallow Water	Graminoid Marsh	n/a	n/a	n/a	n/a	8	No	No	No	H														Wetland has developed in excavated hole.	
94	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	26	No	No	No	M	Yes					Yes								Most of wetland harvested ~20 years ago. Southern tip of wetland cut off by HWY - Increased damage.	
99	Swamp	2	Mixed Treed Swamp	Moss Swamp	n/a	n/a	n/a	n/a	44	No	No	No	H	Yes					Yes								Marsh has developed in cleared RoW.	Dw
102	Swamp	2	Coniferous Treed Swamp	Cut-Over Deciduous Treed Swamp	n/a	n/a	n/a	n/a	44	No	No	No	H	Yes							Yes						Hydrology of wetland altered. Wetter than normal.	Dw
103	Swamp / Marsh	2	Mixed Treed Swamp	Graminoid Marsh	n/a	n/a	n/a	n/a	28	No	No	No	H	Yes						Yes				Yes			Hydrology altered by HWY construction, marsh created during construction of HWY.	Dw
107	Swamp	2	Coniferous Treed Swamp	Tall Shrub Swamp	n/a	n/a	n/a	n/a	39	No	No	No	H	Yes						Yes							Tall shrub swamp developed in following impoundment caused by s road construction.	Dw
109	Marsh	1	Moss Marsh	n/a	n/a	n/a	n/a	n/a	6	No	No	No	H							Yes							Wetland created by removal of soil. Entirely anthropogenic.	
114	Bog / Swamp	2	Tall Shrub Bog	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	65	No	No	No	H							Yes							Partially infilled by HWY construction. Garbage dump on east side includes steel drums, gas tanks and car parts.	Dw
118	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	17	No	No	No	L											Yes			No obvious anthropogenic disturbance.	Dw
122	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	25	No	No	No	H	Yes	Yes												ATV traffic through wetland. Heavy rutting at one location.	Dw
125	Swamp	1	Graminoid Swamp	n/a	n/a	n/a	n/a	n/a	25	No	No	No	H	Yes	Yes												Regularly cleared and herbicided. ATV trail has rutted small are in middle of wetlands.	Dw
126	Swamp	1	Graminoid Swamp	n/a	n/a	n/a	n/a	n/a	31	No	No	No	H	Yes	Yes												Regularly cleared and herbicided. ATV trail has rutted small are in eastern end of wetlands.	Dw
127	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	38	No	No	No	M								Yes				Yes		Receives a now dry run off channel from steep HWY slope, may get a bit extra sediment, likely in part created by past highway slope.	Dw

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Wetland Class	# of Plant Communities	Plant Community 1	Plant Community 2	Plant Community 3	Plant Community 4	Plant Community 5	Plant Community 6	Plant Species Richness	Plant Species At Risk or of Conservation Concern?	Dominant Exotic Plants?	Potential Invasive Plants?	Intensity of Disturbance	H	He	Sl	G	M	D	I	Oh	Il	IN	SD	S	E	Comments	Stressed Vegetation
129	Swamp	2	Coniferous Treed Swamp	Cut-Over Mixed Treed Swamp	n/a	n/a	n/a	n/a	57	No	No	No	M	Yes													Southern tip of wetland crossed by highway	
131	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	33	No	No	No	L	Yes													Some old cut stumps visible but large trees present.	
135	Swamp	2	Coniferous Treed Swamp	Cut-Over Coniferous Treed Swamp	n/a	n/a	n/a	n/a	36	No	No	No	M	Yes						Yes							HWY affects drainage (pooling)	
138	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	25	No	No	No	M	Yes													Signs of old harvesting but not recent.	
141	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	45	No	No	No	L															
142	Swamp	2	Tall Shrub Swamp	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	46	No	No	No	M								Yes						HWY end wetter - likely receives H2O from HWY	
145	Swamp / Marsh	2	Tall Shrub Swamp	Graminoid Marsh	n/a	n/a	n/a	n/a	44	No	No	No	M	Yes					Yes		Yes						Cutting for ATV trail and drainage from ditch	
146	Fen/Swamp	3	Graminoid Dominated Fen (75%)	Mixed Treed Swamp (15%)	Tall Shrub Swamp (10%)	n/a	n/a	n/a	56	No	No	No	M														Infilling (construction of HWY 103)	
148	Swamp	3	Coniferous Treed Swamp (50%)	Tall Shrub Swamp (30%)	Moss Dominated Swamp (20%)	n/a	n/a	n/a	41	No	No	No	M			Y											Infilling (HWY 103) receives storm water from HWY	
149	Swamp	2	Coniferous Treed Swamp	Tall Shrub Swamp	n/a	n/a	n/a	n/a	26	No	No	No							Yes								Hydrology - altered by ditch drainage	
150	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	26	No	No	No	M			Y											Partially infilled by HWY 103 construction.	
153	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	28	No	No	No	M			Y											Partially infilled by HWY 103 construction.	
154	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	14	No	No	No	L														None evident.	
158	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	18	No	No	No	L														None evident.	
167	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	19	No	No	No	M														~30 yeas ago	
168	Swamp / Shallow Water	2	Non-Vegetated Shallow Water	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	17	No	No	No	H	Yes					Yes	Yes	Yes						Old cut stumps and shallow ditch along HWY	Other
169	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	20	No	No	No	M	Yes													Cut 40 years ago.	
172	Swamp / Shallow Water	2	Non-Vegetated Shallow Water	Mixed Shrub Swamp	n/a	n/a	n/a	n/a	22	No	No	No	M						Yes		Yes						Likely anthropogenic - high H2O fluctuation due to HWY.	
176	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	13	No	No	No	M								Yes						Boulders from HWY construction at edge	
178	Swamp	2	Tall Shrub Swamp	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	19	No	No	No	M							Yes	Yes						Large boulder from HWY at edge; likely receives input from HWY.	
183	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	33	No	No	No	H						Yes	Yes	Yes						Wetland is HWY ditch.	
185	Bog	1	Mixed Shrub Bog	n/a	n/a	n/a	n/a	n/a	30	No	No	No	L															
186	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	23	No	No	No	M						Yes	Yes	Yes						WL Likely in part anthropogenic due to HWY	
193	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	41	No	Yes	No	L	Yes							Yes						Past harvest. Possible inflow from near road or gw stream.	
202	Swamp	2	Mixed Treed Swamp	Low Shrub Swamp	n/a	n/a	n/a	n/a	63	No	No	No	L														Road edge near	
207	Swamp	2	Mixed Treed Swamp	Tall Shrub Swamp	n/a	n/a	n/a	n/a	36	No	No	No	M					Yes									Cutting back shrubs in area near road.	

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Wetland Class	# of Plant Communities	Plant Community 1	Plant Community 2	Plant Community 3	Plant Community 4	Plant Community 5	Plant Community 6	Plant Species Richness	Plant Species At Risk or of Conservation Concern?	Dominant Exotic Plants?	Potential Invasive Plants?	Intensity of Disturbance	H	He	SI	G	M	D	I	Oh	II	IN	SD	S	E	Comments	Stressed Vegetation
208	Swamp	2	Mixed Treed Swamp	Tall Shrub Swamp	n/a	n/a	n/a	n/a	25	No	No	No	H								Yes						Area seems to have gained ground water inputs and this killed and allowed to root larger trees.	Dw
210	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	24	No	No	No	M	Y													~20 yrs ago.	
211	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	22	No	No	No	H						Y								Wetland essentially ditch.	
215	Swamp	3	Coniferous Treed Swamp	Low Shrub Swamp	Cut-Over Coniferous Treed Swamp	n/a	n/a	n/a	40	No	No	No	M	Yes													Mostly cut-over.	
219	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	40	No	No	No	L	Y													~5% of area and skidder road.	
220	Swamp	2	Tall Shrub Swamp	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	34	No	No	No	M			Yes					Yes						Part near the road modified by road construction - stabilized succession. Inflows, mineral off ditch and road.	
221	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	34	No	No	No	M								Yes						Largely anthropogenic. Some drainage input from roadside ditch.	
222	Swamp / Marsh	2	Tall Shrub Swamp	Graminoid Marsh	n/a	n/a	n/a	n/a	41	No	No	No	L														Stabilize WL created on former scrape area and tracks off existing HWY.	
223	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	25	No	No	No	L														None evident.	
224	Swamp	2	Coniferous Treed Swamp	Tall Shrub Swamp	n/a	n/a	n/a	n/a	41	No	No	No	L								Yes						Relatively stable now, receives some through flow from.	
226	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	24	No	No	No	L															
227	Swamp / Shallow Water	2	Coniferous Treed Swamp	Non-Vegetated Shallow Water	n/a	n/a	n/a	n/a	22	No	No	No	L														No real current or recent disturbance, relatively young so past harvest.	
233	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	20	No	No	No	L															
234	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	20	No	No	No	L														None evident.	
244	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	21	No	No	No	L														None evident.	
248	Swamp	2	Mixed Treed Swamp	Cut-Over Mixed Treed Swamp	n/a	n/a	n/a	n/a	31	No	No	No	M	Yes													Within 10 years	
249	Swamp	2	Coniferous Treed Swamp	Cut-Over Coniferous Treed Swamp	n/a	n/a	n/a	n/a	36	Yes	No	No	M	Yes														
252	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	28	No	No	No	L															
253	Swamp	2	Mixed Treed Swamp	Cut-Over Mixed Treed Swamp	n/a	n/a	n/a	n/a	27	No	No	No	M	Yes														
259	Swamp	2	Mixed Treed Swamp	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	24	No	No	No	L															
261	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	13	No	No	No	L															

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Wetland Class	# of Plant Communities	Plant Community 1	Plant Community 2	Plant Community 3	Plant Community 4	Plant Community 5	Plant Community 6	Plant Species Richness	Plant Species At Risk or of Conservation Concern?	Dominant Exotic Plants?	Potential Invasive Plants?	Intensity of Disturbance	H	He	Sl	G	M	D	I	Oh	Il	IN	SD	S	E	Comments	Stressed Vegetation
262	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	44	No	No	No	L						Yes	Yes	Yes		Yes				Some pooling at S end due to HWY. Possible infilling at W end due to old road bed.	
267	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	25	No	No	No	L															
268	Swamp	2	Mixed Treed Swamp	Tall Shrub Swamp	n/a	n/a	n/a	n/a	38	No	No	No	L	Yes													Along N edge.	
270	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	37	No	No	No	M	Yes													Recent cutting along E edge.	
277	Swamp / Shallow Water	2	Mixed Treed Swamp	Moss Shallow Water	n/a	n/a	n/a	n/a	37	No	No	No	M	Yes					Yes	Yes	Yes						Shallow water in cut stumps; flooded at S end due to HWY.	Dw
283	Bog	1	Coniferous Treed Bog	n/a	n/a	n/a	n/a	n/a	37	No	No	No	L														Old road bed on W side but outside WL boundary - 10m	
285	Swamp / Marsh	2	Mixed Treed Swamp	Graminoid Marsh	n/a	n/a	n/a	n/a	46	No	No	No	M	Yes					Yes		Yes						Marsh component due to HWY.	
288	Swamp / Marsh	2	Tall Shrub Swamp	Graminoid Marsh	n/a	n/a	n/a	n/a	47	No	No	No	M							Yes						Yes	Likely resulted from past impoundment of drier WL many years ago	
290	Swamp	2	Coniferous Treed Swamp	Tall Shrub Swamp	n/a	n/a	n/a	n/a	38	No	No	No	M								Yes						A small road possibly impounds WL288 which might once have connected to upper TS portion of WL290 some drainage off the road.	
292	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	15	No	No	No	M								Yes						A push off berm on one end and rail line off other likely send water pooling here but either percolates through quiche.	
294	Swamp	1	Mixed Shrub Swamp	n/a	n/a	n/a	n/a	n/a	23	No	No	No	H							Yes							Culvert across road recently blocked by beaver, entire basin full to upland rim and beyond.	
296	Swamp / Shallow Water	4	Non-Vegetated Shallow Water	Low Shrub Swamp	Mixed Treed Swamp	Aquatic Shallow Water	n/a	n/a	85	Yes	No	No	L			Yes											Really little intrusion - litter from HWY. Salt likely negligible. Minor parking area 1 side	
303	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	42	No	No	No	L								Yes						An old drainage ditch leads through much of WL from off HWY103	
304	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	35	No	No	No	L													Yes	None to speak of, poss. mild "eutrohication"	
306	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	27	No	No	No	L								Yes						From past- from HWY a drainage channel directed to WL and push off mounds edge the east side and head.	
307	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	13	No	No	No	L															
312	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	8	No	No	No	L														None evident.	

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Wetland Number	Wetland Class	# of Plant Communities	Plant Community 1	Plant Community 2	Plant Community 3	Plant Community 4	Plant Community 5	Plant Community 6	Plant Species Richness	Plant Species At Risk or of Conservation Concern?	Dominant Exotic Plants?	Potential Invasive Plants?	Intensity of Disturbance	H	He	SI	G	M	D	I	Oh	II	IN	SD	S	E	Comments	Stressed Vegetation
314	Swamp / Shallow Water	2	Non-Vegetated Shallow Water	Tall Shrub Swamp	n/a	n/a	n/a	n/a	66	Yes	No	No	M								Yes						Mild possible beaver dam, inflow from ditch culverts or ditch streams.	
316	Swamp	2	Tall Shrub Swamp	Mixed Treed Swamp	n/a	n/a	n/a	n/a	57	Yes	Yes	No	M								Yes					Yes	The proximity of HWY 103 interchange and a side road likely have made more minerals and nutrients available.	
317	Swamp	2	Tall Shrub Swamp	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	37	No	No	No	M								Yes						The origin of the seep head stream and additional seeps off base of HWY 103 likely in part created on drainage hydrology of the WL.	
318	Swamp	1	Coniferous Treed Swamp	n/a	n/a	n/a	n/a	n/a	22	No	No	No	L														Little disturbance, mature, and recent minor cut line at south edge.	
321	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	18	No	No	No	L								Yes						road runs along one side, may have been past altered hydrology - stable now.	
324	Swamp	1	Mixed Treed Swamp	n/a	n/a	n/a	n/a	n/a	20	No	No	No	L															Dw
325	Swamp	3	Cut-Over Mixed Treed Swamp	Mixed Treed Swamp	Tall Shrub Swamp	n/a	n/a	n/a	47	No	No	No	H	Yes							Yes						cut-over relatively recently, old road, raised edge one side, HWY 103 push back may have original impoundment.	Dw
327	Swamp	1	Tall Shrub Swamp	n/a	n/a	n/a	n/a	n/a	55	No	Yes	No	L													Yes		
335	Swamp / Shallow Water	2	Non-Vegetated Shallow Water	Tall Shrub Swamp	n/a	n/a	n/a	n/a	41	No	No	No	M								Yes					Yes	Anthropogenic in origin. Fed by ditch flow off of highway, some nutrient input from road side possible.	
336	Shallow Water / Marsh	2	Moss Shallow Water	Graminoid Marsh	n/a	n/a	n/a	n/a	41	No	No	No	L								Yes						Area a scrape put from old road works. Runs out to ditch not in.	

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Wetland Number	Other	Comments	Vegetative Integrity	Comments	Interspersion of Vegetation and Water	Ratio	Vegetation Interpersion	Wetland Types (for Birds)	Bird Species At Risk or of Conservation Concern?	Comments	Amphibian Breeding Potential	Comments	Amphibian Breeding Potential - Fish Presence	Comments	Herpetile Overwintering	Comments	Logs?	Comments
5			High	Its not a very diverse WL, few pools.	n/a		n/a		Yes			Very poor for either class.	L		L	Minor poss. In stream for Green frog.		
6		None per say - vegetation seems adapted to water flux.	High		High	60:40:00	Low		No	Only small anthropogenic basin epherneral pool/marsh.	V	Marginal perhaps - none seen as had dried earlier.	L	No fish possible.	L	Might be possible for some to overwinter		
8	Minor Dead Fir	Minor	High		n/a		n/a		No		V	Very marginal, very small pools , no evidece observed.	L		L			
9		Possibly from some greater H2O inputs from HWY proximity and slight impoundment effect	Moderate		n/a		Low		No		V	The outflow stream of WL10 had some P.S.S egg	L		L	Minor potential for a green frog in flow.		
10			Moderate		High	50:50:00	Low		Yes		V PP		L		L			
12	Y (Trees).	Veg kept small via suppressive cutting.	Moderate		n/a		n/a		No		V	Very poor, limitied pools.	L					
13			High		n/a		n/a		No			Not likely.	L		L			
16		Stress apparently disease to genescence related largely in mature fir standing as snags.	Moderate		n/a		Low		Yes		V	Very minor sites at NE area end - otherwise none seen or evidence.	L		L	Unlikely to host permanent water hibernating amphibians.		
18		Some standing snags - not killed by water level fluctuation just disease or genescence	High	Not old growth in or in surrounding upland. No exotics noted.	n/a		n/a		No				L		L			
19			Moderate		n/a		n/a		Yes		V	Poor breeding site in the small exit flow pool.	L		L			
22		Marginal WL	Low		n/a		n/a		No			Very very very poor. Likely could barely serve frogs on a very good year.	L					
25		Minor amounts, senesant conifer - not H2O stressed.	High		n/a		n/a		Yes		V	The slow flow pool stream fairly cold and poor for 4 toe.	L		L	Juv. And adult green frogs might overwinter in slow flow		
26			High		n/a		n/a		No		V	Has small shallow pools, possible for 4 toes, none found	L		L			
31	Appears To Be Largely Fir Likely Dead Of Disease	Largely dead fir, not drowned, abundant and young for when ?	Moderate		n/a		n/a		No			No pools.	L	But no real aquatic stage amphib habitat.				
34		Alder dying a little cposs via wet briefly then dry	Moderate		n/a		n/a		No		V	Unlikely to marginal - tidal pools dry early - possibly good for frog - no evidence	L					
39		Not at all in the existing WL	High		High	50%	Low	Sw	No	Old beaver presence, HWY impoundment, had 5 or 6 black duck.	PP	Green frogs seen, possible mink frog, peepers, no tadpole	M	Some evidence of fish - perhaps banded killfish.	M	Diifficult to say - some relatively shallow and some deeper spots. Frog population not huge.	Yes	Many have "gardens" of veg growing.
40			High		n/a		Low	Sw	Yes	Next to point of mill lake.	V PP	Marginal for vernal pool species.	L		H - L	High in take low in interior treed swamp.	Yes	Mostly rocks intake - some logs.
49		Some snags associated with hydrological alterations associated with old dam.	High		High	60:40:00	Low	Sw	Yes	Wetland occupies part of small lake.Low shrub swamp adjacent to shallow lake water.	PP	Shallow water of lake.	H	Fish observed.	H		Yes	Rocks provide good turtle resting areas. No turtles observed.
55			High		n/a		Low		Yes		V	Marginal habitat, no evidence of herpetiles.	M		L			
63			High		n/a		n/a		Yes			No open water.	L					
65			Low		Medium	80:20:00	Low		No		V		L		L			

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68			Moderate		n/a	50:50:00	Low		No		V		L		L			
80			Moderate		n/a		Medium		No		V		L		L			
82			Moderate		n/a		Medium		No		V		L		L			
84			Moderate		n/a		Low		Yes		V	Poor quality amphibian habitat.	L		L			
88			High		n/a		Low		Yes			No open water.	M					
91			Moderate		n/a		n/a		Yes		V	Poor quality amphibian habitat.	L		L			
92			Moderate		n/a		n/a		Yes		V	Low quality amphibian habitat. No herps observed.	L		L			
93			Moderate		n/a	0:01	Low		No	Very small <10 m across.	PP		L		M			
94			High		n/a		n/a		Yes			No open water.	L					
99		Some dead spruce at border between swamp and marsh.	Moderate		n/a	10:01	Low		No	Open water = narrrow ditch.	V	Poor quality amphibian habitat.	L		L			
102		Most mature Picen mariana are in poor condition or dying.	Moderate		n/a		Low		No			No pools.	L					
103		Relatively few dead trees.	Moderate		Medium	1:01	Low		No		V	Poor quality, pools draw down quickly.	L		L			
107	Some Picea Mariana In Poor Condition Due To Hydrology Changes		Moderate		n/a		Low		No	Area of open water very small and shallow.	V		L		L			
109			Low		Medium	5:01	n/a		No	Wetland is extremly small. No bird usage.	V	Peeper present in pools. Two peepers in amplexus.	L		L			
114	Acer Rubrum Red Leaves, Most Mature Picea Mariana Are In Very Poor Condition.	Vegetation stress caused by impoundment of wetland by HWY construction.	Moderate		n/a		Low		Yes		V PP	Relatively poor amphibian breeding habitat.	M		M			
118	Moderate Mortality Of Fir And Spruce	May be insect or wind related mortality.	High		n/a		n/a		Yes			No pools.	L					
122	Morphological Abnormalities In Some Plants Due To Herbicide Exposure.	y vegetation is periodically cleared and herbicided	Moderate		n/a		n/a		Yes		V	Pool subject to ATV traffic no amphibians present.	L		L			
125	Herbicide Induced Deformities In Some Plants.	Wetland located entirely within transmission line, cleared and herbicided regularly.	Moderate		n/a		n/a		No		V	Very poor amphibian habitat. No herps observed.	L		L			
126	Herbicide Induced Deformities In Some Plants.	Wetland located entirely within transmission line, cleared and herbicided regularly.	Moderate		n/a		n/a		No		V	Very poor amphibian habitat. No herps observed.	L		L			
127		Several old tall standing stumps/short snags - possible died from HWY in past altering hydrology. Present tree growth healthy.	Moderate		n/a		n/a		No			Likely non as insufficient pool depth and lake.	L		L	Likely non as insufficient pool depth and lake.		

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129			Moderate		n/a		Low		Yes		V	Poor quality amphibian habitat.	L		L			
131			High		n/a		n/a		Yes		V		L					
135			Moderate		n/a		Low		Yes			NO OPEN WATER	L					
138			Moderate		n/a		n/a		Yes			NO OPEN WATER	L					
141			High		n/a		n/a		Yes		V		L		L			
142			Moderate		n/a		Low		Yes		V		L		L			
145			Moderate	Marsh community reflection of drainage from HWY.	Medium		Medium		No	Some open water but too small for water fowl.	V PP		M		L			
146			High		n/a		Low	Sw	No		V PP		H		L			
148			Moderate		n/a		Low		No		V		L		L			
149			High		n/a		Low		Yes		V PP		M		L			
150			Moderate		n/a		n/a		No		V		L		L			
153			Moderate		n/a		n/a		Yes		V		L		L			
154			High		n/a		n/a		No		V		L		L			
158			High		n/a		n/a		No		V		L		L			
167			Moderate		n/a		n/a		Yes		V		L					
168	High Fluctuation In Water Due To Artificial Flooding.	Very limited plant growth in "shallow water" - dry during visit.	Low		n/a	0.479166667	Low		No	Not suitable for water fowl	V PP		L		L			
169			Moderate		n/a		n/a		No		V		L		L			
172		No veg except for marginal - high H2O fluctuation	Moderate		n/a	1:09	Low		Yes	Too small, ephemeral and shallow for waterfowl.	V		L		L			
176			Moderate		n/a		n/a		No		V		L					
178			Moderate		n/a		Low		Yes		V		L		L			
183			Moderate		n/a		n/a		No		V		L		L			
185			High		n/a		n/a	Sw	Yes	Bog with open water - beaver pond/stream.	V PP		M		H			
186			Moderate		n/a		n/a		Yes		V		L		L			
193			Low		n/a		n/a		No		V	Possible but no larvae observed or nesting, 4 toes found and 1 male frog.	L		L			
202		Some few	High		n/a		Low	Sw	Yes	Adjacent to lake potential for duck nesting.	PP	The lake. Pools in WL too scarce to really offer vernal pool sps.	L	Fish essentially do not enter into the few pools in the WL.	H - L	Low in WL for species, good for lake.		Rocks in lake.
207		Only near road - Alnuv viridis stressed by cutting.	Moderate		n/a		Low		Yes		V	Very few small pools - likely inadequate for vernal pool sps. None noted.	L			Insufficient for aquatic hibernations [?].		

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208		Change to hydrology has stressed and killed.	Moderate		n/a		Low		No		V	None seen, very cool water at the GW discharge site.	L		L	Possible for some.	Yes	
210			Moderate		n/a		n/a		No				L					
211			Moderate		n/a		n/a		No		V		L		L			
215			Moderate		n/a		Medium		Yes		V	Likely primarily vernal pool sps.	L		L			
219			High	Majority of WL undisturbed.	Low	99:1 (Stream)	Low		No		V		L		L			
220			Moderate		n/a		Medium		No		V	Pool breeding possible ut non really observed.	L		M	Flowing ditch stream and pools could offer aquatic hibernation site - but not ideal.		
221		No real stressed vegetation.	High		n/a		n/a		No		V	Small pools, large shallow pool, no 4-toed salamanders found, likely not deep enough or aerated to supply multi year larvae.	L		L			
222			Moderate		n/a		Low		No		V	Possible for vernal pool sps. Though none observed, might have dried.	L		L			
223			High		n/a		n/a	Sw	No	Next to lacustrine pond/river.	V PP		M	In water but not in swamp.	H		Yes	
224		Some minor dead .	High		n/a		Medium		No		V PP	Small potential for green frogs (present), very more likely though - no larvae noted.	L		L			
226			High		n/a		n/a	Sw	Yes	Edge a slower pool of the river, may be good for ducks.	PP	In pool of river e.g. green frog - none in WL, no pools.	L	No pools in WL		Not in WL but in river.		
227			Moderate		n/a		Low		No		V	Saw yellow spotted salamanders - likely frogs and spring peepers.	M	Trout from nearby river could likely get in but not good habitat.	L	Some possibility for green frog.		
233			High		n/a		n/a		No		V		L	N				
234			High		n/a		n/a		No		V		L					
244			High		n/a		n/a		No		V		L					
248			Moderate		n/a		Low		Yes		V		L		L			
249			Moderate	Surrounding forest clearcut	n/a		Low		Yes		V		L		L			
252			High		n/a		n/a		Yes		V		M	Stream through WL but good micro-separation.	L			
253			Moderate		n/a		Low		Yes		V		L		L			
259			High		n/a		Low		Yes		V		L		L			
261			High	But of minimal importance.	n/a		n/a		Yes		V		L		L			

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Other	Comments	Vegetative Integrity	Comments	Interspersion of Vegetation and Water	Ratio	Vegetation Interpersion	Wetland Types (for Birds)	Bird Species At Risk or of Conservation Concern?	Comments	Amphibian Breeding Potential	Comments	Amphibian Breeding Potential - Fish Presence	Comments	Herpetile Overwintering	Comments	Logs?	Comments
262			Moderate		n/a		n/a		No		V		L	N	L	N		N
267			High		n/a		n/a		Yes		V		L		L			
268			High	But marginal WL.	n/a		Low		No		V		L		L			
270			High		n/a		n/a		No		V		L		L			
277	Old Snags Cut-Off, Several Remain.		High		n/a	1:09	Low	Sw	Yes		V PP		M	Stream continues under culvert, fish present but predetray unknown.	H		Yes	
283			High		n/a		n/a		Yes		V		L		L			
285			Moderate		n/a		Low		Yes		V		L		L			
288		Not currently distressed other than shrubs and trees small due to high water table.	Moderate		n/a	2:01	Low	Fm	Yes	Relatively minimal but brood of 6+ black ducks using plus G Blue Heron wanted to come in.	V PP	Only Green frogs and peepers noted.	L		M			
290		Nothing significant	High		n/a		Low		No		V	Very poor potential in gen.	L		L	For aquatic hibernations.		
292		Veg such as 73, is about upper "ring" up basin area or on rocks	Moderate		n/a		n/a		No		V	Possibly very poor, all dry but rain refill small pools.	L		L			Logs present, stumps but not turtle habitat.
294	Veg Totally Sub Merged.	Shrubs/trees out of water not yet stressed - to soon but most will die.	Moderate	Very recent Beaver flood.	n/a		n/a	Sw	Yes	Flooded by beaver pond	PP	Green frogs all ready calling - habitat improved for them.	H	There are trout in the original stream.	H	Before the stream was okay for some Amphinians. Now a pond.		
296			Moderate		Medium	30:80	Medium	Sw	Yes	Lake shore swamp and pools - good for Ducks etc.	V PP	Green frogs.	H	Some potential for micro spatial separation.	M		Yes	Juv. Panted turtle seen. Rocks present.
303			High		n/a		n/a		Yes		V	No 4 toes found, no other species seen.	L		L			
304			Moderate		n/a		n/a		No	Is next to lake but no use by waterfowl.			L					
306			High		n/a		n/a		No	isad, to Sawler lake but not good for water fowl habitat.	V	Very poor potential, relatively few pools.	L		L			
307			High		n/a		n/a		No			No pools.	L			Just maybe terrestrial species.		
312			High		n/a		n/a		No		V		L					

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Other	Comments	Vegetative Integrity	Comments	Interspersion of Vegetation and Water	Ratio	Vegetation Interpersion	Wetland Types (for Birds)	Bird Species At Risk or of Conservation Concern?	Comments	Amphibian Breeding Potential	Comments	Amphibian Breeding Potential - Fish Presence	Comments	Herpetile Overwintering	Comments	Logs?	Comments
314			High		n/a	2:08	Low	Sw	No		PP	In take.	H		H	In take.		Not a lot but turtles can hold out.
316		Relatively minor.	Low	Ranunculus repens along with lesser amount of Solman dulcanara and other exotics.	n/a		Medium		No		V	None noted.	M	Predatory fish (trout) on the stream.	L	Some potential in the stream.		
317		Not much stressed vegetation.	Moderate		n/a		Low		No		V	Large leafy possible ephemeral pool at terminus [?] smaller pools. None noted.	L	Likely trout don't ascend into it despite relative proximity of maple lake out flow stream in WL16	L			
318			High	Except proximity to road a mature WL.	n/a		n/a		No			No pools.	L			Save for terrestrial sps.		
321	Minor Stress On Some Betula Papyrifera.	In the WL - likely not due to hydrology but possible.	High		n/a		n/a		No		V	Likely none - no good pools.	L	No real amphibian breeding habitat - trout in stream would not use.		No good pools, slight possibility in streamlet.		
324		Some snags but natural mortality unrelated to hydrology fluctuation.	High	May have cut-over in the past, relatively mature now.	n/a		n/a		Yes		V	Not much, most water stream - no good for pools.	L	Poor potential for Amphibian breeding / trout in stream.	L	Some frogs could maybe hibernate in stream pools but not ideal.		
325		Some standing snags but likely dead due to other than more water.	Moderate		n/a		Low		No		V	Not much noted other than a pickerel frog and off edges a smooth green snake and garden snake.	L	Unlikey brook trout come here.	L	But stream flow could accomadate some aquatic hibernators.		
327			Low	Mostly only due to dominance of Ranimcelis repeus along with Poapalustris in ground veg.	n/a		n/a		No		V	Very minimal for our species - no good side pools, lotic small stream.	M	Any pool amphibians would not have to really contend with small trout.	L	Mostly because no pools and stream not best for green frog.		
335			Moderate		n/a	99:01:00	Low		No		V	Possible for vernal, perhaps for PP but no evidence.	L		L	May tend to winterkill due to decaying algae etc., but flow suggests possible.		
336			Moderate		n/a	60:40:00	Low		No		V PP	frogs and green frog larvae observed.	L		H			

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Herpetiles At Risk or of Conservation Concern?	Otter Potential?	Mink Potential?	Muskrat Potential?	Beaver Potential?	Mammals At Risk or of Conservation Concern?	Fish Habitat	Comments	Comments	Fish Observed	Fish Species Observed
5	No	No	No	No	No	No	Negligible	Likely not but brook trout might get up in stream.		No	
6	No	No	No	No	No	No	Negligible			No	
8	No	No	No	No	No	No	Negligible			No	
9	No	No	No	No	No	No	Negligible			No	
10	No	No	No	No	No	No	Low			No	
12	No	No	No	No	No	No	Negligible			No	
13	No	No	No	No	No	No	Negligible			No	
16	No	No	No	No	No	No	Negligible			No	
18	No	No	No	No	No	No	Low			No	
19	No	No	No	No	No	No	Negligible			No	
22	No	No	No	No	No	No	Negligible			No	
25	No	No	No	No	No	No	Negligible			No	
26	No	No	No	No	No	No	Negligible			No	
31	No	No	No	No	No	No	Negligible			No	
34	No	No	No	No	No	No	Negligible			No	
39	No	No	Yes	Yes	Yes	No	High	Not commerical species.	relatively isolate.	Yes	Possible Banded Killfish
40	No	No	Yes	Yes	Yes	No	High	In lake.	In take.	Yes	Couldn't Tell, Minnow Like And Ospray King Fisher Both Looking.
49	No	Yes	Yes	Yes	Yes	No	High	Fish observed, Piscivovous birds present.		Yes	Probably Brook Trout And Banded Killfish.
55	No	No	No	No	No	No	Negligible			No	
63	No	No	No	No	No	No	Negligible			No	
65	No	No	No	No	No	No	Negligible			No	

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Herpetiles At Risk or of Conservation Concern?	Otter Potential?	Mink Potential?	Muskrat Potential?	Beaver Potential?	Mammals At Risk or of Conservation Concern?	Fish Habitat	Comments	Comments	Fish Observed	Fish Species Observed
68	No	No	No	No	No	No	Negligible			No	
80	No	No	No	No	No	No	Negligible			No	
82	No	No	No	No	No	No	Negligible			No	
84	No	No	No	No	No	No	Negligible			No	
88	No	No	No	No	No	No	Negligible			No	
91	No	No	No	No	No	No	Negligible			No	
92	No	No	No	No	No	No	Negligible			No	
93	No	No	No	No	No	No	Negligible			No	
94	No	No	No	No	No	No	Negligible			No	
99	No	No	No	No	No	No	Negligible			No	
102	No	No	No	No	No	No	Negligible			No	
103	No	No	No	No	No	No	Negligible			No	
107	No	No	No	No	No	No	Negligible			No	
109	No	No	No	No	No	No	Negligible			No	
114	No	No	No	No	No	No	Negligible			No	
118	No	No	No	No	No	No	Negligible			No	
122	No	No	No	No	No	No	Negligible			No	
125	No	No	No	No	No	No	Negligible			No	
126	No	No	No	No	No	No	Negligible			No	
127	No	No	Yes	No	No	No	High			No	

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Herpetiles At Risk or of Conservation Concern?	Otter Potential?	Mink Potential?	Muskrat Potential?	Beaver Potential?	Mammals At Risk or of Conservation Concern?	Fish Habitat	Comments	Comments	Fish Observed	Fish Species Observed
129	No	No	No	No	No	No	Negligible			No	
131	No	No	No	No	No	No	Low			No	
135	No	No	No	No	No	No	Low			No	
138	No	No	No	No	No	No	Negligible			No	
141	No	No	Yes	No	No	No	Moderate			No	
142	No	No	Yes	No	No	No	Moderate			No	
145	No	No	Yes	No	No	No	High		Connected to river via stream	No	
146	No	Yes	Yes	Yes	Yes	No	High			No	
148	No	No	No	No	No	No	Low			No	
149	No	No	No	No	No	No	Negligible			No	
150	No	No	No	No	No	No	Low			No	
153	No	No	No	No	No	No	Low			No	
154	No	No	No	No	No	No	Negligible		Subterranean flow only.	No	
158	No	No	No	No	No	No	Negligible			No	
167	No	No	Yes	No	No	No	Moderate			No	
168	No	No	Yes	No	No	No	Moderate			No	
169	No	No	Yes	No	No	No	Moderate			No	
172	No	No	Yes	No	No	No	Moderate			No	
176	No	No	No	No	No	No	Negligible			No	
178	No	No	Yes	No	No	No	Moderate			No	
183	No	No	No	No	No	No	Negligible			No	
185	No	No	Yes	No	Yes	No	High			No	
186	No	No	No	No	No	No	Negligible			No	
193	No	No	No	No	No	No	Negligible			No	
202	No	Yes	Yes	Yes	Yes	No	High		Not in WL, in lake	No	
207	No	No	No	No	No	No	Negligible			No	

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Herpetiles At Risk or of Conservation Concern?	Otter Potential?	Mink Potential?	Muskrat Potential?	Beaver Potential?	Mammals At Risk or of Conservation Concern?	Fish Habitat	Comments	Comments	Fish Observed	Fish Species Observed
208	No	No	No	No	No	No	Negligible			No	
210	No	No	No	No	No	No	Negligible			No	
211	No	No	No	No	No	No	Negligible		Ditch running through (WC?)	No	
215	No	No	No	No	No	No	Negligible			No	
219	No	No	Yes	No	No	No	High		Stream through WL edge but no real habitat.	No	
220	No	No	Yes	No	No	No	Moderate			No	
221	No	No	No	No	No	No	Low			No	
222	No	No	No	No	No	No	Negligible			No	
223	No	No	Yes	Yes	No	No	High			No	
224	No	No	Yes	No	No	No	Moderate			No	
226	No	No	Yes	Yes	Yes	No	High			No	Not In WI In River - Brook Trout.
227	No	No	No	No	No	No	Negligible		Bad place unless can get out.	No	Not In WI Pools, Definite Trout In Nearby Stream.
233	No	No	No	No	No	No	Negligible			No	
234	No	No	No	No	No	No	Negligible			No	
244	No	No	No	No	No	No	Negligible			No	
248	No	No	No	No	No	No	Negligible			No	
249	No	No	No	No	No	No	Negligible		Small outflow not suitable for fish (seepage).	No	
252	No	No	Yes	No	No	No	High		Stream channel only fish habitat.	No	
253	No	No	Yes	No	No	No	High		Stream channel through WL only potential fish habitat.	No	
259	No	No	No	No	No	No	Negligible			No	
261	No	No	No	No	No	No	Negligible		Intermittent strem but no haitat except for channel.	No	

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Herpetiles At Risk or of Conservation Concern?	Otter Potential?	Mink Potential?	Muskrat Potential?	Beaver Potential?	Mammals At Risk or of Conservation Concern?	Fish Habitat	Comments	Comments	Fish Observed	Fish Species Observed
262	No	No	No	No	No	No	Negligible		Stream through wetland but no fish habitat except for intermittant channel.	No	
267	No	No	No	No	No	No	Negligible			No	
268	No	No	No	No	No	No	Negligible			No	
270	No	No	No	No	No	No	Negligible		Stream runs through WL but inable to support except for treinsiants in channel.	No	
277	No	No	Yes	No	No	No	High			Yes	Unknown
283	No	No	No	No	No	No	Negligible			No	
285	No	No	No	No	No	No	Negligible			No	
288	No	No	No	No	No	No	Negligible			No	
290	No	No	No	No	No	No	Negligible			No	
292	No	No	No	No	No	No	Negligible			No	
294	No	No	Yes	No	Yes	No	High	Not for commercial species - likely for others.		Yes	Previous Year Brook Trout.
296	No	Yes	Yes	Yes	Yes	No	High	Not necessary for highly commercial species - inlets and pools connect to lakes.		Yes	Brook Trout, White Sucker, Banded Killfish, Gaspereau (Alewife), Stickleback, Possible Chub.
303	No	No	No	No	No	No	Negligible			No	
304	No	No	Yes	No	No	No	High			No	
306	No	No	No	No	No	No	Negligible			No	
307	No	No	No	No	No	No	Negligible			No	
312	No	No	No	No	No	No	Negligible			No	

Table 3 Wetland Functional Assessment Data (Wildlife-Related)

Wetland Number	Herpetiles At Risk or of Conservation Concern?	Otter Potential?	Mink Potential?	Muskrat Potential?	Beaver Potential?	Mammals At Risk or of Conservation Concern?	Fish Habitat	Comments	Comments	Fish Observed	Fish Species Observed
314	No	Yes	Yes	Yes	Yes	No	High	brook trout and possible salmonid in sream.		Yes	Brook Trout - Juvs And Possible Salminid.
316	No	No	Yes	No	No	No	High	Possible minor salmonid spawning in the stream.		Yes	Salmonids Including Brook Trout In Maple Lake's Outflow Stream.
317	No	No	No	No	No	No	Negligible			No	
318	No	No	No	No	No	No	Negligible			No	
321	No	No	Yes	No	No	No	High	Only to extent that young trout can ascend into the stream.		Yes	Small Brook Trout In Stream Just Below The WI, No Impediment To Then Entering Portion Of Stream In The WI.
324	No	No	Yes	No	No	No	High	Near culvert have seen brook trout spawning anf young trout.		Yes	Brook Trout
325	No	No	Yes	No	No	No	High			No	
327	No	No	Yes	No	No	No	High	Not great for spawning travel imbedded. Fine nursery for young trout.	Fish conifned to the small stream.	Yes	Brook Trout (203 Cm In Small < 1 M Wide 20 Cm Deep Stream).
335	No	No	No	No	No	No	Negligible			No	
336	No	No	No	No	No	No	Negligible		Potential for introduction(e.g. stickleback)	No	

Table 4 Birds Recorded Within or in Association with Wetlands and Information on their Population Status

Wetland Number	Common Name	Scientific Name	AC CDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
5	Common Raven	*Corvus corax*	S5	Secure		
5	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
5	Winter Wren	*Troglodytes troglodytes*	S5B	Secure		
8	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
9	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
9	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
10	Bay-breasted Warbler	*Dendroica castanea*	S3S4B	Sensitive		
10	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
10	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
10	Blue Jay	*Cyanocitta cristata*	S5	Secure		
10	Common Raven	*Corvus corax*	S5	Secure		
10	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
10	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
10	Rusty Blackbird	*Euphagus carolinus*	S2S3B	May Be At Risk		Special Concern
10	Song Sparrow	*Melospiza melodia*	S5B	Secure		
10	Swamp Sparrow	*Melospiza georgiana*	S5B	Secure		
12	Chestnut-sided Warbler	*Dendroica pensylvanica*	S5B	Secure		
12	Song Sparrow	*Melospiza melodia*	S5B	Secure		
12	Swamp Sparrow	*Melospiza georgiana*	S5B	Secure		
13	Ovenbird	*Seiurus aurocapillus*	S5B	Secure		
16	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
16	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
16	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
16	Hairy Woodpecker	*Picoides villosus*	S5	Secure		
16	Scarlet Tanager	*Piranga olivacea*	S2B	Undetermined		
16	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
19	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
25	Brown Creeper	*Certhia americana*	S5	Secure		
25	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
31	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
38	Common Raven	*Corvus corax*	S5	Secure		
39	American Black Duck	*Anas rubripes*	S5	Secure		
39	Belted Kingfisher	*Megaceryle alcyon*	S5B	Secure		
39	Blue-headed Vireo	*Vireo solitarius*	S5B	Secure		
39	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
39	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
39	Osprey	*Pandion haliaetus*	S5B	Secure		
39	Swamp Sparrow	*Melospiza georgiana*	S5B	Secure		
39	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
40	Belted Kingfisher	*Megaceryle alcyon*	S5B	Secure		
40	Common Grackle	*Quiscalus quiscula*	S5B	Secure		
40	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
40	Osprey	*Pandion haliaetus*	S5B	Secure		
40	Song Sparrow	*Melospiza melodia*	S5B	Secure		
40	Tree Swallow	*Tachycineta bicolor*	S4B	Sensitive		
49	American Black Duck	*Anas rubripes*	S5	Secure		
49	Barn Swallow	*Hirundo rustica*	S3B	Sensitive		
49	Belted Kingfisher	*Megaceryle alcyon*	S5B	Secure		
49	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
49	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
49	Blue-headed Vireo	*Vireo solitarius*	S5B	Secure		
49	Brown Creeper	*Certhia americana*	S5	Secure		
49	Canada Goose	*Branta canadensis*	SNAB,S4N	Secure		
49	Common Grackle	*Quiscalus quiscula*	S5B	Secure		
49	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
49	Double-crested Cormorant	*Phalacrocorax auritus*	S5B	Secure		Not at Risk
49	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
49	Hairy Woodpecker	*Picoides villosus*	S5	Secure		
49	Herring Gull	*Larus argentatus*	S4S5	Secure		
49	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
49	Osprey	*Pandion haliaetus*	S5B	Secure		
49	Song Sparrow	*Melospiza melodia*	S5B	Secure		
49	Swamp Sparrow	*Melospiza georgiana*	S5B	Secure		
49	Tree Swallow	*Tachycineta bicolor*	S4B	Sensitive		
49	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		

Table 4 Birds Recorded Within or in Association with Wetlands and Information on their Population Status

Wetland Number	Common Name	Scientific Name	AC CDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
49	Wood Duck	*Aix sponsa*	S4S5B	Secure		
49	Yellow-bellied Flycatcher	*Empidonax flaviventris*	S3S4B	Sensitive		
49	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
55	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
55	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
55	Blue-headed Vireo	*Vireo solitarius*	S5B	Secure		
55	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
55	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
55	Nashville Warbler	*Vermivora ruficapilla*	S5B	Secure		
55	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
55	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
63	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
63	Boreal Chickadee	*Poecile hudsonica*	S3	Sensitive		
63	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
68	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
68	Blue Jay	*Cyanocitta cristata*	S5	Secure		
68	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
68	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
68	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
80	American Robin	*Turdus migratorius*	S5B	Secure		
80	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
80	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
80	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
80	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
82	Broad-winged Hawk	*Buteo platypterus*	S4S5B	Secure		
82	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
82	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
82	Red-tailed Hawk	*Buteo jamaicensis*	S5	Secure		Not at Risk
82	Swamp Sparrow	*Melospiza georgiana*	S5B	Secure		
82	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
84	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
84	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
84	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
84	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
84	Pileated Woodpecker	*Dryocopus pileatus*	S5	Secure		
84	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
84	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
88	American Crow	*Corvus brachyrhynchos*	S5	Secure		
88	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
88	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
88	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
88	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
88	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
88	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
91	American Robin	*Turdus migratorius*	S5B	Secure		
91	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
91	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
91	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
92	Bay-breasted Warbler	*Dendroica castanea*	S3S4B	Sensitive		
92	Blackburnian Warbler	*Dendroica fusca*	S4B	Secure		
92	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
92	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
92	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
93	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
93	Pileated Woodpecker	*Dryocopus pileatus*	S5	Secure		
94	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
94	Common Raven	*Corvus corax*	S5	Secure		
94	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
94	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
94	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
99	American Robin	*Turdus migratorius*	S5B	Secure		
99	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
99	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
99	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
99	Lincoln's Sparrow	*Melospiza lincolnii*	S4B	Secure		

Table 4 Birds Recorded Within or in Association with Wetlands and Information on their Population Status

Wetland Number	Common Name	Scientific Name	AC CDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
99	Mourning Warbler	*Oporornis philadelphia*	S4B	Secure		
99	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
99	Ruby-throated Hummingbird	*Archilochus colubris*	S5B	Secure		
99	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
102	Alder Flycatcher	*Empidonax alnorum*	S5B	Secure		
102	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
102	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
102	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
102	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
102	Lincoln's Sparrow	*Melospiza lincolnii*	S4B	Secure		
102	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
102	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
102	Swamp Sparrow	*Melospiza georgiana*	S5B	Secure		
102	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
103	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
107	Alder Flycatcher	*Empidonax alnorum*	S5B	Secure		
107	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
107	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
107	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
107	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
107	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
107	Lincoln's Sparrow	*Melospiza lincolnii*	S4B	Secure		
107	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
107	Northern Parula	*Parula americana*	S5B	Secure		
107	Osprey	*Pandion haliaetus*	S5B	Secure		
107	Ovenbird	*Seiurus aurocapillus*	S5B	Secure		
107	Swainson's Thrush	*Catharus ustulatus*	S4S5B	Secure		
107	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
109	Alder Flycatcher	*Empidonax alnorum*	S5B	Secure		
109	American Robin	*Turdus migratorius*	S5B	Secure		
109	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
109	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
114	American Robin	*Turdus migratorius*	S5B	Secure		
114	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
114	Black-backed Woodpecker	*Picoides arcticus*	S3S4	Sensitive		
114	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
114	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
114	Cedar Waxwing	*Bombycilla cedrorum*	S5B	Secure		
114	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
114	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
114	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
114	Lincoln's Sparrow	*Melospiza lincolnii*	S4B	Secure		
114	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
114	Pileated Woodpecker	*Dryocopus pileatus*	S5	Secure		
114	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
114	Winter Wren	*Troglodytes troglodytes*	S5B	Secure		
114	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
118	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
118	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
118	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
118	Red-breasted Nuthatch	*Sitta canadensis*	S4S5	Secure		
122	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
122	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
122	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
122	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
125	Blackburnian Warbler	*Dendroica fusca*	S4B	Secure		
125	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
125	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
125	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
125	Nashville Warbler	*Vermivora ruficapilla*	S5B	Secure		
126	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
126	Blue-headed Vireo	*Vireo solitarius*	S5B	Secure		
126	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
126	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
126	Northern Flicker	*Colaptes auratus*	S5B	Secure		

Table 4 Birds Recorded Within or in Association with Wetlands and Information on their Population Status

Wetland Number	Common Name	Scientific Name	AC CDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
127	American Robin	*Turdus migratorius*	S5B	Secure		
127	Blackburnian Warbler	*Dendroica fusca*	S4B	Secure		
127	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
127	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
127	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
127	Swainson's Thrush	*Catharus ustulatus*	S4S5B	Secure		
127	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
129	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
129	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
129	Blue Jay	*Cyanocitta cristata*	S5	Secure		
129	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
129	Hairy Woodpecker	*Picoides villosus*	S5	Secure		
129	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
129	Swainson's Thrush	*Catharus ustulatus*	S4S5B	Secure		
129	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
131	Blackburnian Warbler	*Dendroica fusca*	S4B	Secure		
131	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
131	Boreal Chickadee	*Poecile hudsonica*	S3	Sensitive		
131	Brown Creeper	*Certhia americana*	S5	Secure		
131	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
131	Red-breasted Nuthatch	*Sitta canadensis*	S4S5	Secure		
131	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
131	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
131	Winter Wren	*Troglodytes troglodytes*	S5B	Secure		
131	Yellow-bellied Flycatcher	*Empidonax flaviventris*	S3S4B	Sensitive		
131	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
135	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
135	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
135	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
135	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
135	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
135	Nashville Warbler	*Vermivora ruficapilla*	S5B	Secure		
135	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
135	Purple Finch	*Carpodacus purpureus*	S4S5	Secure		
135	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
135	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
135	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
138	Blue Jay	*Cyanocitta cristata*	S5	Secure		
138	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
138	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
138	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
138	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
141	American Robin	*Turdus migratorius*	S5B	Secure		
141	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
141	Blue Jay	*Cyanocitta cristata*	S5	Secure		
141	Blue-headed Vireo	*Vireo solitarius*	S5B	Secure		
141	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
141	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
141	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
141	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
142	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
142	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
142	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
142	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
142	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
142	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
145	Alder Flycatcher	*Empidonax alnorum*	S5B	Secure		
145	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
145	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
145	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
145	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
146	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
146	Blue Jay	*Cyanocitta cristata*	S5	Secure		
146	Golden-crowned Kinglet	*Regulus satrapa*	S5	Sensitive		
148	Golden-crowned Kinglet	*Regulus satrapa*	S5	Sensitive		

Table 4 Birds Recorded Within or in Association with Wetlands and Information on their Population Status

Wetland Number	Common Name	Scientific Name	AC CDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
149	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
149	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
153	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
153	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
167	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
167	Blue-headed Vireo	*Vireo solitarius*	S5B	Secure		
167	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
167	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
169	Blackburnian Warbler	*Dendroica fusca*	S4B	Secure		
169	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
169	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
169	Blue-headed Vireo	*Vireo solitarius*	S5B	Secure		
169	Common Raven	*Corvus corax*	S5	Secure		
169	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
172	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
172	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
176	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
176	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
176	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
178	Black-throated Blue Warbler	*Dendroica caerulescens*	S5B	Secure		
178	Chestnut-sided Warbler	*Dendroica pensylvanica*	S5B	Secure		
178	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
178	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
183	American Robin	*Turdus migratorius*	S5B	Secure		
183	Blackburnian Warbler	*Dendroica fusca*	S4B	Secure		
183	Blue Jay	*Cyanocitta cristata*	S5	Secure		
185	American Goldfinch	*Carduelis tristis*	S5	Secure		
185	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
185	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
185	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
185	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
185	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
185	Hairy Woodpecker	*Picoides villosus*	S5	Secure		
185	Northern Parula	*Parula americana*	S5B	Secure		
185	Osprey	*Pandion haliaetus*	S5B	Secure		
185	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
185	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
185	Swamp Sparrow	*Melospiza georgiana*	S5B	Secure		
185	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
186	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
186	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
193	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
202	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
202	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
202	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
202	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
202	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
207	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
207	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
207	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
208	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
215	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
215	Boreal Chickadee	*Poecile hudsonica*	S3	Sensitive		
215	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
215	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
215	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
215	Spruce Grouse	*Falcipennis canadensis*	S5	Secure		
215	Winter Wren	*Troglodytes troglodytes*	S5B	Secure		
223	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
223	Hairy Woodpecker	*Picoides villosus*	S5	Secure		
224	American Robin	*Turdus migratorius*	S5B	Secure		
224	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
226	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
226	Canada Warbler	*Wilsonia canadensis*	S3B	At Risk		Threatened
226	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		

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Wetland Number	Common Name	Scientific Name	AC CDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
226	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
226	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
227	American Robin	*Turdus migratorius*	S5B	Secure		
227	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
233	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
233	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
233	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
233	Ovenbird	*Seiurus aurocapillus*	S5B	Secure		
248	American Crow	*Corvus brachyrhynchos*	S5	Secure		
248	Common Raven	*Corvus corax*	S5	Secure		
248	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
248	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
248	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
248	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
249	Alder Flycatcher	*Empidonax alnorum*	S5B	Secure		
249	American Goldfinch	*Carduelis tristis*	S5	Secure		
249	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
249	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
249	Nashville Warbler	*Vermivora ruficapilla*	S5B	Secure		
249	Northern Flicker	*Colaptes auratus*	S5B	Secure		
249	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
249	Purple Finch	*Carpodacus purpureus*	S4S5	Secure		
249	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
249	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
249	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
252	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
252	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
252	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
252	Ovenbird	*Seiurus aurocapillus*	S5B	Secure		
252	Purple Finch	*Carpodacus purpureus*	S4S5	Secure		
253	Blackburnian Warbler	*Dendroica fusca*	S4B	Secure		
253	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
253	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
253	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
253	Nashville Warbler	*Vermivora ruficapilla*	S5B	Secure		
253	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
253	Purple Finch	*Carpodacus purpureus*	S4S5	Secure		
253	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
253	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
259	Black-throated Blue Warbler	*Dendroica caerulescens*	S5B	Secure		
259	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
259	Blue Jay	*Cyanocitta cristata*	S5	Secure		
259	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
259	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
259	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
259	Northern Parula	*Parula americana*	S5B	Secure		
259	Ovenbird	*Seiurus aurocapillus*	S5B	Secure		
259	Purple Finch	*Carpodacus purpureus*	S4S5	Secure		
259	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
259	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
261	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
261	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
262	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
262	Blue Jay	*Cyanocitta cristata*	S5	Secure		
262	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
267	Blackburnian Warbler	*Dendroica fusca*	S4B	Secure		
267	Black-throated Blue Warbler	*Dendroica caerulescens*	S5B	Secure		
267	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
267	Ovenbird	*Seiurus aurocapillus*	S5B	Secure		
268	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
268	Ovenbird	*Seiurus aurocapillus*	S5B	Secure		
270	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		
270	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
270	Black-throated Blue Warbler	*Dendroica caerulescens*	S5B	Secure		
270	Blue Jay	*Cyanocitta cristata*	S5	Secure		

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Wetland Number	Common Name	Scientific Name	AC CDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
270	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
270	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
270	Nashville Warbler	*Vermivora ruficapilla*	S5B	Secure		
270	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
277	American Black Duck	*Anas rubripes*	S5	Secure		
277	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
277	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
277	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
277	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
277	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
277	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
277	Nashville Warbler	*Vermivora ruficapilla*	S5B	Secure		
277	Northern Flicker	*Colaptes auratus*	S5B	Secure		
277	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
277	Rusty Blackbird	*Euphagus carolinus*	S2S3B	May Be At Risk		Special Concern
277	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
277	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
279	American Black Duck	*Anas rubripes*	S5	Secure		
279	American Crow	*Corvus brachyrhynchos*	S5	Secure		
279	American Robin	*Turdus migratorius*	S5B	Secure		
279	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
279	Canada Warbler	*Wilsonia canadensis*	S3B	At Risk		Threatened
279	Cedar Waxwing	*Bombycilla cedrorum*	S5B	Secure		
279	Common Yellowthroat	*Geothlypis trichas*	S5B	Secure		
279	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
279	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
279	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
279	Purple Finch	*Carpodacus purpureus*	S4S5	Secure		
279	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
279	Rusty Blackbird	*Euphagus carolinus*	S2S3B	May Be At Risk		Special Concern
279	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
279	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
283	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
283	Canada Warbler	*Wilsonia canadensis*	S3B	At Risk		Threatened
283	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
283	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
283	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
283	Nashville Warbler	*Vermivora ruficapilla*	S5B	Secure		
283	Palm Warbler	*Dendroica palmarum*	S5B	Secure		
283	Ruby-crowned Kinglet	*Regulus calendula*	S4B	Sensitive		
283	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
283	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
285	American Robin	*Turdus migratorius*	S5B	Secure		
285	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
285	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
285	Magnolia Warbler	*Dendroica magnolia*	S5B	Secure		
285	Nashville Warbler	*Vermivora ruficapilla*	S5B	Secure		
285	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
288	American Black Duck	*Anas rubripes*	S5	Secure		
288	American Goldfinch	*Carduelis tristis*	S5	Secure		
288	Great Blue Heron	*Ardea herodias*	S4B	Secure		
288	Red-winged Blackbird	*Agelaius phoeniceus*	S4S5B	Secure		
288	Rusty Blackbird	*Euphagus carolinus*	S2S3B	May Be At Risk		Special Concern
288	Swamp Sparrow	*Melospiza georgiana*	S5B	Secure		
288	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
290	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
290	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
294	American Black Duck	*Anas rubripes*	S5	Secure		
294	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
294	Rusty Blackbird	*Euphagus carolinus*	S2S3B	May Be At Risk		Special Concern
294	Swamp Sparrow	*Melospiza georgiana*	S5B	Secure		
294	Tree Swallow	*Tachycineta bicolor*	S4B	Sensitive		
296	Cape May Warbler	*Dendroica tigrina*	S3?B	Sensitive		
296	Common Grackle	*Quiscalus quiscula*	S5B	Secure		
296	Great Blue Heron	*Ardea herodias*	S4B	Secure		

Table 4 Birds Recorded Within or in Association with Wetlands and Information on their Population Status

Wetland Number	Common Name	Scientific Name	AC CDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
296	Northern Parula	*Parula americana*	S5B	Secure		
296	Osprey	*Pandion haliaetus*	S5B	Secure		
296	Song Sparrow	*Melospiza melodia*	S5B	Secure		
303	Broad-winged Hawk	*Buteo platypterus*	S4S5B	Secure		
303	Cape May Warbler	*Dendroica tigrina*	S3?B	Sensitive		
303	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
304	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
306	American Crow	*Corvus brachyrhynchos*	S5	Secure		
306	Brown Creeper	*Certhia americana*	S5	Secure		
306	Dark-eyed Junco	*Junco hyemalis*	S4S5	Secure		
306	Hairy Woodpecker	*Picoides villosus*	S5	Secure		
306	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
306	Red-breasted Nuthatch	*Sitta canadensis*	S4S5	Secure		
307	Hermit Thrush	*Catharus guttatus*	S5B	Secure		
312	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
314	American Robin	*Turdus migratorius*	S5B	Secure		
314	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
314	Song Sparrow	*Melospiza melodia*	S5B	Secure		
317	American Robin	*Turdus migratorius*	S5B	Secure		
317	Black-throated Green Warbler	*Dendroica virens*	S4S5B	Secure		
318	Northern Parula	*Parula americana*	S5B	Secure		
321	Downy Woodpecker	*Picoides pubescens*	S5	Secure		
321	Hairy Woodpecker	*Picoides villosus*	S5	Secure		
324	Black-capped Chickadee	*Poecile atricapilla*	S5	Secure		
324	Golden-crowned Kinglet	*Regulus satrapa*	S4	Sensitive		
324	Hairy Woodpecker	*Picoides villosus*	S5	Secure		
324	Swainson's Thrush	*Catharus ustulatus*	S4S5B	Secure		
325	American Goldfinch	*Carduelis tristis*	S5	Secure		
325	Blue-headed Vireo	*Vireo solitarius*	S5B	Secure		
325	Mourning Dove	*Zenaida macroura*	S5	Secure		
325	Red-eyed Vireo	*Vireo olivaceus*	S5B	Secure		
325	White-throated Sparrow	*Zonotrichia albicollis*	S5B	Secure		
327	American Robin	*Turdus migratorius*	S5B	Secure		
327	Song Sparrow	*Melospiza melodia*	S5B	Secure		
327	Yellow-rumped Warbler	*Dendroica coronata*	S5B	Secure		
335	Black-and-White Warbler	*Mniotilta varia*	S4S5B	Secure		

Table 5 Herpetiles Recorded Within Wetlands and Information on their Population Status

Wetland Number	Common Name	Scientific Name	AC CDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
5	Redback Salamander	*Plethodon cinereus*	S5	Secure		
6	Common Garter Snake	*Thamnophis sirtalis*	S5	Secure		
6	Green Frog	*Rana clamitans*	S5	Secure		
9	Green Frog	*Rana clamitans*	S5	Secure		
9	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
9	Yellow Spotted Salamander	*Ambystoma maculatum*	S5	Secure		
10	American Toad	*Bufo americanus*	S5	Secure		
10	Common Garter Snake	*Thamnophis sirtalis*	S5	Secure		
10	Green Frog	*Rana clamitans*	S5	Secure		
10	Wood Frog	*Rana sylvatica*	S5	Secure		
12	Green Frog	*Rana clamitans*	S5	Secure		
12	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
16	Green Frog	*Rana clamitans*	S5	Secure		
16	Redback Salamander	*Plethodon cinereus*	S5	Secure		
19	Wood Frog	*Rana sylvatica*	S5	Secure		
25	Green Frog	*Rana clamitans*	S5	Secure		
25	Wood Frog	*Rana sylvatica*	S5	Secure		
29	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
31	Redback Salamander	*Plethodon cinereus*	S5	Secure		
39	Green Frog	*Rana clamitans*	S5	Secure		
39	Mink Frog	*Rana septentrionalis*	S5	Secure		
39	Northern Painted Turtle	*Chrysemys picta*	S5	Secure		
39	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
40	Common Garter Snake	*Thamnophis sirtalis*	S5	Secure		
40	Green Frog	*Rana clamitans*	S5	Secure		
49	American Toad	*Bufo americanus*	S5	Secure		
49	Green Frog	*Rana clamitans*	S5	Secure		
49	Redbelly Snake	*Storeria occipitomaculata*	S5	Secure		
49	Ringneck Snake	*Diadophis punctatus*	S5	Secure		
49	Smooth Green Snake	*Liochlorophis vernalis*	S5	Secure		
49	Snapping Turtle	*Chelydra serpentina*	S5	Secure		Special Concern
49	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
65	Green Frog	*Rana clamitans*	S5	Secure		
68	Green Frog	*Rana clamitans*	S5	Secure		
80	Green Frog	*Rana clamitans*	S5	Secure		
80	Pickerel Frog	*Rana palustris*	S5	Secure		Not at Risk
80	Wood Frog	*Rana sylvatica*	S5	Secure		
84	Green Frog	*Rana clamitans*	S5	Secure		
93	Green Frog	*Rana clamitans*	S5	Secure		
93	Yellow Spotted Salamander	*Ambystoma maculatum*	S5	Secure		
99	Green Frog	*Rana clamitans*	S5	Secure		
102	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
109	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
114	Green Frog	*Rana clamitans*	S5	Secure		
127	American Toad	*Bufo americanus*	S5	Secure		
129	Green Frog	*Rana clamitans*	S5	Secure		
129	Wood Frog	*Rana sylvatica*	S5	Secure		
142	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
145	Green Frog	*Rana clamitans*	S5	Secure		
145	Northern Painted Turtle	*Chrysemys picta*	S5	Secure		
146	Green Frog	*Rana clamitans*	S5	Secure		
149	Green Frog	*Rana clamitans*	S5	Secure		
178	Green Frog	*Rana clamitans*	S5	Secure		
183	Green Frog	*Rana clamitans*	S5	Secure		
185	American Toad	*Bufo americanus*	S5	Secure		
185	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
186	Wood Frog	*Rana sylvatica*	S5	Secure		
193	Wood Frog	*Rana sylvatica*	S5	Secure		
201	Green Frog	*Rana clamitans*	S5	Secure		
202	Green Frog	*Rana clamitans*	S5	Secure		
202	Redback Salamander	*Plethodon cinereus*	S5	Secure		
208	Green Frog	*Rana clamitans*	S5	Secure		
215	Green Frog	*Rana clamitans*	S5	Secure		
215	Wood Frog	*Rana sylvatica*	S5	Secure		
221	Green Frog	*Rana clamitans*	S5	Secure		
221	Redback Salamander	*Plethodon cinereus*	S5	Secure		
224	Common Garter Snake	*Thamnophis sirtalis*	S5	Secure		
224	Green Frog	*Rana clamitans*	S5	Secure		
225	Green Frog	*Rana clamitans*	S5	Secure		
227	Green Frog	*Rana clamitans*	S5	Secure		

Table 5 Herpetiles Recorded Within Wetlands and Information on their Population Status

Wetland Number	Common Name	Scientific Name	AC CDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
227	Wood Frog	*Rana sylvatica*	S5	Secure		
227	Yellow Spotted Salamander	*Ambystoma maculatum*	S5	Secure		
249	Green Frog	*Rana clamitans*	S5	Secure		
277	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
279	Green Frog	*Rana clamitans*	S5	Secure		
288	Green Frog	*Rana clamitans*	S5	Secure		
288	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
290	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
294	Green Frog	*Rana clamitans*	S5	Secure		
296	American Toad	*Bufo americanus*	S5	Secure		
296	Green Frog	*Rana clamitans*	S5	Secure		
296	Northern Painted Turtle	*Chrysemys picta*	S5	Secure		
296	Pickerel Frog	*Rana palustris*	S5	Secure		Not at Risk
298	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
302	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
305	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
306	Redback Salamander	*Plethodon cinereus*	S5	Secure		
314	Green Frog	*Rana clamitans*	S5	Secure		
314	Pickerel Frog	*Rana palustris*	S5	Secure		Not at Risk
318	Redback Salamander	*Plethodon cinereus*	S5	Secure		
324	Wood Frog	*Rana sylvatica*	S5	Secure		
325	Common Garter Snake	*Thamnophis sirtalis*	S5	Secure		
325	Pickerel Frog	*Rana palustris*	S5	Secure		Not at Risk
325	Smooth Green Snake	*Liochlorophis vernalis*	S5	Secure		
325	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
336	Common Garter Snake	*Thamnophis sirtalis*	S5	Secure		
336	Green Frog	*Rana clamitans*	S5	Secure		
336	Spring Peeper	*Pseudacris crucifer*	S5	Secure		
336	Wood Frog	*Rana sylvatica*	S5	Secure		

Table 6 Mammals Recorded Within Wetlands and Information on their Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
5	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
5	Snowshoe Hare	*Lepus americanus*	S5	Green		
5	Southern Red-backed Vole	*Myodes gapperi*	S5	Green		
12	Eastern Chipmunk	*Tamias striatus*	S5	Green		
12	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
16	Southern Red-backed Vole	*Myodes gapperi*	S5	Green		
16	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
18	North American Porcupine	*Erethizon dorsatum*	S5	Green		
31	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
34	Eastern Coyote	*Canis latrans*	S5	Green		
34	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
39	American Beaver	*Castor canadensis*	S5	Green		
39	Meadow Vole	*Microtus pennsylvanicus*	S5	Green		
39	Mink	*Neovison vison*	S5	Green		
39	Muskrat	*Ondatra zibethicus*	S5	Green		
39	Red Fox	*Vulpes vulpes*	S5	Green		
40	American Beaver	*Castor canadensis*	S5	Green		
40	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
40	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
49	American Beaver	*Castor canadensis*	S5	Green		
49	Muskrat	*Ondatra zibethicus*	S5	Green		
49	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
49	Snowshoe Hare	*Lepus americanus*	S5	Green		
49	Water Shrew	*Sorex palustris*	S5	Green		
49	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
50	American Beaver	*Castor canadensis*	S5	Green		
50	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
55	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
55	Snowshoe Hare	*Lepus americanus*	S5	Green		
55	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
63	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
63	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
65	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
88	Eastern Coyote	*Canis latrans*	S5	Green		
88	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
88	Snowshoe Hare	*Lepus americanus*	S5	Green		
92	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
94	Snowshoe Hare	*Lepus americanus*	S5	Green		
102	North American Porcupine	*Erethizon dorsatum*	S5	Green		
102	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
103	Snowshoe Hare	*Lepus americanus*	S5	Green		
107	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
107	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
114	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
118	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
118	Snowshoe Hare	*Lepus americanus*	S5	Green		
118	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
127	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
127	Snowshoe Hare	*Lepus americanus*	S5	Green		
129	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
131	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
135	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
135	Snowshoe Hare	*Lepus americanus*	S5	Green		
141	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
142	Snowshoe Hare	*Lepus americanus*	S5	Green		
146	American Beaver	*Castor canadensis*	S5	Green		
146	American Beaver	*Castor canadensis*	S6	Green		
146	Cinereus Shrew	*Sorex cinereus*	S6	Green		
146	White-tailed Deer	*Odocoileus virginianus*	S6	Green		
148	Snowshoe Hare	*Lepus americanus*	S5	Green		
148	White-tailed Deer	*Odocoileus virginianus*	S6	Green		
150	Snowshoe Hare	*Lepus americanus*	S5	Green		
172	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
176	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
185	American Beaver	*Castor canadensis*	S5	Green		
193	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
202	American Beaver	*Castor canadensis*	S5	Green		
210	Snowshoe Hare	*Lepus americanus*	S5	Green		
210	White-tailed Deer	*Odocoileus virginianus*	S6	Green		
215	Snowshoe Hare	*Lepus americanus*	S5	Green		

Table 6 Mammals Recorded Within Wetlands and Information on their Population Status

Wetland Number	Common Name	Scientific Name	ACCDC Rank	NSDNR Rank	NSESA Rank	COSEWIC Rank
215	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
223	Muskrat	*Ondatra zibethicus*	S5	Green		
226	American Beaver	*Castor canadensis*	S5	Green		
226	Muskrat	*Ondatra zibethicus*	S5	Green		
226	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
248	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
249	Snowshoe Hare	*Lepus americanus*	S5	Green		
252	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
259	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
268	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
288	Southern Red-backed Vole	*Myodes gapperi*	S5	Green		
288	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
292	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
292	Snowshoe Hare	*Lepus americanus*	S5	Green		
294	American Beaver	*Castor canadensis*	S5	Green		
294	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
296	American Beaver	*Castor canadensis*	S5	Green		
296	Muskrat	*Ondatra zibethicus*	S5	Green		
296	Northern River Otter	*Lutra canadensis*	S5	Green		
298	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
302	Snowshoe Hare	*Lepus americanus*	S5	Green		
303	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
306	Cinereus Shrew	*Sorex cinereus*	S5	Green		
306	Eastern Chipmunk	*Tamias striatus*	S5	Green		
306	Northern Raccoon	*Procyon lotor*	S5	Green		
306	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
307	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
314	American Beaver	*Castor canadensis*	S5	Green		
314	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		
314	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
317	White-tailed Deer	*Odocoileus virginianus*	S5	Green		
318	Red Squirrel	*Tamiasciurus hudsonicus*	S5	Green		

Table 7 Summary of Key Wildlife Functions Provided by the Assessed Wetlands.

Wetland Number	High Vegetation Integrity	High Vegetation Diversity	Waterfowl / Waterbird habitat	Herpetile Habitat	Mammal Habitat	Fish Habitat	Habitat for Species at Risk or of Conservation Concern
5	✓			✓			✓
6	✓			✓			
8	✓			✓			
9				✓			
10		✓		✓			✓
12		✓		✓			
13	✓						
16				✓			✓
18	✓						
19				✓			✓
22							
25	✓			✓			✓
26	✓			✓			
31				✓			
34				✓			
39	✓	✓	✓	✓	✓	✓	
40	✓		✓	✓	✓	✓	✓
49	✓	✓	✓	✓	✓	✓	✓
55	✓			✓			✓
63	✓						✓
65				✓			
68				✓			
80				✓			
82				✓			
84				✓			✓
88	✓						✓
91				✓			✓
92				✓			✓
93				✓			

Table 7 Summary of Key Wildlife Functions Provided by the Assessed Wetlands.

Wetland Number	High Vegetation Integrity	High Vegetation Diversity	Waterfowl / Waterbird habitat	Herpetile Habitat	Mammal Habitat	Fish Habitat	Habitat for Species at Risk or of Conservation Concern
94	✓						✓
99				✓			
102				✓			
103				✓			
107				✓			
109				✓			
114		✓		✓			✓
118	✓						✓
122				✓			✓
125				✓			
126				✓			
127				✓	✓	✓	
129				✓			✓
131	✓			✓			✓
135							✓
138							✓
141	✓			✓	✓	✓	✓
142				✓	✓	✓	✓
145				✓	✓	✓	
146	✓		✓	✓	✓	✓	
148				✓			
149	✓			✓			✓
150				✓			
153				✓			✓
154	✓			✓			
158	✓			✓			
167				✓	✓	✓	✓
168				✓	✓	✓	
169				✓	✓	✓	

Table 7 Summary of Key Wildlife Functions Provided by the Assessed Wetlands.

Wetland Number	High Vegetation Integrity	High Vegetation Diversity	Waterfowl / Waterbird habitat	Herpetile Habitat	Mammal Habitat	Fish Habitat	Habitat for Species at Risk or of Conservation Concern
172				✓	✓	✓	✓
176				✓			
178				✓	✓	✓	✓
183				✓			
185	✓		✓	✓	✓	✓	✓
186				✓			✓
193				✓			
202	✓	✓	✓	✓	✓	✓	✓
207				✓			✓
208				✓			
210							
211				✓			
215				✓			✓
219	✓			✓	✓	✓	
220				✓	✓	✓	
221	✓			✓			
222				✓			
223	✓		✓	✓	✓	✓	
224	✓			✓	✓	✓	
226	✓		✓	✓	✓	✓	✓
227				✓			
233	✓			✓			
234	✓			✓			
244	✓			✓			
248				✓			✓
249				✓			✓
252	✓			✓	✓	✓	✓
253				✓	✓	✓	✓
259	✓			✓			✓

Table 7 Summary of Key Wildlife Functions Provided by the Assessed Wetlands.

Wetland Number	High Vegetation Integrity	High Vegetation Diversity	Waterfowl / Waterbird habitat	Herpetile Habitat	Mammal Habitat	Fish Habitat	Habitat for Species at Risk or of Conservation Concern
261	✓			✓			✓
262				✓			
267	✓			✓			✓
268	✓			✓			
270	✓			✓			
277	✓		✓	✓	✓	✓	✓
283	✓			✓			✓
285				✓			✓
288			✓	✓			✓
290	✓			✓			
292				✓			
294			✓	✓	✓	✓	✓
296		✓	✓	✓	✓	✓	✓
303	✓			✓			✓
304					✓	✓	
306	✓			✓			
307	✓						
312	✓			✓			
314	✓	✓	✓	✓	✓	✓	✓
316				✓	✓	✓	✓
317				✓			
318	✓			✓			
321	✓			✓	✓	✓	
324	✓			✓	✓	✓	✓
325				✓	✓	✓	
327				✓	✓	✓	
335				✓			
336				✓			

Table 8 Summary of Hydrogeomorphological and Other Non-Wildlife Functions Provided by the Assessed Wetlands.

Wetland Number	Baseflow Maintenance	Stormwater management	Erosion control	Water Storage	Groundwater Recharge	Water Quality Improvement	Carbon Sequestration Potential	Food Chain Support	Social Function
5	✓	✓		✓			✓	✓	✓
6									
8		✓		✓		✓	✓		
9	✓	✓	✓			✓	✓	✓	
10	✓			✓			✓	✓	
12	✓			✓			✓	✓	
13	✓						✓		
16	✓			✓			✓	✓	
18	✓	✓			✓		✓	✓	
19	✓	✓					✓	✓	
22		✓		✓	✓	✓		✓	
25	✓	✓					✓	✓	
26	✓	✓				✓	✓		
31		✓				✓	✓		
34	✓	✓					✓		
39		✓	✓			✓		✓	
40	✓	✓	✓			✓	✓	✓	
49	✓		✓				✓	✓	
55	✓	✓	✓			✓	✓	✓	
63		✓				✓	✓		
65		✓		✓		✓	✓		
68		✓	✓			✓	✓		
80	✓	✓					✓	✓	
82	✓	✓	✓	✓		✓	✓	✓	
84	✓	✓		✓		✓	✓	✓	
88							✓	✓	
91		✓				✓	✓		✓
92	✓	✓			✓		✓		
93		✓		✓		✓			
94							✓		
99	✓						✓	✓	
102	✓	✓				✓	✓	✓	✓
103		✓				✓	✓		
107		✓		✓			✓		✓
109		✓				✓			
114	✓						✓	✓	✓
118		✓				✓	✓		
122		✓				✓	✓		✓
125						✓			
126									✓
127	✓	✓		✓		✓	✓	✓	
129	✓	✓					✓		✓
131	✓	✓					✓	✓	
135	✓	✓		✓	✓	✓	✓		
138	✓						✓		
141	✓			✓			✓	✓	
142	✓	✓		✓		✓	✓	✓	
145	✓		✓	✓		✓	✓	✓	✓
146	✓	✓	✓	✓		✓	✓	✓	
167		✓		✓		✓	✓		
148	✓	✓		✓		✓		✓	
169		✓		✓	✓	✓	✓	✓	
172		✓	✓	✓		✓			
176		✓				✓	✓		

Table 8 Summary of Hydrogeomorphological and Other Non-Wildlife Functions Provided by the Assessed Wetlands.

Wetland Number	Baseflow Maintenance	Stormwater management	Erosion control	Water Storage	Groundwater Recharge	Water Quality Improvement	Carbon Sequestration Potential	Food Chain Support	Social Function
149	✓	✓	✓	✓		✓	✓	✓	
183		✓		✓	✓	✓	✓		
150		✓		✓	✓	✓		✓	
186		✓		✓	✓	✓	✓		
153	✓	✓		✓	✓	✓		✓	
202				✓			✓	✓	
207		✓		✓			✓		
208				✓			✓	✓	
154		✓					✓	✓	
158		✓		✓			✓	✓	
168	✓		✓	✓		✓		✓	
222							✓		
178	✓	✓	✓	✓		✓	✓	✓	
226			✓			✓	✓	✓	✓
227		✓		✓		✓	✓		
185	✓						✓	✓	
193	✓	✓		✓			✓	✓	
210		✓					✓	✓	
211				✓			✓	✓	
215	✓	✓		✓		✓	✓	✓	
259							✓		✓
219	✓	✓	✓	✓		✓		✓	✓
220	✓	✓		✓		✓	✓	✓	
221	✓	✓	✓			✓	✓	✓	
223			✓			✓		✓	✓
224	✓			✓			✓	✓	
233	✓	✓					✓	✓	
283							✓		
285		✓				✓	✓		
288		✓		✓	✓	✓	✓	✓	
290		✓				✓	✓		
292		✓		✓			✓		
294			✓	✓		✓	✓	✓	
296			✓			✓			
303		✓				✓	✓		
234		✓		✓				✓	
244		✓		✓				✓	
307						✓	✓		✓
248	✓	✓		✓			✓	✓	✓
249	✓	✓		✓			✓	✓	✓
252	✓		✓	✓		✓	✓	✓	
318		✓				✓	✓		
253	✓						✓	✓	✓
261	✓	✓				✓	✓	✓	
262	✓	✓		✓		✓	✓	✓	
267	✓	✓				✓	✓		✓
268	✓	✓				✓	✓	✓	
270	✓	✓	✓	✓		✓	✓	✓	
277	✓	✓					✓	✓	
304	✓					✓	✓	✓	✓
306	✓	✓				✓	✓	✓	✓
312				✓			✓	✓	
314	✓	✓	✓	✓		✓		✓	
316	✓	✓	✓	✓		✓	✓	✓	

Table 8 Summary of Hydrogeomorphological and Other Non-Wildlife Functions Provided by the Assessed Wetlands.

Wetland Number	Baseflow Maintenance	Stormwater management	Erosion control	Water Storage	Groundwater Recharge	Water Quality Improvement	Carbon Sequestration Potential	Food Chain Support	Social Function
317	✓		✓	✓		✓	✓	✓	
321	✓		✓	✓		✓	✓	✓	✓
324	✓	✓	✓	✓		✓	✓	✓	
325	✓	✓				✓	✓	✓	
327	✓		✓		✓	✓	✓	✓	✓
335	✓		✓			✓		✓	
336	✓	✓		✓					

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Group	Class 1	Form 1	Type 1	Class 2	Form 2	Type 2	Class 3	Form 3	Type 3	Infill	Excavation	Compaction	Veg-Clearing
5	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
6	Swamp / Marsh	MARSH	FLAT (BASIN)	GRAMINOID MARSH (80%)	SWAMP	FLAT (BASIN)	MEDIUM SHRUB SWAMP (20%)	N/A	N/A	N/A	NO	NO	NO	NO
8	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
9	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP (95%)	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP (5%)	N/A	N/A	N/A	YES	NO	NO	NO
10	Swamp / Marsh	SWAMP	FLAT (BASIN)	CONIFEROUS TREED SWAMP (70%)	MARSH	FLAT (BASIN)	Mixed TREED SWAMP (10%)	N/A	N/A	N/A	YES	NO	NO	NO
12	Swamp	SWAMP	SLOPE	cut-over mixed TREED SWAMP	SWAMP	SLOPE	N/A	N/A	N/A	N/A	NO	NO	NO	YES
13	Swamp	SWAMP	SLOPE	DECIDUOUS TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
16	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	N/A	N/A	cut-over mixed TREED SWAMP	N/A	N/A	N/A	NO	NO	NO	NO
18	Swamp	SWAMP	FLAT (BASIN)	MIXED treed swamp	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
19	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
22	Marsh	MARSH	FLAT (BASIN)	GRAMINOID MARSH	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	YES
25	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
26	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
31	Swamp	SWAMP	FLAT (BASIN)	MIXED treed swamp	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
34	Swamp	SWAMP	FLAT (BASIN)	TALL shrub swamp	N/A	N/A	N/A	N/A	N/A	N/A	NO	YES	NO	NO
39	Swamp / Shallow Water	SHALLOW WATER	BASIN (ISOLATED)	AQUATIC SHALLOW WATER (86%)	SWAMP	RIPARIAN (LACUSTRINE)	TALL SHRUB SWAMP (12%)	N/A	N/A	N/A	YES	NO	NO	NO
40	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS TREED SWAMP (80%)	SWAMP	RIPARIAN (LACUSTRINE)	TALL SHRUB SWAMP (15%)	N/A	N/A	N/A	YES	NO	NO	NO
49	Swamp / Shallow Water / Fen	Shallow Water	BASIN WATER (LINKED)	AQUATIC SHALLOW WATER	SWAMP	RIPARIAN (LACUSTRINE)	LOW SHRUB SWAMP	Swamp	RIPARIAN (RIVERINE)	TALL SHRUB	YES	NO	NO	NO
55	Swamp	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP (60%)	SWAMP	RIPARIAN (RIVERINE)	CONIFEROUS TREED SWAMP(40%)	N/A	N/A	N/A	NO	NO	NO	NO
63	Swamp	SWAMP	FLAT (BASIN)	MIXED treed swamp	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
65	Swamp / Marsh	SWAMP	FLAT (BASIN)	MIXED SHRUB SWAMP (60%)	MARSH	BASIN	GRAMINOID MARSH (40%)	N/A	N/A	N/A	YES	NO	NO	NO
68	Swamp / Shallow Water	SWAMP	RIPARIAN (RIVERINE)	CONIFEROUS TREED SWAMP (80%)	SHALLOW WATER	BASIN (ISOLATED)	Moss SHALLOW WATER (20%)	N/A	N/A	N/A	YES	NO	NO	YES
80	Swamp	SWAMP	FLAT (BASIN)	LOW SHRUB SWAMP (70%)	N/A	N/A	TALL SHRUB SWAMP (30%)	N/A	N/A	N/A	NO	YES	NO	YES
82	Swamp	SWAMP	RIPARIAN (SHORE)	cut-over mixed TREED SWAMP (50%)	SWAMP	RIPARIAN (RIVERINE)	CONIFEROUS TREED SWAMP (35%)	N/A	N/A	N/A	YES	NO	NO	NO
84	Swamp	SWAMP	FLAT (BASIN)	MIXED treed swamp (80%)	SWAMP	BASIN	MOSS SWAMP (20%)	N/A	N/A	N/A	YES	NO	NO	NO
88	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS treed swamp (75%)	BOG	BASIN	CONIFEROUS treed bog (15%)	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB	NO	NO	NO	NO
91	Swamp	SWAMP	SLOPE	TALL SHRUB SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
92	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED swamp	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	YES
93	Shallow Water / Marsh	SHALLOW WATER	BASIN (ISOLATED)	non-vegetated SHALLOW WATER (80%)	MARSH	BASIN (ISOLATED)	GRAMINOID MARSH (20%)	N/A	N/A	N/A	NO	YES	NO	NO
94	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS treed swamp	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
99	Swamp	SWAMP	SLOPE	MIXED TREED SWAMP (80%)	SWAMP	FLAT (BASIN)	MOSS SWAMP (20%)	N/A	N/A	N/A	YES	NO	NO	YES
102	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS treed swamp (85%)	N/A	N/A	cut-over DECIDUOUS treed swamp (15%)	N/A	N/A	N/A	YES	NO	NO	NO
103	Swamp / Marsh	SWAMP	FLAT (BASIN)	MIXED TREED swamp (40%)	MARSH	BASIN	graminoid marsh (60%)	N/A	N/A	N/A	YES	NO	NO	NO

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Group	Class 1	Form 1	Type 1	Class 2	Form 2	Type 2	Class 3	Form 3	Type 3	Infill	Excavation	Compaction	Veg-Clearing
107	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS treed swamp (50%)	SWAMP	FLAT (BASIN)	TALL SHRUB SWAMP (50%)	N/A	N/A	N/A	YES	NO	NO	NO
109	Marsh	MARSH	BASIN (ISOLATED)	moss marsh	N/A	N/A	N/A	N/A	N/A	N/A	NO	YES	NO	NO
114	Bog / Swamp	BOG	FLAT (BASIN)	TALL SHRUB BOG (60%)	SWAMP	BASIN	CONIFEROUS treed swamp (40%)	N/A	N/A	N/A	YES	NO	NO	NO
118	Swamp	SWAMP	FLAT (BASIN)	MIXED treed swamp	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
122	Swamp	SWAMP	FLAT (BASIN)	TALL shrub swamp	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	YES	YES
125	Swamp	SWAMP	SLOPE	GRAMINOID SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	YES	YES
126	Swamp	SWAMP	SLOPE	GRAMINOID SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
127	Swamp	SWAMP	SLOPE	TALL SHRUB SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
129	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS treed swamp (80%)	N/A	N/A	cut-over mixed TREED swamp (20%)	N/A	N/A	N/A	NO	NO	NO	NO
131	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
135	Swamp	SWAMP	SLOPE	CONIFEROUS TREED SWAMP (90%)	N/A	N/A	cut-over coniferous TREED SWAMP (10%)	N/A	N/A	N/A	YES	NO	NO	NO
138	Swamp	SWAMP	SLOPE	CONIFEROUS TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
141	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
142	Swamp	SWAMP	FLAT (BASIN)	TALL SHRUB SWAMP (65%)	SWAMP	FLAT (BASIN)	CONIFEROUS TREED SWAMP (35%)	N/A	N/A	N/A	NO	NO	NO	NO
145	Swamp / Marsh	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP (75%)	MARSH	RIPARIAN (STREAM)	GRAMINOID MARSH (25%)	N/A	N/A	N/A	NO	NO	NO	NO
149	Swamp	SWAMP	RIPARIAN (RIVERINE)	CONIFEROUS TREED SWAMP (50%)	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP (50%)	N/A	N/A	N/A	YES	NO	NO	NO
167	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
168	Swamp / Shallow Water	SHALLOW WATER	RIPARIAN (RIVERINE)	non-vegetated SHALLOW WATER (70%)	SWAMP	RIPARIAN (RIVERINE)	CONIFEROUS TREED SWAMP (30%)	N/A	N/A	N/A	NO	NO	NO	NO
169	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
172	Swamp / Shallow Water	SHALLOW WATER	BASIN (ISOLATED)	non-vegetated SHALLOW WATER (90%)	SWAMP	RIPARIAN (LACUSTRINE)	MIXED SHRUB SWAMP (10%)	N/A	N/A	N/A	NO	NO	NO	NO
176	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
178	Swamp	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP (65%)	SWAMP	RIPARIAN (RIVERINE)	CONIFEROUS TREED SWAMP (35%)	N/A	N/A	N/A	YES	NO	NO	NO
183	Swamp	SWAMP	FLAT (BASIN)	TALL SHRUB SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
185	Bog	BOG	FLAT (BASIN)	MIXED SHRUB BOG	BOG	FLAT (BASIN)	N/A	BOG	RIPARIAN	MIXED SHRUB	NO	NO	NO	NO
186	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
193	Swamp	SWAMP	FLAT (BASIN)	TALL shrub swamp	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
202	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP (80%)	SWAMP	LACUSTRINE	LOW SHRUB SWAMP (15%)	N/A	N/A	N/A	YES	NO	NO	YES
207	Swamp	SWAMP	SLOPE	MIXED TREED SWAMP (70%)	N/A	N/A	TALL SHRUB SWAMP (30%)	N/A	N/A	N/A	NO	NO	NO	NO
208	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP (90%)	N/A	N/A	TALL SHRUB SWAMP (10%)	N/A	N/A	N/A	NO	NO	NO	NO
215	Swamp	SWAMP	SLOPE	CONIFEROUS TREED SWAMP (80%)	SWAMP	SLOPE	LOW SHRUB SWAMP (5%)	N/A	N/A	N/A	NO	NO	NO	NO
220	Swamp	SWAMP	SLOPE	TALL SHRUB SWAMP (40%)	N/A	N/A	CONIFEROUS TREED SWAMP (20%)	N/A	N/A	N/A	NO	NO	NO	NO
221	Swamp	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP (100%)	SWAMP	RIPARIAN (RIVERINE)	N/A	N/A	N/A	N/A	YES	NO	NO	NO
222	Swamp / Marsh	SWAMP	FLAT (BASIN)	TALL SHRUB SWAMP (75%)	MARSH	BASIN	GRAMINOID MARSH (25%)	N/A	N/A	N/A	NO	YES	NO	NO
224	Swamp	SWAMP	SLOPE	CONIFEROUS TREED SWAMP (65%)	SWAMP	SLOPE	TALL SHRUB SWAMP (35%)	N/A	N/A	N/A	NO	NO	NO	NO
226	Swamp	SWAMP	RIPARIAN (LACUSTRINE)	CONIFEROUS TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
227	Swamp / Shallow Water	SWAMP	FLAT (BASIN)	CONIFEROUS TREED SWAMP (70%)	SHALLOW WATER	BASIN (ISOLATED)	NON-VEGETATED SHALLOW WATER (30%)	N/A	N/A	N/A	NO	NO	NO	NO
233	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP (100%)	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Group	Class 1	Form 1	Type 1	Class 2	Form 2	Type 2	Class 3	Form 3	Type 3	Infill	Excavation	Compaction	Veg-Clearing
248	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP (50%)	N/A	N/A	cut-over mixed TREED SWAMP (50%)	N/A	N/A	N/A	NO	NO	NO	NO
249	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS TREED SWAMP (80%)	N/A	N/A	cut-over coniferous TREED SWAMP (20%)	N/A	N/A	N/A	YES	NO	NO	NO
252	Swamp	SWAMP	RIPARIAN (RIVERINE)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
253	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP (60%)	N/A	N/A	cut-over mixed TREED SWAMP (40%)	N/A	N/A	N/A	NO	NO	NO	NO
259	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP (60%)	N/A	N/A	CONIFEROUS TREED SWAMP (40%)	N/A	N/A	N/A	NO	NO	NO	NO
261	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
262	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	SWAMP	SLOPE	N/A	N/A	N/A	N/A	YES	NO	NO	NO
267	Swamp	SWAMP	SLOPE	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
268	Swamp	SWAMP	SLOPE	MIXED TREED SWAMP (90%)	N/A	N/A	TALL SHRUB SWAMP (10%)	N/A	N/A	N/A	YES	NO	NO	NO
270	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	SWAMP	RIPARIAN (RIVERINE)	N/A	N/A	N/A	N/A	YES	NO	NO	NO
277	Swamp / Shallow Water	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP (80%)	SHALLOW WATER	BASIN	Moss SHALLOW WATER (20%)	N/A	N/A	N/A	YES	NO	NO	NO
283	Bog	BOG	BASIN	Coniferous TREED BOG	N/A	N/A	N/A	N/A	N/A	N/A	YES	YES	NO	NO
285	Swamp / Marsh	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP (85%)	MARSH	BASIN	GRAMINOID MARSH (15%)	N/A	N/A	N/A	NO	NO	NO	YES
288	Swamp / Marsh	SWAMP	FLAT (BASIN)	TALL SHRUB SWAMP (70%)	MARSH	BASIN (ISOLATED)	GRAMINOID MARSH (30%)	N/A	N/A	N/A	YES	NO	NO	NO
290	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS treed swamp (90%)	SWAMP	FLAT (BASIN)	TALL shrub swamp (10%)	N/A	N/A	N/A	YES	NO	NO	NO
292	Swamp	SWAMP	N/A	TALL SHRUB SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
294	Swamp	SWAMP	RIPARIAN (RIVERINE)	MIXED SHRUB SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
296	Swamp / Shallow Water	SHALLOW WATER	LACUSTRINE (SHORE)	NON-VEGETATED SHALLOW WATER	SWAMP	RIPARIAN (LACUSTRINE)	LOW SHRUB SWAMP	SWAMP	RIPARIAN (LACUSTRINE)	MIXED TREED				
303	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS treed swamp (90%)	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
304	Swamp	SWAMP	SLOPE	CONIFEROUS TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
306	Swamp	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
307	Swamp	SWAMP	SLOPE	CONIFEROUS TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
314	Swamp / Shallow Water	SHALLOW WATER	LACUSTRINE (SHORE)	NON-VEGETATED SHALLOW WATER	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP	SWAMP	RIPARIAN (LACUSTRINE)	GRAMINOID	YES	NO	NO	NO
316	Swamp	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP (75%)	SWAMP	FLAT (BASIN)	MIXED TREED SWAMP (25%)	N/A	N/A	N/A	YES	NO	NO	NO
317	Swamp	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP (75%)	SWAMP	RIPARIAN (RIVERINE)	CONIFEROUS TREED SWAMP (25%)	N/A	N/A	N/A	YES	NO	NO	NO
318	Swamp	SWAMP	FLAT (BASIN)	CONIFEROUS TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	NO	NO	NO	NO
321	Swamp	SWAMP	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
324	Swamp	SWAMP	RIPARIAN (RIVERINE)	MIXED TREED SWAMP	N/A	N/A	N/A	N/A	N/A	N/A	YES	NO	NO	NO
325	Swamp	SWAMP	FLAT (BASIN)	cut-over mixed treed swamp (70%)	SWAMP	FLAT (BASIN)	MIXED treed swamp (27%)	N/A	N/A	N/A	YES	NO	NO	YES

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Group	Class 1	Form 1	Type 1	Class 2	Form 2	Type 2	Class 3	Form 3	Type 3	Infill	Excavation	Compaction	Veg-Clearing
327	Swamp	SWAMP	SLOPE	TALL SHRUB SWAMP	SWAMP	RIPARIAN (RIVERINE)	N/A	N/A	N/A	N/A	YES	NO	NO	YES
335	Swamp / Shallow Water	Shallow water	Basin	NON-VEGETATED SHALLOW WATER (80%)	Swamp	RIPARIAN (RIVERINE)	TALL SHRUB SWAMP (20%)	N/A	N/A	N/A	NO	NO	NO	NO
336	Shallow Water / Marsh	SHALLOW WATER	BASIN	MOSS SHALLOW WATER (65%)	MARSH	?	GRAMINOID MARSH (30%)	N/A	N/A	N/A	NO	NO	NO	NO
154		Swamp (100%)	Basin	Mixed Treed	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	No
158		Swamp (100%)	Basin	Mixed Treed	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	No
210		Swamp (100%)	Basin	Mixed Treed	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	No
211		Swamp (100%)	Basin	Mixed Treed	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	No
219		Swamp (100%)	Basin	Mixed Treed	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	Yes
223		Swamp (100%)	Lakeside	Mixed Treed	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	No
234		Swamp (100%)	Drainageway	Mixed Treed	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	No
244		Swamp (100%)	Drainageway	Mixed Treed	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	No
312		Swamp (100%)	Basin	Coniferous Treed	N/A	N/A	N/A	N/A	N/A	N/A	No	No	No	No
148		Swamp (50%)	Slope	Coniferous Treed	Swamp (30%)	Stream	Tall Shrub	Swamp (20%)	Slope	Moss	Yes	No	No	No
146		Fen (75%)	Stream	Graminoid (Sedge)	Swamp (15%)	Spring	Mixed Treed	Swamp (10%)	Riverine	Shrub (Tall)	Yes	No	No	No
150		Swamp (100%)	Slope	Coniferous Treed	N/A	N/A	N/A	N/A	N/A	N/A	Yes	No	No	No
153		Swamp (100%)	Slope	Tall Shrub	N/A	N/A	N/A	N/A	N/A	N/A	Yes	No	No	No

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Impoundment	Drainage	Other	Forest	Field	Bedrock	Shrub	Landscaped	Paved	Agriculture	Other	Adjacent Slope	Confined-Basin	Channel	Sloped	Riparian Riverine	Riparian Lacustrine	Floodplain	Concave	Convex
5	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE TO STEEP (SHORT)	YES	NO	NO	NO	NO	NO	NO	NO
6	NO	NO	DUG OUT	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	YES	NO
8	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE (SHORT)	YES	NO	NO	NO	NO	NO	NO	NO
9	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	TRANSMISSION LINE RoW	STEEP TO HWY - GENTLE TO MODERATE OTHERWISE (SHORT)	YES	NO	NO	YES	NO	NO	NO	NO
10	YES	NO	NO	YES	NO	NO	YES	NO	YES	NO	NO	GENTLE TO STEEP	YES	NO	NO	NO	NO	NO	NO	NO
12	NO	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE TO STEEP (LONG)	NO	YES	YES	NO	NO	NO	NO	NO
13	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE TO STEEP (LONG)	NO	NO	YES	NO	NO	NO	NO	NO
16	NO	NO	HARVESTED	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE TO STEEP	YES	NO	NO	NO	NO	NO	NO	NO
18	NO	NO	DISTURBED	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO STEEP	YES	NO	NO	NO	NO	NO	NO	NO
19	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE (SHORT)	YES	NO	NO	NO	NO	NO	NO	NO
22	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	Gentle	YES	NO	NO	NO	NO	NO	NO	NO
25	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE (LONG)	YES	NO	NO	NO	NO	NO	NO	NO
26	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE TO STEEP (SHORT)	YES	NO	NO	NO	NO	NO	NO	NO
31	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
34	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE TO STEEP (SHORT)	YES	NO	NO	NO	NO	NO	NO	NO
39	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE TO STEEP (LONG)	YES	NO	NO	NO	YES	NO	YES	NO
40	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE	YES	NO	NO	NO	NO	NO	NO	NO
49	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATELY STEEP (SHORT)	NO	NO	NO	NO	YES	NO	NO	NO
55	NO	NO	DEVELOPED	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO STEEP	NO	NO	NO	NO	NO	NO	NO	NO
63	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
65	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE (SHORT)	YES	NO	NO	NO	NO	NO	YES	NO
68	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO STEEP	YES	NO	NO	NO	NO	NO	NO	NO
80	NO	YES	NO	YES	NO	NO	YES	NO	NO	NO	NO	MODERATE (SHORT)	YES	NO	YES	NO	NO	NO	NO	NO
82	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE TO STEEP	NO	NO	NO	YES	NO	NO	NO	NO
84	NO	NO	HARVESTED	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO STEEP	YES	NO	NO	NO	NO	NO	NO	NO
88	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
91	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE	NO	NO	YES	NO	NO	NO	NO	NO
92	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
93	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	YES	NO
94	NO	NO	HARVESTED	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE	YES	NO	NO	NO	NO	NO	NO	NO
99	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	NO	NO	YES	NO	NO	NO	NO	NO
102	NO	NO	HARVESTED	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
103	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Impoundment	Drainage	Other	Forest	Field	Bedrock	Shrub	Landscaped	Paved	Agriculture	Other	Adjacent Slope	Confined-Basin	Channel	Sloped	Riparian Riverine	Riparian Lacustrine	Floodplain	Concave	Convex
107	NO	NO	HARVESTED	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
109	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO STEEP	YES	NO	NO	NO	NO	NO	YES	NO
114	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO STEEP	YES	NO	NO	NO	NO	NO	NO	NO
118	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO STEEP (LONG)	YES	NO	NO	NO	NO	NO	NO	NO
122	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
125	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE TO STEEP (LONG)	NO	NO	YES	NO	NO	NO	YES	NO
126	NO	NO	DISTURBED	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO STEEP	NO	NO	YES	NO	NO	NO	NO	NO
127	NO	NO	DISTURBED	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE	NO	YES	NO	NO	NO	NO	NO	NO
129	NO	NO	HARVESTED	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
131	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
135	NO	NO	NO	YES	NO	NO	YES	NO	YES	NO	NO	GENTLE TO MODERATE	NO	NO	YES	NO	NO	NO	NO	NO
138	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE (SHORT)	NO	NO	YES	NO	NO	NO	NO	NO
141	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE TO STEEP	YES	NO	YES	NO	NO	NO	NO	NO
142	NO	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	NO	YES	NO	NO	NO	NO	YES	NO
145	YES	NO	DISTURBED	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE TO STEEP (SHORT)	NO	NO	NO	YES	NO	NO	NO	NO
149	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	NO	YES	NO	YES	NO	NO	NO	NO
167	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE	YES	NO	NO	NO	NO	NO	NO	NO
168	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE	NO	NO	NO	YES	NO	NO	NO	NO
169	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE	YES	YES	NO	NO	NO	NO	NO	NO
172	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE (SHORT)	YES	NO	NO	NO	NO	NO	YES	NO
176	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE (SHORT)	YES	NO	NO	NO	NO	NO	YES	NO
178	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE (LONG)	NO	NO	NO	YES	NO	NO	NO	NO
183	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE (SHORT)	YES	NO	NO	NO	NO	NO	NO	NO
185	NO	NO	INUNDATION	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE (LONG)	YES	NO	NO	YES	NO	NO	NO	NO
186	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE	YES	NO	NO	NO	NO	NO	NO	NO
193	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE (SHORT)	YES	NO	NO	NO	NO	NO	NO	NO
202	YES	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	NO	NO	NO	NO	YES	NO	NO	NO
207	NO	NO	EXCAVATION	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE TO STEEP	NO	NO	YES	NO	NO	NO	NO	NO
208	NO	NO	DEVELOPED	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
215	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE	NO	YES	YES	NO	NO	NO	NO	NO
220	NO	NO	DITCH	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	NO	YES	YES	NO	NO	NO	NO	NO
221	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE (SHORT)	YES	NO	NO	YES	NO	NO	NO	NO
222	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE	NO	YES	NO	NO	NO	NO	YES	NO
224	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	NO	NO	NO	NO	NO	NO	YES	NO
226	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE (SHORT)	NO	NO	NO	NO	YES	NO	NO	NO
227	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE (SHORT)	YES	NO	NO	NO	NO	NO	YES	NO
233	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE (SHORT-LONG)	YES	NO	YES	NO	NO	NO	NO	NO

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Impoundment	Drainage	Other	Forest	Field	Bedrock	Shrub	Landscaped	Paved	Agriculture	Other	Adjacent Slope	Confined-Basin	Channel	Sloped	Riparian Riverine	Riparian Lacustrine	Floodplain	Concave	Convex
248	NO	NO	HARVESTED	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
249	NO	NO	HARVESTED	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
252	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE (SHORT-LONG)	NO	NO	NO	YES	NO	NO	NO	NO
253	NO	NO	HARVESTED	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
259	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE	YES	NO	NO	NO	NO	NO	NO	NO
261	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
262	NO	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
267	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE	NO	NO	YES	NO	NO	NO	NO	NO
268	NO	NO	HARVESTED	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO STEEP	NO	NO	YES	NO	NO	NO	NO	NO
270	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE (SHORT-LONG)	YES	NO	NO	YES	NO	NO	NO	NO
277	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO STEEP	YES	NO	NO	NO	NO	NO	NO	NO
283	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE (SHORT)	YES	NO	NO	NO	NO	NO	NO	NO
285	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE (SHORT)	YES	NO	NO	NO	NO	NO	NO	NO
288	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE (SHORT)	YES	NO	NO	NO	NO	NO	YES	NO
290	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
292	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	GENTLE TO MODERATE (SHORT)	YES	NO	NO	NO	NO	NO	YES	NO
294	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	PRIVATE ROAD	MODERATE (SHORT)	NO	NO	NO	YES	NO	NO	NO	NO
296																				
303	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE TO MODERATE (LONG)	YES	NO	NO	NO	NO	NO	NO	NO
304	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE TO STEEP (SHORT)	NO	NO	YES	NO	NO	NO	NO	NO
306	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE (LONG)	YES	NO	NO	NO	NO	NO	NO	NO
307	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE (LONG)	NO	NO	YES	NO	NO	NO	NO	NO
314	NO	NO	BEAVER DAM	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE TO STEEP (SHORT)	NO	NO	NO	YES	YES	NO	NO	NO
316	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE (LONG)	YES	NO	NO	YES	NO	NO	NO	NO
317	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE (LONG)	NO	YES	NO	YES	NO	NO	NO	NO
318	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	MODERATE	YES	NO	NO	NO	NO	NO	NO	NO
321	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE (MODERATE-SHORT)	NO	YES	NO	YES	NO	NO	NO	NO
324	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE (LONG)	NO	NO	NO	YES	NO	NO	NO	NO
325	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE (SHORT-LONG)	YES	NO	NO	NO	NO	NO	NO	NO

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Impoundment	Drainage	Other	Forest	Field	Bedrock	Shrub	Landscaped	Paved	Agriculture	Other	Adjacent Slope	Confined-Basin	Channel	Sloped	Riparian Riverine	Riparian Lacustrine	Floodplain	Concave	Convex
327	YES	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	MODERATE (SHORT)	NO	NO	YES	YES	NO	NO	NO	NO
335	NO	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO	Moderate	NO	NO	NO	NO	NO	NO	YES	NO
336	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	GENTLE	YES	NO	NO	NO	NO	NO	YES	NO
154	No	No	No	Yes	No	No	No	No	No	No	No	N/A	Yes	No	No	No	No	No	Yes	No
158	No	No	No	Yes	No	No	No	No	No	No	No	N/A	Yes	No	No	No	No	No	Yes	No
210	No	No	No	Yes	No	No	No	No	No	No	No	N/A	Yes	No	No	No	No	No	Yes	No
211	No	No	Drainage ditch along HWY103 - Provides hydroogy.	Yes	No	No	No	No	Yes	No	No	N/A	No	Yes	No	No	No	No	Yes	No
219	No	No	Clear cut road, old but still cleared, possibly forestry road.	Yes	No	No	No	No	Yes	No	No	N/A	Yes	No	No	Yes	No	No	No	No
223	No	No	No	Yes	No	No	No	No	No	No	Pond	N/A	No	No	No	Yes	No	No	No	No
234	No	No	Recent clearance adjacent to WL.	Yes	No	No	Yes	No	Yes	No	No	N/A	Yes	No	Yes	No	No	No	Yes	No
244	No	No	No	Yes	No	No	No	No	No	No	No	N, W andE - upslope	Yes	No	Yes	No	No	No	Yes	No
312	No	No	Possible historic infill - boulder bank between WL and lake.	Yes	No	No	No	No	No	No	HWY, Lake	Step slope in W, lake to E		Yes	No	No	No	No	Yes	No
148	No	No	No	Yes	No	No	No	No	Yes	No	No	N/A	No	No	Yes	No	No	No	No	No
146	No	No	Partially infilled by past HWY construction	Yes	No	No	No	No	Yes	No	No	N/A	No	No	No	Yes	No	No	No	No
150	No	No	No	Yes	No	No	No	No	Yes	No	No	N/A	No	No	Yes	No	No	No	No	No
153	No	No	No	Yes	No	No	No	No	Yes	No	No	N/A	No	No	Yes	No	No	No	No	No

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Hummock	Ribbed	Lawn	Flat	Watercourse	Runoff	Spring	Groundwater	Precipitation	Ditch/ Culvert	In	Upgradient	Open Water	% Cover	Est. Depth (Cm)	Sheet	Straight	Meandering	Braided	Discontinuous	Other	At Surface	Below Surface	Above Surface	Wet Width Inflow 1
5	YES	NO	NO	YES	NO	YES	YES	NO	YES	NO	1	1	FLOWING	<1	5	NO	NO	NO	YES	YES	NO	NO	40	20 to 60	N/A
6	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	0	0	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	NO	30	N/A	N/A
8	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	STAGNANT	5	5	YES	NO	NO	NO	NO	NO	YES	N/A	N/A	N/A
9	NO	NO	NO	YES	NO	YES	YES	NO	YES	YES	0	0	N/A	10	5 to 20	YES	YES	NO	NO	NO	NO	YES	40	N/A	60
10	YES	NO	NO	NO	NO	YES	NO	YES	YES	YES	0	0	STAGNANT / FLOWING	5	5	NO	NO	NO	NO	YES	NO	YES	N/A	N/A	150
12	YES	NO	NO	NO	YES	YES	YES	NO	YES	NO	0	1	FLOWING	5	5	NO	NO	NO	YES	YES	NO	YES	50	N/A	70
13	NO	NO	NO	YES	NO	YES	YES	NO	YES	NO	2	0	N/A	1	5	NO	NO	NO	YES	NO	NO	NO	20	N/A	N/A
16	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	1	10	NO	NO	NO	NO	YES	NO	NO	22	N/A	30
18	NO	NO	NO	YES	YES	YES	NO	NO	NO	NO	0	0	N/A	<1	10	NO	NO	NO	NO	YES	NO	NO	25	N/A	105
19	NO	NO	NO	YES	NO	YES	YES	NO	YES	NO	1	0	N/A	1	5	NO	NO	NO	YES	YES	NO	NO	20	N/A	N/A
22	YES	NO	NO	NO	NO	YES	NO	NO	YES	YES	0	0	Stagnant / flowing	15	5	NO	NO	NO	YES	NO	NO	NO	N/A	N/A	25
25	NO	NO	NO	YES	YES	YES	YES	NO	YES	NO	0	0	N/A	1	10	NO	YES	NO	YES	NO	NO	NO	40	N/A	100
26	NO	NO	NO	YES	NO	YES	YES	NO	YES	NO	1	0	N/A	2	10	YES	NO	NO	NO	YES	NO	NO	10	N/A	N/A
31	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO	0	0	N/A	0	0	YES	NO	NO	NO	NO	NO	NO	30	N/A	N/A
34	NO	NO	NO	YES	NO	YES	YES	NO	YES	NO	0	0	N/A	20	15	NO	NO	NO	YES	NO	NO	NO	15	N/A	N/A
39	NO	NO	NO	NO	NO	YES	NO	YES	YES	NO	0	0	N/A	90	100	YES	NO	NO	NO	NO	NO	NO	10	N/A	N/A
40	YES	NO	NO	NO	YES	YES	NO	NO	YES	YES	0	0	STAGNANT	0	0	NO	NO	NO	NO	YES	NO	NO	20	N/A	0
49	NO	NO	NO	YES	YES	YES	NO	YES	YES	YES	0	0	N/A	80	100	YES	NO	NO	NO	NO	NO	NO	20	N/A	20
55	YES	NO	NO	NO	YES	YES	NO	YES	YES	YES	0	0	N/A	10	5	NO	NO	NO	YES	NO	NO	NO	20	N/A	66
63	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	0	0	YES	NO	NO	NO	NO	NO	NO	30	N/A	N/A
65	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	10	15	YES	NO	NO	NO	NO	NO	NO	0	15	N/A
68	NO	NO	NO	YES	YES	YES	NO	YES	YES	NO	0	0	N/A	25	50	NO	YES	NO	NO	NO	NO	NO	27	N/A	70
80	NO	NO	NO	YES	NO	YES	YES	NO	YES	NO	2	0	N/A	10	10	NO	NO	NO	YES	NO	NO	YES	N/A	N/A	N/A
82	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	4	0	FLOWING	10	5 to 15	NO	NO	NO	NO	YES	NO	NO	15	0	10
84	YES	NO	NO	NO	NO	YES	NO	YES	YES	YES	0	0	STAGNANT / FLOWING	15	5 to 15	NO	NO	NO	NO	NO	SMALL POOLS	NO	10	0	N/A
88	YES	NO	NO	NO	NO	YES	NO	YES	YES	NO	0	0	FLOWING	1	2	NO	YES	NO	NO	NO	NO	NO	10	0	46
91	YES	NO	NO	NO	NO	YES	NO	YES	YES	NO	0	0	STAGNANT	1	5	YES	NO	NO	NO	NO	NO	NO	10	N/A	N/A
92	YES	NO	NO	NO	NO	YES	YES	YES	YES	NO	0	0	N/A	1	5	NO	NO	NO	NO	YES	NO	NO	20	N/A	20
93	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	STAGNANT	80	70	YES	NO	NO	NO	NO	NO	NO	N/A	N/A	N/A
94	NO	NO	NO	YES	NO	YES	NO	YES	YES	NO	0	0	STAGNANT	1	5	NO	NO	NO	NO	NO	NO	NO	25	0	N/A
99	YES	NO	NO	NO	NO	YES	YES	YES	YES	YES	1	0	FLOWING	2	1 to 10	NO	NO	NO	NO	YES	NO	NO	20	0	N/A
102	YES	NO	NO	NO	NO	YES	NO	NO	YES	YES	0	0	FLOWING	1	10	NO	NO	NO	NO	YES	NO	NO	20	0	N/A
103	YES	NO	NO	NO	NO	YES	NO	NO	YES	YES	0	0	STAGNANT	1	0	NO	NO	NO	NO	NO	NO	NO	15	0	N/A

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Hummock	Ribbed	Lawn	Flat	Watercourse	Runoff	Spring	Groundwater	Precipitation	Ditch/ Culvert	In	Upgradient	Open Water	% Cover	Est. Depth (Cm)	Sheet	Straight	Meandering	Braided	Discontinuous	Other	At Surface	Below Surface	Above Surface	Wet Width Inflow 1
107	YES	NO	NO	NO	NO	YES	NO	YES	YES	YES	0	0	STAGNANT	20	5	NO	NO	NO	NO	NO	NO	NO	20	0	N/A
109	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	10	25	YES	NO	NO	NO	NO	NO	NO	20	N/A	N/A
114	YES	NO	NO	YES	NO	YES	NO	YES	YES	YES	0	0	FLOWING	1	5 to 30	NO	NO	NO	NO	YES	NO	NO	10	0	N/A
118	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	N/A	N/A	YES	NO	NO	NO	NO	NO	NO	45	N/A	N/A
122	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO	0	0	STAGNANT	0.5	10	YES	NO	NO	NO	NO	NO	NO	30	N/A	N/A
125	NO	NO	NO	NO	NO	YES	NO	YES	YES	NO	0	0	STAGNANT / FLOWING	0.5	5	NO	NO	NO	NO	YES	NO	NO	20	N/A	N/A
126	NO	NO	NO	YES	NO	YES	NO	YES	YES	NO	0	0	STAGNANT	2	1 to 10	NO	NO	NO	NO	NO	NO	NO	20	0	N/A
127	YES	NO	NO	NO	NO	YES	NO	YES	YES	NO	0	0	FLOWING	5	1 to 10	NO	NO	NO	YES	NO	NO	NO	15	0	N/A
129	YES	NO	NO	NO	NO	YES	YES	YES	YES	NO	1	0	FLOWING	2	5 to 25	NO	NO	NO	NO	YES	NO	NO	15	0	N/A
131	YES	NO	NO	NO	NO	YES	NO	YES	YES	NO	0	0	FLOWING	2	5 to 15	NO	YES	NO	NO	NO	NO	NO	20	0	N/A
135	YES	NO	NO	NO	NO	YES	NO	YES	YES	YES	1	0	STAGNANT	5	5 to 30	NO	NO	NO	NO	YES	NO	NO	15	0	40
138	YES	NO	NO	NO	NO	YES	1	NO	YES	NO	0	0	N/A	N/A	N/A	NO	NO	NO	YES	NO	NO	NO	20	N/A	N/A
141	YES	NO	NO	NO	NO	NO	YES	YES	YES	NO	1	1	N/A	2	5 to 20	NO	YES	NO	NO	YES	NO	NO	30 to 40	N/A	29
142	YES	NO	NO	NO	YES	YES	NO	YES	YES	NO	0	0	STAGNANT / FLOWING	5	13	NO	YES	NO	NO	NO	NO	NO	20	N/A	74
145	YES	NO	NO	NO	YES	YES	NO	NO	YES	NO	0	0	FLOWING	20	15	NO	NO	NO	YES	NO	NO	NO	30	0	65
149	NO	NO	NO	YES	YES	YES	NO	NO	YES	NO	0	0	FLOWING	10	20	YES	YES	NO	NO	NO	NO	NO	10	0	66
167	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	STAGNANT	5	20	YES	NO	NO	NO	NO	NO	NO	20	0	N/A
168	YES	NO	NO	YES	YES	YES	NO	NO	YES	NO	0	0	FLOWING	50	20	NO	YES	NO	NO	NO	NO	YES	0	0	90
169	YES	NO	NO	NO	YES	YES	NO	NO	YES	NO	0	0	STAGNANT	5	10	YES	NO	NO	NO	YES	NO	NO	30	N/A	80
172	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	STAGNANT	90	50	NO	NO	NO	NO	NO	NO	YES	N/A	50	N/A
176	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	N/A	N/A	YES	NO	NO	NO	NO	NO	NO	30	N/A	N/A
178	YES	NO	NO	YES	YES	YES	NO	NO	YES	NO	0	0	FLOWING	30	20	NO	YES	NO	NO	NO	NO	NO	10	10	0
183	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO	0	0	STAGNANT	10	5	YES	NO	NO	NO	NO	NO	YES	N/A	N/A	N/A
185	NO	NO	NO	YES	YES	YES	NO	YES	YES	NO	0	0	FLOWING	2	100+	NO	YES	NO	NO	NO	NO	NEAR	100+	N/A	N/A
186	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	STAGNANT	5	5	YES	NO	NO	NO	YES	NO	NO	5	N/A	N/A
193	NO	NO	NO	NO	NO	YES	YES	NO	YES	NO	0	1	STAGNANT	10	5	NO	NO	NO	NO	YES	NO	NO	10	N/A	30
202	YES	NO	YES	NO	NO	YES	NO	YES	YES	NO	0	0	STAGNANT	1	1	NO	NO	NO	NO	NO	NO	N	30	N/A	N/A
207	YES	NO	NO	NO	NO	YES	NO	YES	YES	NO	0	0	N/A	N/A	N/A	NO	NO	NO	NO	NO	NO	NO	0 to 5	N/A	N/A
208	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	0	0	STAGNANT	20	10 to 20	NO	NO	NO	NO	NO	NO	NO	N/A	N/A	N/A
215	NO	NO	NO	NO	YES	YES	NO	YES	YES	NO	0	0	STAGNANT / FLOWING	2	10 to 20	NO	YES	NO	NO	YES	NO	NO	5 to 20	N/A	41
220	YES	NO	YES	NO	YES	YES	NO	YES	YES	YES	0	0	STAGNANT / FLOWING	3	6 to 15	NO	NO	NO	NO	YES	NO	YES	N/A	N/A	37
221	YES	NO	NO	NO	1	YES	NO	NO	YES	NO	0	0	N/A	15	10	NO	NO	NO	YES	NO	NO	YES	N/A	N/A	50
222	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	0	0	N/A	5	N/A	NO	NO	NO	NO	NO	NO	NO	N/A	N/A	N/A
224	YES	NO	NO	NO	NO	NO	NO	YES	YES	YES	0	0	N/A	5	10	NO	YES	NO	NO	YES	NO	NO	10	N/A	33
226	YES	NO	NO	NO	NO	NO	NO	YES	YES	NO	0	0	N/A	N/A	N/A	YES	NO	NO	NO	NO	NO	NO	40	N/A	N/A
227	YES	NO	NO	NO	NO	YES	NO	YES	YES	NO	0	0	STAGNANT	50	30	YES	NO	NO	NO	NO	NO	NO	15	30	N/A
233	YES	NO	NO	NO	NO	YES	YES	NO	YES	NO	0	0	N/A	N/A	N/A	NO	NO	NO	YES	NO	NO	NO	10 to 40	N/A	N/A

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Hummock	Ribbed	Lawn	Flat	Watercourse	Runoff	Spring	Groundwater	Precipitation	Ditch/ Culvert	In	Upgradient	Open Water	% Cover	Est. Depth (Cm)	Sheet	Straight	Meandering	Braided	Discontinuous	Other	At Surface	Below Surface	Above Surface	Wet Width Inflow 1
248	YES	NO	NO	NO	NO	YES	NO	YES	YES	NO	0	0	STAGNANT	1	13	NO	NO	NO	NO	YES	NO	NO	15	N/A	N/A
249	YES	NO	NO	NO	YES	NO	NO	YES	YES	YES	0	0	STAGNANT	<1	5 to 12	NO	NO	NO	NO	YES	NO	NO	15	N/A	36
252	YES	NO	NO	YES	1	YES	YES	NO	YES	NO	1	0	FLOWING	10	15	NO	YES	NO	YES	NO	NO	YES	N/A	N/A	110
253	YES	NO	NO	NO	YES	NO	NO	YES	YES	YES	0	0	STAGNANT / FLOWING	1	12	NO	NO	YES	NO	NO	NO	NO	10	N/A	23
259	YES	NO	NO	NO	NO	NO	NO	YES	YES	NO	0	0	N/A	<1	N/A	NO	NO	NO	NO	NO	NO	NO	34	N/A	N/A
261	YES	NO	NO	NO	NO	YES	NO	YES	YES	NO	0	0	FLOWING	2	6	NO	NO	YES	NO	NO	NO	NO	30	N/A	44
262	YES	NO	NO	NO	YES	YES	NO	YES	YES	NO	0	0	STAGNANT / FLOWING	<1	10	YES	NO	NO	YES	NO	NO	NO	16	N/A	70
267	YES	NO	NO	NO	NO	YES	NO	YES	YES	YES	0	0	N/A	<1	5 to 10	NO	NO	NO	NO	YES	NO	NO	45	N/A	N/A
268	YES	NO	NO	NO	NO	YES	NO	YES	YES	YES	0	0	STAGNANT / FLOWING	2	1 to 20	NO	NO	NO	NO	YES	NO	NO	40	N/A	0
270	NO	NO	NO	YES	YES	YES	YES	NO	YES	NO	0	0	STAGNANT / FLOWING	10	15	NO	YES	NO	YES	NO	NO	NO	20	N/A	170
277	YES	NO	NO	NO	YES	YES	NO	YES	YES	YES	0	0	N/A	10	5 to 100	NO	YES	NO	NO	NO	NO	NO	30	N/A	220
283	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO	0	0	N/A	0	N/A	NO	NO	NO	NO	NO	NO	NO	40	N/A	N/A
285	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO	0	0	STAGNANT	1	30	YES	NO	NO	NO	NO	NO	NO	40	N/A	N/A
288	NO	NO	NO	NO	NO	YES	NO	NO	YES	YES	0	0	STAGNANT	40	30	YES	YES	NO	NO	NO	NO	YES	N/A	30	40
290	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO	0	0	N/A	0	N/A	YES	NO	NO	NO	NO	NO	NO	40	N/A	N/A
292	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	STAGNANT	5	5	NO	NO	NO	NO	NO	NO	NO	40	N/A	N/A
294	NO	NO	NO	YES	YES	YES	NO	NO	YES	NO	0	0	FLOWING	100	30 to 100	NO	YES	NO	NO	NO	NO	NO	N/A	50	200
296																									
303	YES	NO	NO	YES	NO	YES	NO	YES	YES	NO	0	0	STAGNANT	1	10	YES	NO	NO	NO	NO	NO	NO	20	N/A	N/A
304	YES	NO	NO	NO	YES	YES	NO	NO	NO	NO	0	0	N/A	1	2	YES	NO	NO	NO	YES	NO	NO	30	N/A	0
306	YES	NO	NO	NO	NO	YES	NO	NO	YES	NO	0	0	N/A	N/A	N/A	YES	NO	NO	NO	YES	NO	NO	40 +	N/A	N/A
307	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO	0	0	N/A	N/A	N/A	YES	NO	NO	NO	NO	NO	NO	40	N/A	N/A
314	NO	YES	NO	NO	NO	YES	NO	YES	YES	YES	0	0	STAGNANT	80	10 to 100	NO	NO	NO	YES	NO	NO	NO	20	50	90
316	YES	YES	NO	NO	YES	YES	YES	NO	YES	NO	0	0	FLOWING	30	5	NO	NO	NO	YES	NO	NO	YES	30	5	70
317	NO	YES	NO	YES	YES	YES	NO	NO	YES	NO	0	0	N/A	50	8	NO	NO	NO	YES	NO	NO	YES	N/A	8	70
318	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO	0	0	N/A	N/A	N/A	YES	NO	NO	NO	NO	NO	NO	20	N/A	N/A
321	NO	YES	NO	NO	YES	YES	NO	NO	YES	YES	0	0	FLOWING	20	10	NO	NO	NO	YES	NO	NO	NO	20	N/A	60
324	YES	NO	NO	NO	YES	YES	NO	NO	YES	NO	0	0	FLOWING	10	7	YES	NO	NO	NO	YES	NO	NO	40	N/A	50
325	YES	NO	NO	YES	NO	YES	1	NO	YES	NO	0	0	STAGNANT	1	7	YES	NO	NO	NO	YES	NO	NO	30	N/A	60

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Hummock	Ribbed	Lawn	Flat	Watercourse	Runoff	Spring	Groundwater	Precipitation	Ditch/ Culvert	In	Upgradient	Open Water	% Cover	Est. Depth (Cm)	Sheet	Straight	Meandering	Braided	Discontinuous	Other	At Surface	Below Surface	Above Surface	Wet Width Inflow 1
327	NO	NO	NO	NO	YES	YES	YES	NO	YES	NO	1	0	N/A	1	10	NO	YES	NO	YES	NO	NO	NO	10	N/A	80
335	YES	NO	NO	YES	NO	YES	YES	NO	YES	YES	1	1	N/A	75	40	NO	YES	NO	YES	NO	NO	N/A	N/A	N/A	N/A
336	NO	NO	NO	YES	NO	YES	NO	YES	YES	NO	O	O	STAGNANT	65	45	NO	NO	NO	NO	NO	NO	N/A	N/A	N/A	N/A
154	Yes	No	No	No	No	Yes	No	Yes	Yes	No	0	0		0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
158	Yes	No	No	No	No	Yes	No	No	Yes	No	0	0		1	15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
210	Yes	No	No	No	No	Yes	No	Yes	Yes	No	0	0		0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
211	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	0	0		5	5	N/A	N/A	Yes	Yes	N/A	N/A	N/A	N/A	N/A	1 m
219	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	No	0	0		1	15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
223	Yes	No	No	Yes	No	Yes	No	Yes	Yes	No	0	0		0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
234	Yes	No	No	No	No	Yes	No	Yes	Yes	No	0	0		1	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
244	No	Yes	No	No	No	Yes	No	Yes	Yes	No	0	0		2	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
312	Yes	No	No	No	No	Yes	No	Yes	Yes	No	0	0		5	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
148	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	1	0		2	20	N/A	N/A	N/A	N/A	Yes	N/A	7 cm	8 cm	13 cm	N/A
146	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	2	0		5	40	N/A	Yes	N/A	N/A	N/A	N/A	40	12	15	N/A
150	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	0	0		2	7	N/A	N/A	N/A	N/A	Yes	N/A	7 cm	N/A	N/A	4 cm
153	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	0	0		2	7	N/A	N/A	N/A	N/A	Yes	N/A	7 cm	N/A	N/A	8 cm

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Dry Width Inflow 1	Dry - Wet Width 1	Depth Inlfow 1	Flow Inlfow 1	Wet Width Inflow 2	Dry Width Inflow 2	Dry - Wet Width 2	Depth Inlfow 2	Flow Inlfow 2	Wet Width Outflow 1	Dry Width Outflow 1	Dry - Wet Width 1	Depth Outflow 1	Flow Outflow 1	Wet Width Outflow 2	Dry Width Outflow 2
5	N/A		N/A	N/A	N/A	N/A		N/A	N/A	110	150	40	10	MODERATE	N/A	N/A
6	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
8	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
9	80	20	25	MODERATE	N/A	N/A		N/A	N/A	100	100	0	20	MODERATE	N/A	N/A
10	150	0	8	STAGNANT	88	115	27	10	STAGNANT	85	115	30	10	MODERATE	23	60
12	70	0	10	MODERATE	30	30	0	10	MODERATE	80	80	0	10	HIGH	N/A	N/A
13	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
16	30	0	16	STAGNANT	N/A	N/A		N/A	N/A	50	66	16	5	MODERATE	N/A	N/A
18	125	20	15	LOW	N/A	N/A		N/A	N/A	36	130	94	5	MODERATE	N/A	N/A
19	N/A		N/A	N/A	N/A	N/A		N/A	N/A	80	80	0	5	LOW	N/A	N/A
22	25	0	5	MODERATE	N/A	N/A		N/A	N/A	20	20	0	3	MODERATE	N/A	N/A
25	100	0	10	LOW	N/A	N/A		N/A	N/A	110	110	0	12	MODERATE	N/A	N/A
26	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
31	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
34	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
39	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
40	70	70	0	STAGNANT	N/A	N/A		N/A	N/A	80	100	20	8	N/A	N/A	N/A
49	60	40	17	MODERATE	75	110	35	16	LOW	2500	2500	0	100	STAGNANT	N/A	N/A
55	114	48	8	MODERATE	N/A	N/A		N/A	N/A	57	107	50	6	MODERATE	N/A	N/A
63	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
65	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
68	70	0	16	LOW	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
80	N/A		N/A	N/A	N/A	N/A		N/A	N/A	80	80	0	10	MODERATE	N/A	N/A
82	30	20	2	HIGH	N/A	N/A		N/A	N/A	43	80	37	6	HIGH	N/A	N/A
84	N/A		N/A	N/A	N/A	N/A		N/A	N/A	36	47	11	3	HIGH	N/A	N/A
88	70	24	9	LOW	N/A	N/A		N/A	N/A	46	74	28	5	MODERATE	N/A	N/A
91	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
92	30	10	3	MODERATE	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
93	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
94	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
99	N/A		N/A	N/A	N/A	N/A		N/A	N/A	35	35	0	8	N/A	N/A	N/A
102	N/A		N/A	N/A	N/A	N/A		N/A	N/A	20	90	70	3	MODERATE	N/A	N/A
103	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Dry Width Inflow 1	Dry - Wet Width 1	Depth Inlfow 1	Flow Inlfow 1	Wet Width Inflow 2	Dry Width Inflow 2	Dry - Wet Width 2	Depth Inlfow 2	Flow Inlfow 2	Wet Width Outflow 1	Dry Width Outflow 1	Dry - Wet Width 1	Depth Outflow 1	Flow Outflow 1	Wet Width Outflow 2	Dry Width Outflow 2
107	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
109	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
114	N/A		N/A	N/A	N/A	N/A		N/A	N/A	60	79	19	12	LOW	N/A	N/A
118	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
122	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
125	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
126	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
127	N/A		N/A	N/A	N/A	N/A		N/A	N/A	16	50	34	3	MODERATE	N/A	N/A
129	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
131	N/A		N/A	N/A	N/A	N/A		N/A	N/A	75	107	32	3	LOW	N/A	N/A
135	40	0	3	LOW	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
138	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
141	29	0	2.5 to 5	LOW	28	90	62	11	MODERATE	70	90	20	12.5	N/A	N/A	N/A
142	92	18	13	LOW	N/A	N/A		N/A	N/A	78	85	7	13	MODERATE	N/A	N/A
145	120	55	7	MODERATE	N/A	N/A		N/A	N/A	70	90	20	15	MODERATE	N/A	N/A
149	90	24	10	MODERATE	0	0	0	0	LOW	90	120	30	12	MODERATE	N/A	N/A
167	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
168	120	30	20	LOW	N/A	N/A		N/A	N/A	160	160	0	25	LOW	N/A	N/A
169	90	10	10	LOW	N/A	N/A		N/A	N/A	80	80	0	10	LOW	N/A	N/A
172	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
176	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
178	0	0	0	LOW	N/A	N/A		N/A	N/A	100	140	40	15	MODERATE	N/A	N/A
183	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
185	N/A		N/A	N/A	N/A	N/A		N/A	N/A	300	350	50	20	HIGH	N/A	N/A
186	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
193	40	10	15	STAGNANT	N/A	N/A		N/A	N/A	25	75	50	15	LOW	N/A	N/A
202	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
207	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
208			N/A	N/A	N/A	N/A		N/A	N/A	63	80	17	5	LOW	N/A	N/A
215	64	23	6	N/A	N/A	N/A		N/A	N/A	30 to 60	70		9.5	LOW	N/A	N/A
220	56	19	16	LOW	N/A	N/A		N/A	N/A	45	75	30	6	N/A	N/A	N/A
221	60	10	10	MODERATE	N/A	N/A		N/A	N/A	90	90	0	25	MODERATE	N/A	N/A
222	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
224	65	32	13	N/A	N/A	N/A		N/A	N/A	55	75	20	7	LOW	N/A	N/A
226	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
227	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
233	N/A		N/A	N/A	N/A	N/A		N/A	N/A	40	40	0	5	LOW	N/A	N/A

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Dry Width Inflow 1	Dry - Wet Width 1	Depth Inlfow 1	Flow Inlfow 1	Wet Width Inflow 2	Dry Width Inflow 2	Dry - Wet Width 2	Depth Inlfow 2	Flow Inlfow 2	Wet Width Outflow 1	Dry Width Outflow 1	Dry - Wet Width 1	Depth Outflow 1	Flow Outflow 1	Wet Width Outflow 2	Dry Width Outflow 2
248	N/A		N/A	N/A	N/A	N/A		N/A	N/A	50	30		10	STAGNANT	N/A	N/A
249	134	98	19	STAGNANT	N/A	N/A		N/A	N/A	35	56	21	9	MODERATE	N/A	N/A
252	110	0	15	HIGH	N/A	N/A		N/A	N/A	200	200	0	30	MODERATE	N/A	N/A
253	30	7	4	STAGNANT	N/A	N/A		N/A	N/A	84	110	26	8	MODERATE	N/A	N/A
259	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
261	90	46	7	LOW	N/A	N/A		N/A	N/A	30	45	15	8	MODERATE	N/A	N/A
262	150		5	LOW	N/A	N/A		N/A	N/A	53	70	17	9	LOW	18	60
267	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
268	64	64	0	STAGNANT	N/A	N/A		N/A	N/A	37	69	32	4	HIGH	N/A	N/A
270	170	0	6	HIGH	N/A	N/A		N/A	N/A	180	180	0	30	MODERATE	N/A	N/A
277	70		22	MODERATE	N/A	N/A		N/A	N/A	80	85	5	32	STAGNANT	N/A	N/A
283	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
285	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
288	70	30	10	LOW	N/A	N/A		N/A	N/A	0	30	30	0	N/A	N/A	N/A
290	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
292	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
294	200	0	25	MODERATE	N/A	N/A		N/A	N/A	90	90	0	100+	LOW	N/A	N/A
296		0					0					0				
303	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
304	30	30	0	N/A	N/A	N/A		N/A	N/A	25	35	10	3	LOW	N/A	N/A
306	N/A		N/A	N/A	N/A	N/A		N/A	N/A	90	120	30	10	N/A	N/A	N/A
307	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
314	90	0	10	LOW	0	80	80	0	N/A	120	190	70	5	MODERATE	N/A	N/A
316	70	0	5	MODERATE	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
317	70	0	8	MODERATE	N/A	N/A		N/A	N/A	100	100	0	8	MODERATE	N/A	N/A
318	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
321	60	0	10	MODERATE	0	70	70	0	N/A	70	70	0	10	MODERATE	N/A	N/A
324	70	20	7	N/A	N/A	N/A		N/A	N/A	110	150	40	11	N/A	N/A	N/A
325	100	40	8	N/A	N/A	N/A		N/A	N/A	70	100	30	8	N/A	N/A	N/A

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Dry Width Inflow 1	Dry - Wet Width 1	Depth Inlfow 1	Flow Inlfow 1	Wet Width Inflow 2	Dry Width Inflow 2	Dry - Wet Width 2	Depth Inlfow 2	Flow Inlfow 2	Wet Width Outflow 1	Dry Width Outflow 1	Dry - Wet Width 1	Depth Outflow 1	Flow Outflow 1	Wet Width Outflow 2	Dry Width Outflow 2
327	100	20	10	MODERATE	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
335	N/A		N/A	N/A	N/A	N/A		N/A	N/A	100	25		5	LOW	N/A	N/A
336	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
154	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
158	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
210	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
211	2 m	100	5 cm	Low	N/A	N/A		N/A	N/A	8 m	2 m	500	4 cm	Low	N/A	N/A
219	N/A		N/A	N/A	N/A	N/A		N/A	N/A	0.5 m	0.5 m	0	0.2 m	Stagnant	N/A	N/A
223	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
234	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
244	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
312	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
148	N/A		N/A	N/A	N/A	N/A		N/A	N/A	21 cm	35 cm	14	11 cm	Moderate	N/A	N/A
146	N/A		N/A	N/A	N/A	N/A		N/A	N/A	2.5 m	15 m	1250	48 cm	Stagnant	N/A	N/A
150	27 cm	23	4 cm	High	N/A	N/A		N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
153	33 cm	25	1 cm	High	N/A	N/A		N/A	N/A	10 cm	37 cm	27	2 cm	High	N/A	N/A

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Dry - Wet Width 2	Depth Outflow 2	Flow Outflow 2	Water Marks	Sediment Deposits	Drift Deposits	Algal Mat	Iron Deposits	Sparsely Vegetated Concave Surface	Water Stained Leaves	Surface Soil Cracks	Drainage Patterns	Moss Trim Lines	Other
5		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6		N/A	N/A	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
8		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
9		N/A	N/A	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
10	37	2	MODERATE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
12		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
13		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
16		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
18		N/A	N/A	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
19		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
22		N/A	N/A	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
25		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
26		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
31		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
34		N/A	N/A	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
39		N/A	N/A	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
40		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
49		N/A	N/A	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	NO
55		N/A	N/A	NO	YES	NO	NO	NO	YES	YES	NO	NO	NO	NO
63		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
65		N/A	N/A	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
68		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
80		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
82		N/A	N/A	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
84		N/A	N/A	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO
88		N/A	N/A	NO	YES	YES	NO	NO	NO	NO	NO	YES	NO	NO
91		N/A	N/A	NO	NO	NO	NO	NO	YES	YES	NO	YES	NO	NO
92		N/A	N/A	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
93		N/A	N/A	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
94		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
99		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
102		N/A	N/A	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
103		N/A	N/A	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Dry - Wet Width 2	Depth Outflow 2	Flow Outflow 2	Water Marks	Sediment Deposits	Drift Deposits	Algal Mat	Iron Deposits	Sparsely Vegetated Concave Surface	Water Stained Leaves	Surface Soil Cracks	Drainage Patterns	Moss Trim Lines	Other
107		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
109		N/A	N/A	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO
114		N/A	N/A	YES	NO	YES	NO	NO	NO	NO	NO	NO	YES	NO
118		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
122		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
125		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
126		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
127		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
129		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
131		N/A	N/A	NO	NO	YES	NO	NO	NO	NO	NO	NO	YES	NO
135		N/A	N/A	NO	NO	YES	NO	NO	YES	YES	NO	YES	NO	NO
138		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
141		N/A	N/A	NO	NO	YES	NO	NO	YES	YES	NO	NO	YES	NO
142		N/A	N/A	NO	NO	YES	NO	NO	YES	YES	NO	YES	NO	NO
145		N/A	N/A	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
149		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
167		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
168		N/A	N/A	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
169		N/A	N/A	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
172		N/A	N/A	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
176		N/A	N/A	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	MATTED MOSS
178		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
183		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
185		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
186		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
193		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
202		N/A	N/A	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
207		N/A	N/A	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
208		N/A	N/A	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO
215		N/A	N/A	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
220		N/A	N/A	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	NO
221		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
222		N/A	N/A	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
224		N/A	N/A	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
226		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
227		N/A	N/A	YES	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO
233		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Dry - Wet Width 2	Depth Outflow 2	Flow Outflow 2	Water Marks	Sediment Deposits	Drift Deposits	Algal Mat	Iron Deposits	Sparsely Vegetated Concave Surface	Water Stained Leaves	Surface Soil Cracks	Drainage Patterns	Moss Trim Lines	Other
248		N/A	N/A	NO	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO
249		N/A	N/A	YES	NO	YES	NO	NO	NO	YES	NO	NO	NO	NO
252		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
253		N/A	N/A	NO	NO	NO	YES	NO	NO	YES	NO	NO	YES	NO
259		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
261		N/A	N/A	YES	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO
262	42	10	LOW	YES	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO
267		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
268		N/A	N/A	NO	NO	YES	NO	NO	YES	YES	NO	YES	NO	NO
270		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
277		N/A	N/A	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
283		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
285		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
288		N/A	N/A	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
290		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
292		N/A	N/A	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
294		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
296	0													
303		N/A	N/A	NO	NO	NO	NO	YES	YES	YES	NO	NO	NO	NO
304		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
306		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
307		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
314		N/A	N/A	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
316		N/A	N/A	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
317		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
318		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
321		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
324		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
325		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Dry - Wet Width 2	Depth Outflow 2	Flow Outflow 2	Water Marks	Sediment Deposits	Drift Deposits	Algal Mat	Iron Deposits	Sparsely Vegetated Concave Surface	Water Stained Leaves	Surface Soil Cracks	Drainage Patterns	Moss Trim Lines	Other
327		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
335		N/A	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
336		N/A	N/A	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
154		N/A	N/A	No	No	No	No	No	No	Yes	No	Yes	No	Pitted hollows beneath trees
158		N/A	N/A	No	No	No	No	No	No	Yes	No	Yes	No	Water in pitted hollows, under trees, between boulders
210		N/A	N/A	No	No	No	No	No	No	Yes	No	Yes	No	Saturated near surface.
211		N/A	N/A	Yes	No	No	No	No	No	Yes	No	Yes	No	Flowing water.
219		N/A	N/A	No	No	No	No	No	No	Yes	No	Yes	No	Water in pitted hollows.
223		N/A	N/A	No	No	No	No	No	No	Yes	No	Yes	No	Pitted hollows with water.
234		N/A	N/A	No	No	No	No	No	No	Yes	No	Yes	No	No
244		N/A	N/A	No	No	No	No	No	No	Yes	No	Yes	No	Water in hummocks.
312		N/A	N/A	No	No	No	No	No	No	Yes	No	Yes	No	Water in hummocks.
148		N/A	N/A	No	No	Yes	No	Yes	No	Yes	No	No	No	No
146		N/A	N/A	No	No	Yes	No	No	No	No	No	No	No	No
150		N/A	N/A	No	No	Yes	No	No	No	No	No	No	Yes	No
153		N/A	N/A	No	No	Yes	No	No	No	No	No	No	Yes	No

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Elevation Of Inundation (Cm)	Frequency Of High-Water	Peat Presence	Estimated Depth Of Peat	Peat Saturated	Wetland Apparently Has Greater Channel Outflow Than Inflow	In 'Dry' (Subjective) Condidtions, Outflow From Wetland Was Observed	Waves Or Currents Observed In Waters Adjacent To Riparian Wetland	Scouring On Trees/Veg In And Adjacent To Riparian Wetland	Erosion In Shoreline Areas Lacking Wetland Veg Near Wetland	Water Flows Through Areas Of Dense Emergent Veg In Wetland	Human Use Observations
5	N/A	N/A	YES	30 to 100+ cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	value
6	N/A	SEASONAL	NO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
8	N/A	N/A	YES	10 to 40 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
9	5	SEASONAL	YES	20 to 100 cm	N/A	YES	N/A	NO	NO	NO	NO	NO
10	N/A	N/A	YES	1 m+	N/A	YES	N/A	N/A	N/A	N/A	N/A	NO
12	N/A	N/A	YES	10 to 30 cm	N/A	YES	N/A	N/A	N/A	N/A	N/A	not value
13	N/A	N/A	YES	10 to 50 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
16	N/A	N/A	YES	1 m+	YES	YES	YES	NO	NO	NO	NO	not value
18	N/A	N/A	YES	50 cm	N/A	NO	YES	NO	NO	NO	NO	NO
19	N/A	N/A	YES	20 to 70 cm	N/A	YES	N/A	N/A	N/A	N/A	N/A	NO
22	N/A	PRECIPITATION EVENTS	NO	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	NO
25	N/A	N/A	YES	20 to 70 cm	N/A	YES	N/A	N/A	N/A	N/A	N/A	NO
26	N/A	N/A	YES	20 to 50 cm	N/A	NO	N/A	N/A	N/A	N/A	N/A	NO
31	N/A	N/A	YES	50 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
34	10	SEASONAL	YES	0 to 20 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	not value
39	10	SEASONAL	YES	30 cm	N/A	N/A	N/A	NO	NO	NO	NO	NO
40	N/A	N/A	YES	30 cm	N/A	YES	N/A	NO	NO	NO	NO	not value
49	30	SEASONAL	YES	1 m +	N/A	YES	YES	YES	NO	NO	NO	not value
55	25	SEASONAL	YES	20 cm	N/A	NO	YES	NO	NO	NO	NO	NO
63	N/A	N/A	YES	30 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
65	20	SEASONAL	YES	15 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
68	N/A	N/A	YES	80 cm	N/A	NO	NO	NO	NO	NO	NO	not value
80	N/A	N/A	YES	10 to 25 cm	N/A	YES	N/A	N/A	N/A	N/A	N/A	NO
82	30	SEASONAL / HIGH PRECIPITATION	YES	50 cm	N/A	YES	YES	NO	NO	NO	YES	NO
84	15	SEASONAL / HIGH PRECIPITATION	YES	60 cm	N/A	YES	YES	NO	NO	NO	NO	NO
88	15	N/A	YES	1 m+	N/A	NO	NO	NO	NO	NO	NO	NO
91	8	SEASONAL / HIGH PRECIPITATION	YES	6 to 40 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	value
92	10	SEASONAL	YES	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
93	40	SEASONAL / HIGH PRECIPITATION	NO	N/A	N/A	N/A	NO	N/A	N/A	NO	YES	not value
94	N/A	N/A	YES	1 m+	N/A	N/A	NO	NO	NO	NO	NO	NO
99	N/A	N/A	YES	20 cm	N/A	YES	YES	NO	NO	NO	NO	not value
102	40	SEASONAL / HIGH PRECIPITATION	YES	90 cm	N/A	YES	YES	NO	NO	NO	NO	value
103	15	SEASONAL / HIGH PRECIPITATION	YES	30 cm	N/A	NO	NO	NO	NO	NO	NO	NO

Table 9   Non-wildlife Functional Assessment Data

Wetland Number	Elevation Of Inundation (Cm)	Frequency Of High-Water	Peat Presence	Estimated Depth Of Peat	Peat Saturated	Wetland Apparently Has Greater Channel Outflow Than Inflow	In 'Dry' (Subjective) Condidtions, Outflow From Wetland Was Observed	Waves Or Currents Observed In Waters Adjacent To Riparian Wetland	Scouring On Trees/Veg In And Adjacent To Riparian Wetland	Erosion In Shoreline Areas Lacking Wetland Veg Near Wetland	Water Flows Through Areas Of Dense Emergent Veg In Wetland	Human Use Observations
107	N/A	N/A	YES	30 cm	N/A	NO	YES	NO	NO	NO	NO	value
109	50 cm	SEASONAL / HIGH PRECIPITATION	NO	N/A	N/A	N/A	NO	N/A	N/A	N/A	NO	not value
114	15	SEASONAL / HIGH PRECIPITATION	YES	100 cm+	N/A	YES	YES	NO	NO	NO	NO	value
118	N/A	N/A	YES	50 cm	N/A	N/A	NO	N/A	N/A	N/A	NO	NO
122	N/A	N/A	YES	40 cm	N/A	N/A	NO	N/A	N/A	N/A	NO	value
125	30 cm	HEAVY PRECIPITATION	YES	20	N/A	N/A	NO	N/A	N/A	N/A	NO	NO
126	N/A	N/A	YES	5 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	value
127	20	SEASONAL / HIGH PRECIPITATION	NO	N/A	N/A	YES	YES	NO	NO	NO	NO	NO
129	20	SEASONAL	YES	1 m+	N/A	NO	NO	NO	NO	NO	NO	value
131	20	SEASONAL	YES	60 cm	N/A	YES	YES	NO	NO	NO	NO	NO
135	25	SEASONAL / HIGH PRECIPITATION	YES	20 cm	N/A	YES	YES	NO	NO	NO	NO	NO
138	N/A	N/A	YES	10 to 25 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
141	22	SEASONAL / HIGH PRECIPITATION	YES	35 cm	YES	YES	YES	NO	NO	NO	NO	NO
142	7	SEASONAL / HIGH PRECIPITATION	YES	16 cm	YES	NO	YES	NO	NO	NO	NO	NO
145	10	SEASONAL	YES	10 cm	N/A	YES	N/A	NO	NO	NO	NO	value
149	N/A	N/A	YES	20 to 50 cm	N/A	YES	N/A	NO	NO	NO	NO	NO
167	N/A	N/A	YES	20 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
168	10	SEASONAL	YES	25 cm	N/A	YES	N/A	NO	NO	NO	NO	NO
169	5	SEASONAL	YES	20 to 30	N/A	NO	N/A	N/A	N/A	N/A	N/A	NO
172	20	SEASONAL	YES	15 cm	N/A	N/A	N/A	NO	NO	NO	NO	NO
176	30	SEASONAL	YES	15 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
178	N/A	N/A	YES	10 cm	N/A	YES	N/A	NO	NO	NO	NO	NO
183	N/A	N/A	YES	10 cm	N/A	NO	N/A	N/A	N/A	N/A	N/A	NO
185	N/A	N/A	YES	10 to 50	N/A	YES	N/A	NO	NO	NO	NO	NO
186	N/A	N/A	YES	15 cm	N/A	NO	N/A	N/A	N/A	N/A	N/A	NO
193	N/A	N/A	YES	15 cm	N/A	YES	N/A	N/A	N/A	N/A	N/A	NO
202	N/A	SEASONAL	YES	40 cm	YES							not value
207	N/A	N/A	YES	5 cm	YES	N/A	N/A	N/A	N/A	N/A	N/A	NO
208	8	SEASONAL / HIGH PRECIPITATION	NO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
215	10	SEASONAL / HIGH PRECIPITATION	YES	27 cm	YES	NO	YES	N/A	N/A	N/A	N/A	NO
220	20	HEAVY PRECIPITATION	YES	24 cm	YES	NO	YES	N/A	N/A	N/A	N/A	NO
221	N/A	N/A	YES	15 cm	N/A	YES	N/A	NO	NO	NO	NO	NO
222	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	not value
224	N/A	SEASONAL / HIGH PRECIPITATION	YES	70 cm	YES	NO	YES	N/A	N/A	N/A	N/A	NO
226	N/A	N/A	YES	50 to 100+ cm	N/A	N/A	N/A	NO	NO	NO	NO	value
227	20	SEASONAL	NO	N/A	N/A	N/A	N/A	NO	N/A	N/A	N/A	NO
233	N/A	N/A	YES	40 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Elevation Of Inundation (Cm)	Frequency Of High-Water	Peat Presence	Estimated Depth Of Peat	Peat Saturated	Wetland Apparently Has Greater Channel Outflow Than Inflow	In 'Dry' (Subjective) Condidtions, Outflow From Wetland Was Observed	Waves Or Currents Observed In Waters Adjacent To Riparian Wetland	Scouring On Trees/Veg In And Adjacent To Riparian Wetland	Erosion In Shoreline Areas Lacking Wetland Veg Near Wetland	Water Flows Through Areas Of Dense Emergent Veg In Wetland	Human Use Observations
248	13	SEASONAL	YES	40 cm	YES	YES	YES	N/A	N/A	N/A	NO	value
249	40	SEASONAL / HIGH PRECIPITATION	YES	1 m+	N/A	YES	YES	N/A	N/A	N/A	NO	value
252	N/A	N/A	YES	20 to 100 cm	N/A	YES	N/A	NO	NO	NO	NO	NO
253	10	SEASONAL	YES	70 cm	N/A	YES	YES	N/A	N/A	N/A	NO	value
259	10	SEASONAL	YES	100 cm	N/A	NO	NO	N/A	N/A	N/A	NO	value
261	8	SEASONAL / HIGH PRECIPITATION	YES	40 cm	N/A	NO	YES	N/A	N/A	N/A	NO	NO
262	10	SEASONAL / HIGH PRECIPITATION	YES	60 cm	N/A	YES	YES	N/A	N/A	N/A	NO	NO
267	10	SEASONAL / HIGH PRECIPITATION	YES	10 cm	N/A	YES	YES	N/A	N/A	N/A	N/A	value
268	25	SEASONAL / HIGH PRECIPITATION	YES	30 cm	N/A	YES	YES	N/A	N/A	N/A	N/A	NO
270	N/A	N/A	YES	30 to 100 cm	N/A	YES	N/A	NO	NO	NO	NO	NO
277	20	SEASONAL	YES	30 cm	N/A	N/A	YES	N/A	N/A	N/A	NO	NO
283	N/A	N/A	YES	100 cm+	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
285	N/A	N/A	YES	50 to 100+	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
288	10	SEASONAL / HIGH PRECIPITATION	YES	15 cm	N/A	NO	N/A	N/A	N/A	N/A	N/A	not value
290	N/A	N/A	YES	20 to 50 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	not value
292	20 to 30 cm	SEASONAL	NO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
294	N/A	N/A	NO	N/A	N/A	NO	N/A	NO	NO	NO	NO	not value
296												
303	10 to 20	SEASONAL	YES	20 to 100 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
304	N/A	N/A	YES	20 cm	N/A	YES	N/A	N/A	N/A	N/A	N/A	value
306	N/A	N/A	YES	0 to 20 cm	N/A	YES	N/A	N/A	N/A	N/A	N/A	value
307	N/A	N/A	YES	10 to 40 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	value
314	10 to 20	SEASONAL	YES	0 to 20 cm	N/A	YES	N/A	YES	NO	NO	NO	NO
316	10 to 20	SEASONAL	YES	10 to 30 cm	N/A	N/A	N/A	NO	NO	NO	NO	NO
317	N/A	N/A	NO	N/A	N/A	YES	N/A	NO	NO	NO	NO	NO
318	N/A	N/A	YES	20 to 60 cm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO
321	N/A	N/A	YES	20	N/A	YES	N/A	NO	NO	NO	NO	value
324	N/A	N/A	YES	30 cm	N/A	YES	N/A	NO	NO	NO	NO	NO
325	N/A	N/A	YES	10 to 30 cm	N/A	NO	N/A	N/A	N/A	N/A	N/A	not value

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Elevation Of Inundation (Cm)	Frequency Of High-Water	Peat Presence	Estimated Depth Of Peat	Peat Saturated	Wetland Apparently Has Greater Channel Outflow Than Inflow	In 'Dry' (Subjective) Condidtions, Outflow From Wetland Was Observed	Waves Or Currents Observed In Waters Adjacent To Riparian Wetland	Scouring On Trees/Veg In And Adjacent To Riparian Wetland	Erosion In Shoreline Areas Lacking Wetland Veg Near Wetland	Water Flows Through Areas Of Dense Emergent Veg In Wetland	Human Use Observations
327	N/A	N/A	YES	15	N/A	YES	N/A	NO	NO	NO	NO	value
335	N/A	N/A	n/a	N/A	N/A	no	YES	N/A	N/A	N/A	N/A	NO
336	5	N/A	YES	10	YES	YES	N/A	N/A	N/A	N/A	N/A	NO
154	N/A	N/A	Yes	70 cm	N/A	No	No	N/A	N/A	N/A	No	no
158	N/A	N/A	Yes	70 cm	Yes	N/A	No	N/A	N/A	N/A	No	no
210	N/A	N/A	Yes	0.5 m	N/A	N/A	No	N/A	N/A	N/A	No	no
211	N/A	N/A	Yes	35 cm	N/A	No	No	N/A	N/A	N/A	No	not value
219	N/A	N/A	Yes	>1 m in some places	Yes	Yes	No	No	No	No	No	value
223	N/A	N/A	Yes	70+ cm	Fibric/Hemic	N/A	N/A	Yes	No	No	No	value
234	N/A	N/A	Yes	40 cm	Hemic	No	N/A	N/A	N/A	N/A	No	no
244	N/A	N/A	Yes	40 cm	Yes	N/A	No	N/A	N/A	N/A	No	no
312	5	N/A	Yes	25 cm	Yes	No	No	N/A	N/A	N/A	No	No
148	10	Seasonal and heavy precipitation	Yes	40 cm	Fibric	Yes	N/A	N/A	N/A	N/A	Yes	not value
146	10	After heavy precipitation events	Yes	>1 m	Fibric	Yes	N/A	Yes	No	No	Yes	not value
150	7	Seasonal and heavy precipitation	Yes	20	Fibric	No	No	N/A	N/A	N/A	No	not value
153	5	Seasonal and heavy precipitation	Yes	35	Fibric	Yes	N/A	N/A	N/A	N/A	No	not value

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Additional Data
5	Large treed swamp, dominated to conifer, but called mixed wood (SW/MW). North half wetter than south half overall. Spring inputs with outflow along west/northwest body. Discontinuous channel flow in this area. South half fed by at least one obvious spring along South body> Also ephemeral channel in southeast on steep slope - mainly run-off point source.
6	Anthropogenic - an enclosed no outlet or inlet shallow basin with marshy centre and narrow edge of Salix pyritolon, Spiarea latifolia and other small shrubs. All dry now therefore totally inadequate even for wood frogs, Not good ephemeral pond habitat, When seen in late summer 2009 it had H2O to as much as 30cm
8	Slight slope had led to some pooling along south body. Saturated due to heavy rain night before.
9	Wetland appears to have seep/spring inflow at eastern body. Also culvert inflowing in NW affecting about 10-20% of wetland. Water table at surface where inflows occur, otherwise about 40cm. Outflow onto RoW road for transmission line. Heavy rain night before.
10	Western half of wetland (conifer swamp) under different hydro regime than eastern half. Discontinuous channel with sub terrain outflow. Eastern half culvert inflow and outflow along with runoff and precipitation. Culvert inflow 2 from HWY only. 2/3 wetland has tree mortality due to impoundment effects.
12	Sloped wetland in channel. One surface flow channel comes from WL9 but is partially redirected by RoW road. Other flows subterrean but audible. Called one subterrean flow a spring input which formed a discontinuous stream in wetland (inflow 2). Outflow from main stream goes subterrean at WL body. Heavy rain night before. Hard to define NW body due to subterrean flows. Ground very stony. Wetland directly under transmission line.
13	Springs could be channeled inter flow from steep slopes leading to wetland.
16	Bear activity.
18	Likely connected to wetland 16 by underground stream. Some surface water may percolate into adjacent wetland.
19	Spring forms discontinuous channel in wetland. Outflow subterrean at body. Suspect there is additional flow though wetland, but not sheet - called braided over all.
22	Very small wetland directly adjacent to Hwy. Ditch fed inflow and braided throgh wetland (no distinct channel). Leads to ephemeral stream outflow. Heavy rain nght before. Wetland arguably just ppart of RoW.
25	Based on topography, outflow from WL19 probably contributes to WL25 inflow. Channel is mainly visible inside wetland. Outside wetland channel (or spring) is subterrean at inflow and discontinuous at outflow. Based on wetland size, there must be other subterrean inflows. Called overall flow braided. More potential here for interflow inputs than WL19.
26	Subterrean flows into wetland forms partial channel inside wetland but below ground at inflow and outflow ends. Wetland small enough to have sheet flow along with partial channel.
31	Small basin swamp separated from nearby stream by small upland ridge. Stream likely fed underground by swamp to some degree, but no obvious channels. Stream also receives ditch flows.
34	Subterrean inflow where mixed wood section is. Opens up to TSS which has an artificial look. Old treed-in road beside wetland suggests area could have been excavated.
39	Shallow water wetland cut off from main water body by HWY.. HWY has caused impoundment conditions - evidence of dead trees in middle of wetland. Open water surrounded by shrub wetland with occasional stunted spruce. Whole area likely swamp before HWY. Water source mainly inflows from upland, with precipitation and groundwater. Pocket of shoe bog on northern shore.
40	Finger in north with dry passes through side road culvert into main wetland. Outflow east into partially dammed river. Partial impoundment has changed shoreline location. Outflow mainly associated with riparian swamp. Flat swamp dominates wetland.
49	BTGW (s), BHVI (s), BASW (nest), DCCO, SOSP (s), SWSP (cf), TRSW (fo), BCCH, GCKI (s), YRWA (s), HAWO (fo), MAWA (s), BRCR (s), COYE (s), COGR (s), CAGO, BLDU, BEKI, WT Deer, Beaver, Spring Peeper, Green Frog, RB Snake. Old dam (non-functional) across SW end of lake with sluice on one side. Inflow to SW end of wetland consists of a mixture of stream flow and ditch flow (flashy). SW inflow comes from WL55.
55	BHVI(s), NAWA(s), BTGW(s), Red squriel, RBNU(s) Water entering wetland consists of a mix of stream water and ditch flow. Ditch flow contributes to flashy conditions.
63	Very small swamp - Currently dry at surface, sub terrain flow through this wetland.
65	Very small wetland with concave marsh section surrounded by swamp margin. May be connected sub terrain to WL68, but no obvious outflows. Ponded water suggests no connection.
68	PAWA(s) Inflow is underground stream which begins and ends in wetland. Starts at SW end and ends at NE end (pond). Water in pond goes underground.
80	Two slope swamps feed excavated area (now swamp) where water collects and flows out channel associated with old access road. Middle of excavated area mainly mosses.
82	COYE(s), SWSP(s), RTHA(fo), YRWA, WT deer, DEJU(PAIR COURTSHIP), WIWR(s), BWHA (fo)
84	MAWA(s), WTSP, GCKI(s), Some flow observed from center of wetland to outflow(culvert)
88	Stream inflow short circuits almost the entire wetland. Wetland appears to contribute little to stream flow.
91	
92	BBWA, HETH, BLWA(s), Red Squirrel
93	
94	BTGW(s), CORA, MAWA(s)
99	COYE(s), WTSP(s), MOWA(s), DEJU(s)
102	PAWA(s), SWSP(s), LISP(s), MAWA(s), COYE(s), V.hare, WT deer, WTSP(s)
103	VI HARE

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Additional Data
107	OSPR(fo), COYE, MAWA(s), BTGW(s), ALFL(s), Wt deer, Seep situated down slope of old logging road, water from wetland seeps through logging road bed on old culvert (not usable).
109	Peepers
114	MAWA(s), BBWO, PIWO, DEJU(s) WIWR(s) BCCH, AMRO, WT deer, Green frog
118	Marginal wetland.
122	Marginal wetland.
125	This wetland would normally be a swamp however, regular clearing and herbiciding has greatly reduced tree and shrub cover and increased the cover of graminoids.
126	HETH (nest), BTGW(s), BWHA, DEJU(s)
127	BLWA(s), MAWA(s), BTGW(s), DEJU(s)
129	BTGW(s), MAWA(s), Appears to act as both groundwater discharge and recharge site. Water emerges then disappears.
131	BTGW(s), RBNU(s), YRWA(s), Wood Frog, DEJU(s), BOCH(s), Red Squirrel
135	COYE(s), Sub terrain outflow, WTSP(s), RCKI(s), Wood Frog
138	Slope swamp with subterrean flows audible but not visible. Likely more than one source so listed as braided flow.
141	See sketch on back of field notes.
142	Fed by stream departing WL141 a small basin and by runoff and ppt from surrounds, Deer tracks< Green frog swamp sparrows
145	Stream flows into river near outlet of wetland. Wetland divided into two sectors with 5-10m channel in between. Beaver activity near outlet (stumps). Stream divides then comes back near outlet. Pooled area on west side just before channel break.
149	Channel 1 stream running parallel to HWY. Channel 2 sub terrain flow which eventually turns into channel inside wetland. Inflows meet at wetland centre then exit as one outflow parallel to HWY. TSS at centre of wetland. Same stream as WL145.
167	Level depressional site partially impounded by HWY. Pooled water table visible between hummocks/rocks
168	Channel inflow partially from WL169. Main channel associated with mossy, stony swamp. Treed along edges. Flow west parallel to HWY.
169	Sub terrain inflow and outflow along with discontinuous channel and sheet flow. Level-depressional site with perched water table visible between mounds/rocks.
172	Depression with open water. Potentially affected by impoundment - old dead tree in middle of open water. Surrounded by thin swamp edge on 70% of shoreline. Perched water table - not groundwater.
176	Very small depression - partially mounded. Looks like it would normally have ponded water in concave areas but currently dry. Looks like no influence from HWY.
178	Sub terrain inflow grades into ill-defined channel through wetland along with pooling. Water level appears to be close to maximum typical level. Outflow channel well defined. Ephemeral stream located just outside wetland going outflow.
183	Wetland directly adjacent to HWY - almost acting as ditch but not excavated. Small pocket of marsh at eastern boundary.
185	Southern tip of large wetland. Beaver dam at outflow has caused water backup. Mainly low shrubs, but some fallen - classes as mixed shrubs. Also patches of Larix along with scattered LARIX. Wetland may grade into bog as move away from stream. However similar veg; Chamaedaphne calyculata, Rhodora, Labrador Tea. Shrub converge continuous over patchy sphagnum. Seems unusually dry in flat swamp section. Description for southern section only.
186	Small wetland with sub terrain inflow and outflow. Occasional pockets of ponded water between hummocks and mounds. Outflow into nearby river which crosses under HWY. There is also a small pocket wetland west of the river that is not mapped, but flagged (too small).
193	Partially dry inflow looks to be spring fed. Iron floc on rocks and bed. Discontinuous channel through wetland leading to defined outflow. Flow NW.
202	Beaver chews at WL / Lake edge; redback vole in treed swamp, American toads clalling along lake edge, redback salamander in WL off te Hwy
207	Very small seepage slope WL, no pools or defined H20 course, No amphibian. Breeding habitat, Drains sub terrain to road. See sketch on back of field notes.
208	A very small WL but with shallow pools and likely permanent to late season (if at all) dry down. See sketch on back of field sheet.
215	Area near the Rd likely anthropogenic gentle slope basin but into the NW its natural treed WL. See sketch on back of field notes.
220	A narrow anthropogenic flow through basin squeezed between mostly medium height tall shrub swamp. See sketch on back of field notes.
221	Small mainly TSS with channel input, braided flow in wetland than channel outflow. Inflow may be partially ditch fed further upstream - wetland runs parallel to HWY. Heavy rain night before.
222	Anthropogenic shallow basin/bowl scraped and presently dry outflow with old ruts track "outflow" Mostly rain affected, Not hydrologically connected to WL220 which drains via running1 and 20 ditch along HWY 103.
224	See sketch on back of field notes.
226	Appears to be mainly level swamp adjacent to pond. Very little slope so minimal runoff. May be discharges to pond through wetland, but no visible evidence. Appears to be groundwater controlled. Conifer dominated in mixed wood.
227	Subterrean inflow from swamp leading to sheet outflow toward shallow water pool and eventually nearby river. Hummocky Stony with seasonal ponding in depressions. More seepage inflow than ground water. Small wetland not a major contributor to river.Small despressional shallow water wetland separated from nearby river by narrow upland ridge.
233	Slight slope to wetland, seep / spring inflow mainly below ground, but visible for a short distance at outflow. Basin is ill defined. Flow appears to be braided around hummocks.

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Additional Data
248	GCKI, WTSP, CORA, MAWA, RCKI
249	RCKI, NAWA, WTSP, COYE, PAWA, WT deer, Snowshoe hare, Listera australis, WPI 20t, 0418780, 4944508, 7 plants, Philo 6566-67, Green frog, Water level fluctuations only noted at outflow culvert, Only part of wetland surveyed, South end of WL receives some off-road drainage.
252	Spring / seep near north body, meets up with defined channel inside wetland (just inside wetland). Heavy rain night before.
253	PUFI, BLWA, WTSP, RCKI, PAWA, NAWA, MAWA, Red Squirrel, BCCH, Only part of WL surveyed.
259	RCKI, GCKI, BTBW, Red Squirrel, Only portion of wetland surveyed
261	BTGW, GCKI
262	BWWA, Wetland does not all drain in same direction, Drainage dived running N-S in middle.
267	OVEN, BLWA, Red Squirrel, WT deer, Marginal wetland.
268	Raccoon, OVEN
270	Large swamp with stream running down western side. East section mainly basin swamp. Outflow data from about middle of wetland - did not reach south body. No springs found but wetland is too big for only stream and run off water. Stream inflow very close to HWY (culvert). Pocket of TSS along inflow. Heavy rain night before. Stream is well defined, older than culvert.
277	BLDU (+4,1A DUCKLINGS), Green Frog, Fish in pond, Wetland partially surveyed (extends out of survey area). Needs to be redelineated,
283	Southern body of wetland likely bisected or truncated by HWY. Other is a thin 10-20 m strip of upland between wetland edge and current RoW. However, there appears to be little impact on wetland hydrology. Tree cover ~10-20% and uniform> Sphagnum ~100%. Evaluation on southern section of wetland only.
285	Treed swamp adjacent to HWY. Northern section. South section butts up to HWY where it opens up into TSS (cleared RoW). Flows eventually lead to ditch, but some pooling (impoundment) evident near road. Looks like HWY was run through overall wet area resulting in wetland on both sides of HWY.
288	Wetland is mainly ditch fed, impounded marsh adjacent to HWY. Outflow is partially infilled culvert where woods road hits HWY. Wetland boundary includes ditched area. Woods road splits wetland into A and B sections. Section A much wetter.
290	Swamp which appears to slope North away from HWY. It's possible that WL 288a feeds (partially) WL288b, but woods road has caused impoundment in 288a. WL288b is partially flagged but not mapped. Large wetland that goes beyond RoW. Took points on either side to cut over using Hard held GPS.
292	Looks like vernal pool, depressions with no vegetation and only scattered shrub on mounds (spiraea). Site relatively dry, even after heavy rain night before. Likely usually more snow melt water, but dry winter last year.
294	Riparian shrub swamp with higher than usual water levels. Appears to be blocked flow inside 3' culvert. Outflow from end of culvert, but ponded at wetland side. Probably beaver dam or debris inside. Evidence of beaver activity around edges and also partial dam at inflow to wetland. Inflow wet width maximum and above average. If left to current conditions, wetland will likely move to shallow water. Culvert outflow leads to nearby river.
296	
303	Swamp which appears to have sub terrain flow to nearby lake to North. No defined channel, but suggested by topography. Current WL water table above lake - groundwater not a likely source of water, at least major source, but connection is there.
304	Inflow channel comes from culvert under HWY currently dry. Channel not well defined - epherpal. Outflow channel goes sub terrain before end of wetland - measurements taken at end of surface section. Looks like inflow is dissipated when entering wetland, flows as sheet as wells channel. Very small slope swamp leading to lake.
306	Marginal wetland - majority of area is arguably upland with pockets of wetland. Very stony. Area collects run-off, but most flow is sub terrain. No inflow channel - outflow leads to lake (through culvert under camp road). Wetland not flagged, perhaps due to private land.
307	Very small slope swamp sloping north/northeast toward western side of WL306. Drainage way closet fit.
314	Braided stream inflow but from one channel source (inflow 1). Inflow 2 dry culvert. Old beaver dam that has been broken near end of lake. Inflow 1 connected to an extension of ditch running adjacent to on-ramp.
316	Outflow from WL317 is inflow to WL316. Also inflow seep/spring from long forested slope along SW body. Pockets of water visible that would not be from channel inflow. There is no outflow channel from WL316 but pooling at NE and where infill has caused some impoundment. Flows must be subterranean. TSS mainly associated with channel area.
317	Inflow braided at higher flow levels, however only one main channel. Wetland gently slopes NE in direction of flow. No peat, but muddy ground. TSS at inflow end.
318	Moderate size swamp located along bench or terrace with macro flow direction ENE. Basin swamp best fit.
321	Inflow, exists culvert under camp road into wetland. Inflow 2 flows partially redirect into wetland by camp road-runs along side. Inflow 2 originates from ditch flow along HWY.
324	Wetland smaller than mapped. Two streams running roughly parallel with upland between (although there is sub terrain flow between) wetland section near bottom where flows become a couple of channel and sheet. West channel becomes discontinuous and feeds wetland area then collects again at out flow channel. East channel not part of wetland although connected hydrologically. Area very stony.
325	Channel inflow and outflow within body of wetland. Spring fed. Partial harvest - open areas slosh and graminoids.

Table 9 Non-wildlife Functional Assessment Data

Wetland Number	Additional Data
327	Swamp at bottom of slope with at least one obvious seep input. Flows partially influenced by adjacent private residence. Stream adjacent to wetland travels into, private property (no outflow measurement). Stream flows through culvert under HWY. Slope swamp flows likely reach stream inside property line. Wetland body not flagged.
335	Inflow is up to 3 m wide in places but is diffuse, mult-braided, outflow subterranean through boulders
336	Small anthropogenic wetland but reasonably diverse. Diffuse outflow in marsh - merges to ditch area, no strong channel.
154	1 subterrean inflow and 1 outflow.
158	1 subterrean outflow - flowing in between bulders.
210	Basin in a valley drainage area.
211	N/A
219	Elbow of stream borders a portion of WL, appears WL has some drainage into it, probably in high flow events. Some wet pitted hollows, some areas of deep peat.
223	Note: low shrubs and young fringing balsam fir also common.
234	Part of subterranean channel flow, hummocks with some surface water pools, one inflow - one outflow noted.
244	Sloped WL, two arms that flow into a WL basin and overflows downslope WL follows this drainage.
312	N/A
148	N/A
146	Detailed information regarding depths and flows of springs in wetland and Ingramport River availble in field notes.
150	N/A
153	N/A

Table 10: Wetland Areas and Project Impacts

Wetland Number	Chainage	Source	Wetland Class	Total Area (ha)	Area in 500m Assessment Area (ha)	Area Inside Study Corridor (ha)	Area Inside Project Impact Area (ha)
1	0	NSDNR	SHALLOW WATER	6.96	6.96	0.00	0.00
2	700	2007 Aerial Photography	MARSH	0.54	0.54	0.54	0.03
3	800	2007 Aerial Photography	SWAMP	6.69	6.66	0.00	0.00
4	1000	2007 Aerial Photography	SWAMP	0.77	0.77	0.09	0.00
5	1000	2007 Aerial Photography	SWAMP	1.72	0.65	0.00	0.25
6	1300	2009 Field Survey	SWAMP / MARSH	0.03	0.03	0.03	0.03
7	1300	2007 Aerial Photography	SWAMP	0.34	0.34	0.21	0.00
8	1500	2009 Field Survey	SWAMP	0.04	0.04	0.04	0.01
9	1550	2009 Field Survey	SWAMP	0.09	0.09	0.09	0.00
10	1600	2009 Field Survey	SWAMP / MARSH	1.07	1.07	1.06	0.25
11	1600	2007 Aerial Photography	BOG	1.59	1.59	0.00	0.00
12	1650	2009 Field Survey	SWAMP	0.21	0.21	0.16	0.06
13	1800	2009 Field Survey	SWAMP	0.04	0.04	0.04	0.03
14	1900	2007 Aerial Photography	SWAMP	0.15	0.15	0.00	0.00
15	1900	2007 Aerial Photography	SWAMP	0.09	0.09	0.00	0.00
16	2000	2009 Field Survey	SWAMP	0.58	0.58	0.46	0.09
17	2000	2007 Aerial Photography	SWAMP	0.09	0.09	0.00	0.00
18	2100	2009 Field Survey	SWAMP	0.12	0.12	0.12	0.12
19	2200	2009 Field Survey	SWAMP	0.12	0.12	0.12	0.06
20	2200	2007 Aerial Photography	SWAMP	0.33	0.33	0.00	0.00
21	2300	2009 Field Survey	SWAMP	0.46	0.46	0.00	0.00
22	2300	2009 Field Survey	MARSH	0.02	0.02	0.02	0.00
23	2300	2007 Aerial Photography	BOG	1.15	1.15	0.00	0.00
24	2300	2007 Aerial Photography	SWAMP	0.22	0.16	0.00	0.00
25	2350	2009 Field Survey	SWAMP	0.32	0.32	0.21	0.08
26	2400	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.01
27	2500	2007 Aerial Photography	SWAMP	1.26	1.26	0.00	0.00
28	2500	2007 Aerial Photography	SWAMP	0.17	0.17	0.00	0.00
29	2600	2009 Field Survey	SWAMP	0.65	0.65	0.55	0.00
30	2700	2009 Field Survey	SWAMP	0.31	0.31	0.31	0.00
31	2750	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.03
32	2850	2009 Field Survey	SWAMP	0.46	0.46	0.10	0.00
33	2900	2007 Aerial Photography	SWAMP	2.42	2.42	0.00	0.00
34	3000	2009 Field Survey	SWAMP	0.04	0.04	0.04	0.04
35	3000	2009 Field Survey	SWAMP	0.47	0.47	0.32	0.00
36	3100	NSDNR	SHALLOW WATER	0.74	0.74	0.00	0.00
37	3150	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.00
38	3400	2009 Field Survey	MARSH	0.19	0.19	0.19	0.00
39	3400	2007 Aerial Photography	SWAMP / SHALLOW WATER	0.87	0.87	0.87	0.77
40	3800	2009 Field Survey	SWAMP	0.56	0.56	0.55	0.34
41	3800	2009 Field Survey	SWAMP	0.27	0.27	0.27	0.00
42	3800	2007 Aerial Photography	SWAMP	0.13	0.13	0.00	0.00
43	3900	2009 Field Survey	SWAMP	0.60	0.60	0.10	0.00
44	3950	2009 Field Survey	MARSH	0.03	0.03	0.03	0.00
45	4100	2007 Aerial Photography	SWAMP	0.63	0.63	0.00	0.00
46	4200	2009 Field Survey	SWAMP	0.39	0.39	0.39	0.00
47	4200	2007 Aerial Photography	SWAMP	0.45	0.03	0.00	0.00
48	4300	2007 Aerial Photography	SWAMP	0.43	0.43	0.00	0.00
49	4400	2009 Field Survey	SWAMP / SHALLOW WATER / FEN	6.75	6.10	2.10	1.18
50	4400	2009 Field Survey	SWAMP / SHALLOW WATER	0.36	0.36	0.36	0.22

Table 10: Wetland Areas and Project Impacts

Wetland Number	Chainage	Source	Wetland Class	Total Area (ha)	Area in 500m Assessment Area (ha)	Area Inside Study Corridor (ha)	Area Inside Project Impact Area (ha)
51	4500	2009 Field Survey	SWAMP	2.99	2.99	0.68	0.00
52	4600	2009 Field Survey	SWAMP	2.81	2.81	0.12	0.00
53	4600	2007 Aerial Photography	SWAMP	0.25	0.25	0.00	0.00
54	4600	2007 Aerial Photography	SWAMP	0.28	0.28	0.00	0.00
55	4700	2009 Field Survey	SWAMP	0.06	0.06	0.06	0.06
56	4700	2009 Field Survey	SWAMP	0.08	0.08	0.07	0.00
57	4700	2007 Aerial Photography	SWAMP	1.38	0.23	0.00	0.00
58	4850	2009 Field Survey	SWAMP	0.09	0.09	0.09	0.00
59	4900	2007 Aerial Photography	SWAMP	0.11	0.11	0.00	0.00
60	5000	2007 Aerial Photography	SWAMP	0.25	0.25	0.00	0.00
61	5100	2007 Aerial Photography	SWAMP	0.55	0.55	0.00	0.00
62	5300	2009 Field Survey	SWAMP	0.11	0.11	0.03	0.00
63	5300	2009 Field Survey	SWAMP	0.01	0.01	0.01	0.01
64	5500	2007 Aerial Photography	SWAMP	0.82	0.82	0.00	0.00
65	5600	2009 Field Survey	SWAMP / MARSH	0.01	0.01	0.01	0.01
66	5600	2007 Aerial Photography	SWAMP	0.36	0.36	0.00	0.00
67	5600	2007 Aerial Photography	SWAMP	0.26	0.26	0.00	0.00
68	5650	2009 Field Survey	SWAMP / SHALLOW WATER	0.24	0.24	0.24	0.24
69	5650	2009 Field Survey	MARSH	0.13	0.13	0.13	0.00
70	5700	2007 Aerial Photography	SWAMP	0.07	0.07	0.00	0.00
71	5700	2007 Aerial Photography	SWAMP	0.14	0.14	0.00	0.00
72	5750	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.00
73	5800	2009 Field Survey	SWAMP	0.14	0.14	0.02	0.00
74	5800	2007 Aerial Photography	SWAMP	0.34	0.34	0.05	0.00
75	5800	2007 Aerial Photography	SWAMP	0.11	0.11	0.00	0.00
76	5800	2007 Aerial Photography	SWAMP	0.02	0.02	0.00	0.00
77	6000	2007 Aerial Photography	SWAMP	0.31	0.31	0.00	0.00
78	6000	2007 Aerial Photography	SWAMP	0.26	0.07	0.00	0.00
79	6000	2007 Aerial Photography	SWAMP	0.63	0.63	0.00	0.00
80	6050	2009 Field Survey	SWAMP	0.12	0.12	0.12	0.09
81	6100	2009 Field Survey	SWAMP	0.19	0.19	0.17	0.00
82	6150	2009 Field Survey	SWAMP	0.15	0.15	0.15	0.15
83	6300	2009 Field Survey	SWAMP	0.01	0.01	0.01	0.00
84	6400	2009 Field Survey	SWAMP	0.10	0.10	0.10	0.10
85	6400	2009 Field Survey	SWAMP	0.13	0.13	0.09	0.00
86	6400	2007 Aerial Photography	SWAMP	1.59	1.59	0.00	0.00
87	6500	2009 Field Survey	SWAMP	0.02	0.02	0.01	0.00
88	6600	2009 Field Survey	SWAMP	0.26	0.26	0.26	0.26
89	6700	2009 Field Survey	SWAMP	0.20	0.20	0.19	0.00
90	6700	2007 Aerial Photography	SWAMP	1.33	1.33	0.00	0.00
91	6750	2009 Field Survey	SWAMP	0.11	0.11	0.10	0.04
92	6750	2009 Field Survey	SWAMP	0.08	0.08	0.08	0.08
93	6800	2009 Field Survey	SHALLOW WATER / MARSH	0.01	0.01	0.01	0.01
94	6800	2009 Field Survey	SWAMP	0.14	0.14	0.14	0.14
95	6800	2007 Aerial Photography	SWAMP	0.27	0.09	0.00	0.00
96	6800	2007 Aerial Photography	SWAMP	0.33	0.33	0.00	0.00
97	6850	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.00
98	6950	2009 Field Survey	SWAMP	0.12	0.12	0.12	0.00
99	7000	2009 Field Survey	SWAMP	0.32	0.32	0.29	0.27
100	7000	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.00

Table 10: Wetland Areas and Project Impacts

Wetland Number	Chainage	Source	Wetland Class	Total Area (ha)	Area in 500m Assessment Area (ha)	Area Inside Study Corridor (ha)	Area Inside Project Impact Area (ha)
101	7000	2009 Field Survey	SWAMP	0.27	0.27	0.00	0.00
102	7100	2009 Field Survey	SWAMP	0.45	0.45	0.45	0.43
103	7100	2009 Field Survey	SWAMP / MARSH	0.07	0.07	0.07	0.07
104	7100	2007 Aerial Photography	BOG	1.42	1.42	0.00	0.00
105	7100	2007 Aerial Photography	SWAMP	1.06	1.06	0.00	0.00
106	7150	2009 Field Survey	SWAMP	0.78	0.78	0.24	0.00
107	7200	2009 Field Survey	SWAMP	0.07	0.07	0.07	0.07
108	7200	2007 Aerial Photography	SWAMP	0.25	0.06	0.00	0.00
109	7300	2009 Field Survey	MARSH	0.02	0.02	0.02	0.02
110	7300	2007 Aerial Photography	SWAMP	0.66	0.26	0.00	0.00
111	7400	2007 Aerial Photography	SWAMP	0.40	0.40	0.00	0.00
112	7400	2007 Aerial Photography	MARSH	0.04	0.04	0.00	0.00
113	7500	2009 Field Survey	BOG	1.77	1.77	0.61	0.00
114	7500	2009 Field Survey	BOG / SWAMP	2.22	2.22	0.89	0.63
115	7500	2007 Aerial Photography	SWAMP	0.50	0.50	0.00	0.00
116	7500	2007 Aerial Photography	SWAMP	0.32	0.32	0.00	0.00
117	7600	2007 Aerial Photography	SWAMP	0.26	0.22	0.00	0.00
118	7700	2009 Field Survey	SWAMP	0.08	0.08	0.08	0.05
119	7700	2007 Aerial Photography	SWAMP	1.30	1.30	0.00	0.00
120	7700	2007 Aerial Photography	SWAMP	0.10	0.00	0.00	0.00
121	7700	2007 Aerial Photography	SWAMP	0.10	0.10	0.00	0.00
122	7800	2009 Field Survey	SWAMP	0.06	0.06	0.06	0.06
123	7800	2007 Aerial Photography	SWAMP	0.11	0.11	0.00	0.00
124	7800	2007 Aerial Photography	SWAMP	0.20	0.20	0.00	0.00
125	7900	2009 Field Survey	SWAMP	0.11	0.11	0.11	0.09
126	8050	2009 Field Survey	SWAMP	0.13	0.13	0.13	0.11
127	8300	2009 Field Survey	SWAMP	0.30	0.30	0.30	0.30
128	8400	2009 Field Survey	SWAMP	0.12	0.12	0.12	0.00
129	8500	2009 Field Survey	SWAMP	0.36	0.36	0.36	0.33
130	8700	2007 Aerial Photography	SWAMP	0.42	0.42	0.00	0.00
131	8800	2009 Field Survey	SWAMP	0.22	0.22	0.22	0.21
132	8800	2007 Aerial Photography	SWAMP	0.11	0.11	0.00	0.00
133	8900	2007 Aerial Photography	SWAMP	0.12	0.12	0.00	0.00
134	9000	2009 Field Survey	SWAMP	0.14	0.14	0.06	0.00
135	9100	2009 Field Survey	SWAMP	0.31	0.31	0.31	0.31
136	9100	2007 Aerial Photography	SWAMP	0.12	0.12	0.00	0.00
137	9250	2009 Field Survey	SWAMP	0.08	0.08	0.08	0.00
138	9300	2009 Field Survey	SWAMP	0.07	0.07	0.07	0.07
139	9400	2007 Aerial Photography	BOG	0.49	0.49	0.00	0.00
140	9450	2009 Field Survey	SWAMP	0.16	0.16	0.16	0.00
141	9500	2009 Field Survey	SWAMP	0.32	0.32	0.32	0.30
142	9500	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.02
143	9600	2009 Field Survey	SWAMP	1.06	1.06	0.43	0.00
144	9600	NSDNR	SWAMP	0.23	0.23	0.00	0.00
145	9700	2009 Field Survey	SWAMP / MARSH	0.17	0.17	0.17	0.17
146	9750	2009 Field Survey	SWAMP / FEN	1.14	1.14	0.40	0.24
147	9800	2007 Aerial Photography	SWAMP	0.69	0.00	0.00	0.00
148	9900	2009 Field Survey	SWAMP	0.31	0.31	0.31	0.07
149	10000	2009 Field Survey	SWAMP	0.12	0.12	0.12	0.12
150	10000	2009 Field Survey	SWAMP	0.06	0.06	0.06	0.00

Table 10: Wetland Areas and Project Impacts

Wetland Number	Chainage	Source	Wetland Class	Total Area (ha)	Area in 500m Assessment Area (ha)	Area Inside Study Corridor (ha)	Area Inside Project Impact Area (ha)
151	10000	2007 Aerial Photography	SWAMP	0.20	0.20	0.00	0.00
152	10000	2007 Aerial Photography	SWAMP	0.55	0.00	0.00	0.00
153	10050	2009 Field Survey	SWAMP	0.05	0.05	0.05	0.00
154	10100	2009 Field Survey	SWAMP	0.30	0.30	0.09	0.10
155	10200	2007 Aerial Photography	SWAMP	0.99	0.99	0.00	0.00
156	10200	2007 Aerial Photography	SWAMP	0.35	0.00	0.00	0.00
157	10200	2007 Aerial Photography	SWAMP	0.18	0.00	0.00	0.00
158	10300	2009 Field Survey	SWAMP	0.14	0.14	0.08	0.13
159	10300	2007 Aerial Photography	SWAMP	0.30	0.30	0.00	0.00
160	10300	2007 Aerial Photography	SWAMP	1.39	1.39	0.00	0.00
161	10300	2007 Aerial Photography	SWAMP	0.39	0.00	0.00	0.00
162	10400	2007 Aerial Photography	SWAMP	0.41	0.41	0.00	0.00
163	10400	2007 Aerial Photography	BOG	0.65	0.65	0.00	0.00
164	10400	2007 Aerial Photography	SWAMP	0.81	0.00	0.00	0.00
165	10400	2007 Aerial Photography	SWAMP	0.24	0.24	0.00	0.00
166	10400	2007 Aerial Photography	SWAMP	0.51	0.00	0.00	0.00
167	10650	2009 Field Survey	SWAMP	0.10	0.10	0.10	0.10
168	10800	2009 Field Survey	SWAMP / SHALLOW WATER	0.03	0.03	0.03	0.03
169	10800	2009 Field Survey	SWAMP	0.08	0.08	0.08	0.08
170	10800	2007 Aerial Photography	SWAMP	2.97	1.31	0.00	0.00
171	10900	2009 Field Survey	SWAMP	0.18	0.18	0.12	0.00
172	10950	2009 Field Survey	SWAMP / SHALLOW WATER	0.02	0.02	0.02	0.02
173	11100	2007 Aerial Photography	SWAMP	0.58	0.58	0.00	0.00
174	11100	2007 Aerial Photography	SWAMP	0.14	0.14	0.00	0.00
175	11200	2007 Aerial Photography	SWAMP	1.79	1.79	0.00	0.00
176	11250	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.02
177	11300	2009 Field Survey	SWAMP	0.00	0.00	0.00	0.00
178	11400	2009 Field Survey	SWAMP	0.15	0.15	0.15	0.15
179	11500	2009 Field Survey	SWAMP	0.28	0.28	0.16	0.00
180	11600	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.00
181	11600	2007 Aerial Photography	SWAMP	7.89	2.24	0.00	0.00
182	11750	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.00
183	11800	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.03
184	11800	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.00
185	11850	2009 Field Survey	BOG	10.37	9.43	0.54	0.43
186	11900	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.02
187	12000	2007 Aerial Photography	SWAMP	1.46	0.48	0.00	0.00
188	12100	2009 Field Survey	BOG	14.68	14.68	3.08	0.00
189	12100	2007 Aerial Photography	SWAMP	0.23	0.23	0.00	0.00
190	12300	2007 Aerial Photography	SWAMP	0.33	0.33	0.00	0.00
191	12400	2007 Aerial Photography	SWAMP	0.14	0.14	0.00	0.00
193	12750	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.03
194	12800	2009 Field Survey	SWAMP	0.07	0.07	0.04	0.00
195	12800	2007 Aerial Photography	SWAMP	0.17	0.17	0.00	0.00
196	12800	2007 Aerial Photography	SWAMP	1.35	1.35	0.00	0.00
197	12850	2009 Field Survey	BOG	0.16	0.16	0.14	0.00
198	12950	2009 Field Survey	BOG	0.15	0.15	0.15	0.00
199	13000	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.00
200	13200	2007 Aerial Photography	SWAMP	3.27	3.27	0.00	0.00
201	13300	2009 Field Survey	BOG	1.46	1.46	0.83	0.00

Table 10: Wetland Areas and Project Impacts

Wetland Number	Chainage	Source	Wetland Class	Total Area (ha)	Area in 500m Assessment Area (ha)	Area Inside Study Corridor (ha)	Area Inside Project Impact Area (ha)
202	13300	2009 Field Survey	SWAMP	0.37	0.37	0.37	0.22
203	13400	2007 Aerial Photography	SWAMP	0.31	0.16	0.00	0.00
204	13500	2009 Field Survey	SWAMP	0.05	0.05	0.05	0.00
205	13500	2007 Aerial Photography	SWAMP	0.19	0.19	0.00	0.00
206	13550	2009 Field Survey	SWAMP	0.05	0.05	0.05	0.00
207	13550	2009 Field Survey	SWAMP	0.10	0.10	0.10	0.09
208	13650	2009 Field Survey	SWAMP	0.04	0.04	0.04	0.04
209	13700	2009 Field Survey	SWAMP	0.37	0.37	0.37	0.00
210	13700	2009 Field Survey	SWAMP	0.05	0.05	0.03	0.04
211	13700	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.02
212	13800	2009 Field Survey	SWAMP	0.20	0.20	0.11	0.00
213	13800	2007 Aerial Photography	SWAMP	0.36	0.36	0.00	0.00
214	13800	2007 Aerial Photography	SWAMP	0.17	0.17	0.00	0.00
215	13850	2009 Field Survey	SWAMP	0.98	0.98	0.95	0.84
216	13900	2007 Aerial Photography	SWAMP	0.14	0.14	0.00	0.00
217	13900	2007 Aerial Photography	SWAMP	0.38	0.38	0.00	0.00
218	13900	2007 Aerial Photography	SWAMP	0.13	0.13	0.00	0.00
219	14000	2009 Field Survey	SWAMP	0.43	0.43	0.26	0.25
220	14000	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.03
221	14000	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.00
222	14100	2009 Field Survey	SWAMP / MARSH	0.02	0.02	0.02	0.02
223	14150	2009 Field Survey	SWAMP	0.13	0.13	0.08	0.08
224	14150	2009 Field Survey	SWAMP	0.41	0.41	0.41	0.40
225	14200	2009 Field Survey	SWAMP / MARSH	1.09	1.09	0.98	0.00
226	14250	2009 Field Survey	SWAMP	0.19	0.19	0.12	0.12
227	14300	2009 Field Survey	SWAMP / SHALLOW WATER	0.03	0.03	0.03	0.03
228	14350	2009 Field Survey	SWAMP	0.00	0.00	0.00	0.00
229	14600	2007 Aerial Photography	SWAMP	0.15	0.01	0.00	0.00
230	14650	2009 Field Survey	SWAMP	0.00	0.00	0.00	0.00
231	14900	2007 Aerial Photography	SWAMP	1.55	0.55	0.00	0.00
232	14900	2007 Aerial Photography	SWAMP	0.09	0.09	0.00	0.00
233	15000	2009 Field Survey	SWAMP	0.05	0.05	0.03	0.04
234	15250	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.03
235	15300	2009 Field Survey	SWAMP	0.06	0.06	0.02	0.00
236	15500	2007 Aerial Photography	SWAMP	0.42	0.16	0.00	0.00
237	15600	2007 Aerial Photography	SWAMP	0.07	0.07	0.00	0.00
238	15900	2007 Aerial Photography	SWAMP	0.93	0.93	0.00	0.00
239	15900	2007 Aerial Photography	SWAMP	4.90	3.53	0.00	0.00
240	16100	2009 Field Survey	SWAMP	0.04	0.04	0.00	0.00
241	16100	2007 Aerial Photography	SWAMP	0.16	0.16	0.00	0.00
242	16150	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.00
243	16250	2009 Field Survey	SWAMP	0.01	0.01	0.01	0.00
244	16350	2009 Field Survey	SWAMP	0.01	0.01	0.01	0.00
245	16400	2009 Field Survey	SWAMP	1.99	1.99	0.25	0.00
246	16500	2007 Aerial Photography	SWAMP	0.36	0.36	0.00	0.00
247	16500	2007 Aerial Photography	SWAMP	0.35	0.09	0.00	0.00
248	16600	2009 Field Survey	SWAMP	0.08	0.08	0.08	0.08
249	16700	2009 Field Survey	SWAMP	7.31	7.31	1.46	0.45
250	16750	2009 Field Survey	SWAMP	0.51	0.51	0.31	0.00
251	16800	2007 Aerial Photography	SWAMP	3.12	3.12	0.00	0.00

Table 10: Wetland Areas and Project Impacts

Wetland Number	Chainage	Source	Wetland Class	Total Area (ha)	Area in 500m Assessment Area (ha)	Area Inside Study Corridor (ha)	Area Inside Project Impact Area (ha)
252	17000	2009 Field Survey	SWAMP	0.36	0.36	0.11	0.00
253	17050	2009 Field Survey	SWAMP	0.72	0.72	0.48	0.11
254	17100	2007 Aerial Photography	SWAMP	1.65	1.18	0.00	0.00
255	17300	2007 Aerial Photography	MARSH	0.27	0.27	0.00	0.00
256	17300	2007 Aerial Photography	SWAMP	0.06	0.06	0.00	0.00
257	17400	2009 Field Survey	SWAMP	0.09	0.09	0.04	0.00
258	17400	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.00
259	17400	2009 Field Survey	SWAMP	3.01	3.01	0.26	0.03
260	17500	2007 Aerial Photography	SWAMP	0.46	0.46	0.00	0.00
261	17600	2009 Field Survey	SWAMP	0.01	0.01	0.01	0.01
262	17650	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.02
263	17700	2009 Field Survey	SWAMP	0.06	0.06	0.02	0.00
264	17700	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.00
265	17700	2009 Field Survey	SWAMP	0.32	0.32	0.32	0.31
266	17700	2007 Aerial Photography	SWAMP	0.30	0.00	0.00	0.00
267	17750	2009 Field Survey	SWAMP	0.64	0.64	0.19	0.06
268	18000	2009 Field Survey	SWAMP	1.17	1.17	0.95	0.74
269	18000	2007 Aerial Photography	SWAMP	0.73	0.73	0.00	0.00
270	18050	2009 Field Survey	SWAMP	0.69	0.69	0.07	0.16
271	18100	2009 Field Survey	SWAMP	0.23	0.23	0.02	0.00
272	18100	2009 Field Survey	SWAMP	0.00	0.00	0.00	0.00
274	18300	2009 Field Survey	SWAMP	0.07	0.07	0.07	0.00
275	18300	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.00
276	18300	2009 Field Survey	BOG / SWAMP	1.38	1.38	0.05	0.00
277	18400	2007 Aerial Photography	SWAMP / SHALLOW WATER	13.97	7.36	1.37	0.37
278	18400	2007 Aerial Photography	BOG	1.02	1.02	0.00	0.00
279	18500	2009 Field Survey	SWAMP	2.25	2.25	1.62	0.00
280	18600	2009 Field Survey	SWAMP	3.71	3.71	0.06	0.00
281	18600	2007 Aerial Photography	BOG	0.22	0.22	0.00	0.00
282	18700	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.00
283	18700	2009 Field Survey	BOG	2.97	2.97	0.82	0.18
284	18700	2007 Aerial Photography	SWAMP	2.03	1.15	0.00	0.00
285	18800	2009 Field Survey	SWAMP / MARSH	0.20	0.20	0.20	0.19
286	18800	NSDNR	BOG	1.14	0.02	0.00	0.00
287	18900	2009 Field Survey	SWAMP	0.17	0.17	0.17	0.00
288	19000	2009 Field Survey	SWAMP / MARSH	0.21	0.21	0.21	0.21
289	19000	2009 Field Survey	SWAMP	2.41	2.41	0.16	0.00
290	19000	2009 Field Survey	SWAMP	0.99	0.99	0.19	0.00
291	19100	2007 Aerial Photography	SWAMP	0.22	0.22	0.00	0.00
292	19150	2009 Field Survey	SWAMP	0.01	0.01	0.01	0.00
293	19150	2009 Field Survey	SWAMP	0.01	0.01	0.01	0.00
294	19200	2009 Field Survey	SWAMP	0.38	0.38	0.38	0.10
295	19300	2009 Field Survey	SWAMP	0.11	0.11	0.11	0.00
296	19300	2009 Field Survey	SWAMP / SHALLOW WATER	1.67	1.67	1.58	0.81
298	19400	2009 Field Survey	SWAMP	0.78	0.78	0.78	0.00
299	19400	2009 Field Survey	SWAMP	0.41	0.41	0.09	0.00
300	19700	2009 Field Survey	SWAMP	0.21	0.21	0.15	0.00
301	19750	2009 Field Survey	SWAMP	0.04	0.04	0.04	0.00
302	19800	2009 Field Survey	BOG	0.28	0.28	0.28	0.00
303	19800	2009 Field Survey	SWAMP	0.52	0.52	0.45	0.25

Table 10: Wetland Areas and Project Impacts

Wetland Number	Chainage	Source	Wetland Class	Total Area (ha)	Area in 500m Assessment Area (ha)	Area Inside Study Corridor (ha)	Area Inside Project Impact Area (ha)
304	20100	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.03
305	20300	2009 Field Survey	SWAMP	0.24	0.24	0.24	0.00
306	20300	2009 Field Survey	SWAMP	0.72	0.72	0.31	0.03
307	20400	2009 Field Survey	SWAMP	0.06	0.06	0.06	0.03
308	20700	2009 Field Survey	SWAMP	0.53	0.53	0.18	0.00
309	20700	2009 Field Survey	SWAMP	0.55	0.55	0.55	0.00
310	20800	NSDNR	SHALLOW WATER	0.97	0.51	0.00	0.00
311	20800	NSDNR	SHALLOW WATER	2.45	2.45	0.00	0.00
312	20900	2009 Field Survey	SWAMP	0.03	0.03	0.03	0.03
313	21200	2007 Aerial Photography	SWAMP	0.32	0.32	0.00	0.00
314	21600	2009 Field Survey	SWAMP / SHALLOW WATER	0.42	0.42	0.11	0.12
315	21600	2007 Aerial Photography	SHALLOW WATER	1.43	1.43	0.00	0.00
316	21700	2009 Field Survey	SWAMP	0.15	0.15	0.05	0.00
317	21800	2009 Field Survey	SWAMP	0.20	0.20	0.16	0.00
318	21900	2009 Field Survey	SWAMP	0.53	0.53	0.36	0.33
319	22200	2007 Aerial Photography	SWAMP	13.26	2.01	0.00	0.00
320	22300	2009 Field Survey	SWAMP	0.01	0.01	0.01	0.00
321	22350	2009 Field Survey	SWAMP	0.02	0.02	0.02	0.02
322	22400	2009 Field Survey	SWAMP	0.13	0.13	0.13	0.00
323	22500	2009 Field Survey	SWAMP	0.00	0.00	0.00	0.00
324	22500	2009 Field Survey	SWAMP	0.18	0.18	0.17	0.16
325	22850	2009 Field Survey	SWAMP	0.26	0.26	0.26	0.24
326	22900	2009 Field Survey	SWAMP	0.05	0.05	0.05	0.00
327	23000	2009 Field Survey	SWAMP	0.12	0.12	0.12	0.00
328	23100	2007 Aerial Photography	SWAMP / SHALLOW WATER	2.34	2.34	0.00	0.00
329	23400	2007 Aerial Photography	SWAMP	6.29	5.39	0.00	0.00
330	23400	2007 Aerial Photography	SWAMP	3.68	1.22	0.00	0.00
331	23700	2007 Aerial Photography	SWAMP	4.23	0.00	0.00	0.00
332	23800	2007 Aerial Photography	SWAMP	2.34	2.34	0.00	0.00
333	23950	2007 Aerial Photography	SWAMP	1.36	1.36	0.00	0.00
334	23950	2007 Aerial Photography	SWAMP	1.55	1.55	0.00	0.00
335	0	2010 Field Survey	SHALLOW WATER / MARSH	0.01	0.01	0.01	0.01
336	0	2010 Field Survey	SWAMP / SHALLOW WATER	0.03	0.03	0.03	0.03

APPENDIX I

SCREENING REPEAL LETTER FROM FISHERIES AND OCEANS CANADA

Fisheries and Oceans Canada | Pêches et Océans Canada

P.O. Box 1006
Dartmouth, Nova Scotia
B2Y 4A2

Our file Notre référence
12-HMAR-MA7-00173
CEAR # 12-01-66265

July 12, 2012

Sylvie Coulomb.
Nova Scotia Department of Transportation and Infrastucture Renewal
P.O. Box 186
1672 Granville Street
Halifax, Nova Scotia
B3J 2N2

Subject: Twinning of Highway 103 from Upper Tantallon to Hubbards, Nova Scotia- The *Canadian Environmental Assessment Act, 2012*.

Dear Ms Coulomb

As part of the Government's plan for Responsible Resource Development, which seeks to modernize the regulatory system for project reviews, the *Canadian Environmental Assessment Act* (S.C. 1992, c. 37) was repealed when the *Canadian Environmental Assessment Act, 2012* (*CEAA 2012*) came into force.

Please be advised that the environmental assessment for the Twinning of Highway 103 from Upper Tantallon to Hubbards, Nova Scotia is no longer required as a result of *CEAA 2012*. All other applicable legislative, regulatory and constitutional requirements still must be fulfilled.

The information related to the project that was available on the Canadian Environmental Assessment Registry can be accessed through the Canadian Environmental Assessment Archives (http://www.ceaa.gc.ca/052/index-eng.cfm). Fisheries and Oceans Canada and Transport Canada may contact you should we require information in order to fulfill our requirements.

For further information concerning *CEAA 2012*, please refer to information on the Canadian Environmental Assessment Agency's Internet site at www.ceaa-acee.gc.ca.

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Should you have any comments or questions, please contact me at 902-426-7818 or via e-mail at Richard.Devine@dfo-mpo.gc.ca.

Sincerely,

Richard Devine
Habitat Assessment Officer
Habitat Management Division

cc: S.Colomb
K. McAllister