ENVIRONMENTAL IMPACT ASSESSMENT
MINE DECOMMISSIONING
PENOBSQUIS POTASH DEPOSIT

Submitted to:

Potash Corporation of Saskatchewan Incorporated (PotashCorp)

NB Division

Penobsquis, New Brunswick

Submitted by:

Amec Foster Wheeler Environment & Infrastructure,

a Division of Amec Foster Wheeler Americas Limited

Fredericton, New Brunswick

April 2016

TE154017.4000

EXECUTIVE SUMMARY

In late October 2012, Potash Corporation of Saskatchewan Inc. - New Brunswick (NB) Division (PotashCorp) began mining the Picadilly deposit, located approximately 400 metres (m) south of the original Penobsquis mine, and jointly operated both mines for approximately 12 months. In November 2015, mining operations permanently ceased at the Penobsquis mine and plans to decommission the site were formulated. Although decommissioning of the Penobsquis site will include removal of the site service shaft and production shaft head frames, as well as other surface infrastructure, the primary components of the decommissioning will involve the underground mine facilities (the Project). Considering that in the near future there will not be any reason to access the underground mine workings at Penobsquis, it is proposed that the management of the underground inflow be stopped, the mine be allowed to flood naturally and the shafts be capped or plugged. Shaft capping/plugging options are currently under review and final design will be reviewed and approved through New Brunswick Department of Energy and Mines (NBDEM).

The Project is considered an undertaking subject to approval under the Environmental Impact Assessment (EIA) Regulation of the New Brunswick *Clean Environment Act*. The Project activities are also subject to stipulations under the New Brunswick *Mining Act*. PotashCorp has retained the services of Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler) to prepare this EIA report in support of the registration of the Project under the provincial EIA process.

A description of both the surface and subsurface environments within which the Project activities will occur, or potentially have an influence on, was developed from existing information. Potential positive and negative interactions between Project activities and the environment were identified. Where negative interactions were anticipated, and potential effects were a concern, methods for mitigating and/or monitoring the effects have been proposed.

A description of the existing environment in the Study Area as well as the Subsurface Study Area (SSA) has been presented (see Section 4.0) based on available information. The Valued Environmental Components (VECs) identified by issue scoping and pathway analysis (see Section 5.0) for which potential effects may be a concern included:

- ambient air quality;
- physiography and drainage;
- surface water;
- groundwater;
- mineral resources;
- species at risk, migratory birds and wildlife;
- migratory birds;
- fish, fish habitat and fisheries resources;
- labour, industry and commerce;
- existing land use; and

- heritage and archaeological resources.

This report also identifies measures intended to mitigate potential environmental concerns, and provided a discussion of potential residual effects resulting from the proposed Project. As the Project progresses discussion surrounding monitoring and mitigation will continue.

Based on this Study, given the proposed mitigation and monitoring, no significant adverse residual effects are anticipated as a result of the Project.

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LIST OF ACRONYMS

3D	3-Dimensional
ACCDC	Atlantic Canada Conservation Data Centre
ACM	Asbestos-containing material
AIA	Archaeological Impact Assessment
AMEC	AMEC Environment & Infrastructure, a division of AMEC Americas Limited
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited
ASNB	Archaeological Services New Brunswick
AZMF	Air Zone Management Framework
BAM	Beta Attenuation Mass
CAAQs	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
CIHB	Canadian Inventory of Historic Buildings
CNR	Canadian National Railway
CNSC	Canadian Nuclear Safety Commission
CO	Carbon monoxide
CO_2	Carbon dioxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CT	County
CWS	Canada-Wide Standards
DFO	Department of Fisheries and Oceans Canada
ECC	Environmental Components of Concern
EEM	Environmental Effects Monitoring
EIA	Environmental Impact Assessment
ESAs	Environmentally Significant Areas
GCDWQ	Guidelines for Canadian Drinking Water Quality
GHG	Greenhouse Gas
GIS	Geographic Information System
H_2S	Hydrogen sulphide
HAZMAT	Hazardous Materials
HRIA	Heritage Resource Impact Assessment
KWRC	Kennebecasis Watershed Restoration Committee
LBP	Lead-based paint
LSD	Local Service Districts
MBBA	Maritime Breeding Bird Atlas
MBCA	*Migratory Birds Convention Act*
MBP	Mercury-based paint
MN	Magnitude
NB	New Brunswick
NBAQOs	New Brunswick Air Quality Objectives
NBDAAF	Department of Agriculture and Aquaculture and Fisheries

NBDELG	New Brunswick Department of Environment and Local Government
NBDEM	New Brunswick Department of Energy and Mines
NBDNR	New Brunswick Department of Natural Resources
NBENV	New Brunswick Department of the Environment
NBEUB	New Brunswick Energy and Utilities Board
NBSRA	*New Brunswick Species at Risk Act*
NO	Nitric oxide
NO_2	Nitrogen dioxide
NTNB	NatureTrust NB
ODS	Ozone depleting substances
OSFH	Old Spruce-Fir Habitat
OWLS	Online Well Log System
PAR	Parish
PCB	Polychlorinated Biphenyl
PID	Property Identification Number
PM	Particulate Matter
PM_{10}	Particulate Matter 10 μm or less
$PM_{2.5}$	Particulate Matter 2.5 μm or less
POL	Petroleum, Oil, Lubricants
PotashCorp	Potash Corporation of Saskatchewan Inc. – New Brunswick Division
RCMP	Royal Canadian Mounted Police
SARA	*Canadian Species at Risk Act*
SARPR	Species at Risk Public Registry
SNB	Service New Brunswick
SO_2	Sulphur dioxide
SSA	Subsurface Study Area
TDG	Transportation of Dangerous Goods
TDS	Total Dissolved Solids
the Agency	Canadian Environmental Assessment Agency
the Project	Decommissioning of the Penobsquis site which encompasses the following components: the SSA (underground mine facilities) as well as the removal of nonessential surface infrastructure.
TRC	Technical Review Committee
TRS	Total Reduced Sulphur
TSP	Total Suspended Particulate
UNBI	Union of New Brunswick Indians
UNFCC	United Nations Framework Convention on Climate Change
USDOT	United States Department of Transportation
VECs	Valued Environmental Components
WAWA	Watercourse and Wetland Alteration
WQI	Water Quality Index

LIST OF UNITS

cm	centimetres
dB	decibels
dBA	A-weighted decibels
gpm	gallons per minute
ha	hectares
km	kilometres
km^2	square kilometres
Ld	Daytime noise level
Leq	energy equivalent sound level
Ln	Nighttime noise level
m	metres
m^2	square metres
masl	metres above sea level
mbgs	metres below ground surface
mg/L	milligrams per litre
ml	millilitres
mm	millimetres
MPN	Most Probable Number
NTU	nephelometric turbidity units
PM_{10}	Particulate Matter less than 10 microns
$PM_{2.5}$	Particulate Matter less than 2.5 microns
ppb	parts per billion
$\mu g/m^3$	microgram per cubic metres
µm	micrometre
µS/cm	micro siemens per centimetre

1.0 INTRODUCTION

In late October 2012, the Potash Corporation of Saskatchewan – New Brunswick (NB) Division (PotashCorp) began mining the Picadilly deposit, located approximately 400 metres (m) south of the original Penobsquis mine (Figure 1.1), and jointly operated both mines for approximately 12 months. In November 2015, mining operations permanently ceased at the Penobsquis mine and plans to decommission the site were devised. Although decommissioning of the Penobsquis site will include removal of the site service shaft and production shaft head frames, as well as other surface infrastructure (Figure 1.2), the primary components of the decommissioning will involve the underground mine facilities (Figure 1.3) (the Project). Shaft capping/plugging options are currently under review and final design will be reviewed and approved through the New Brunswick Department of Energy and Mines (NBDEM).

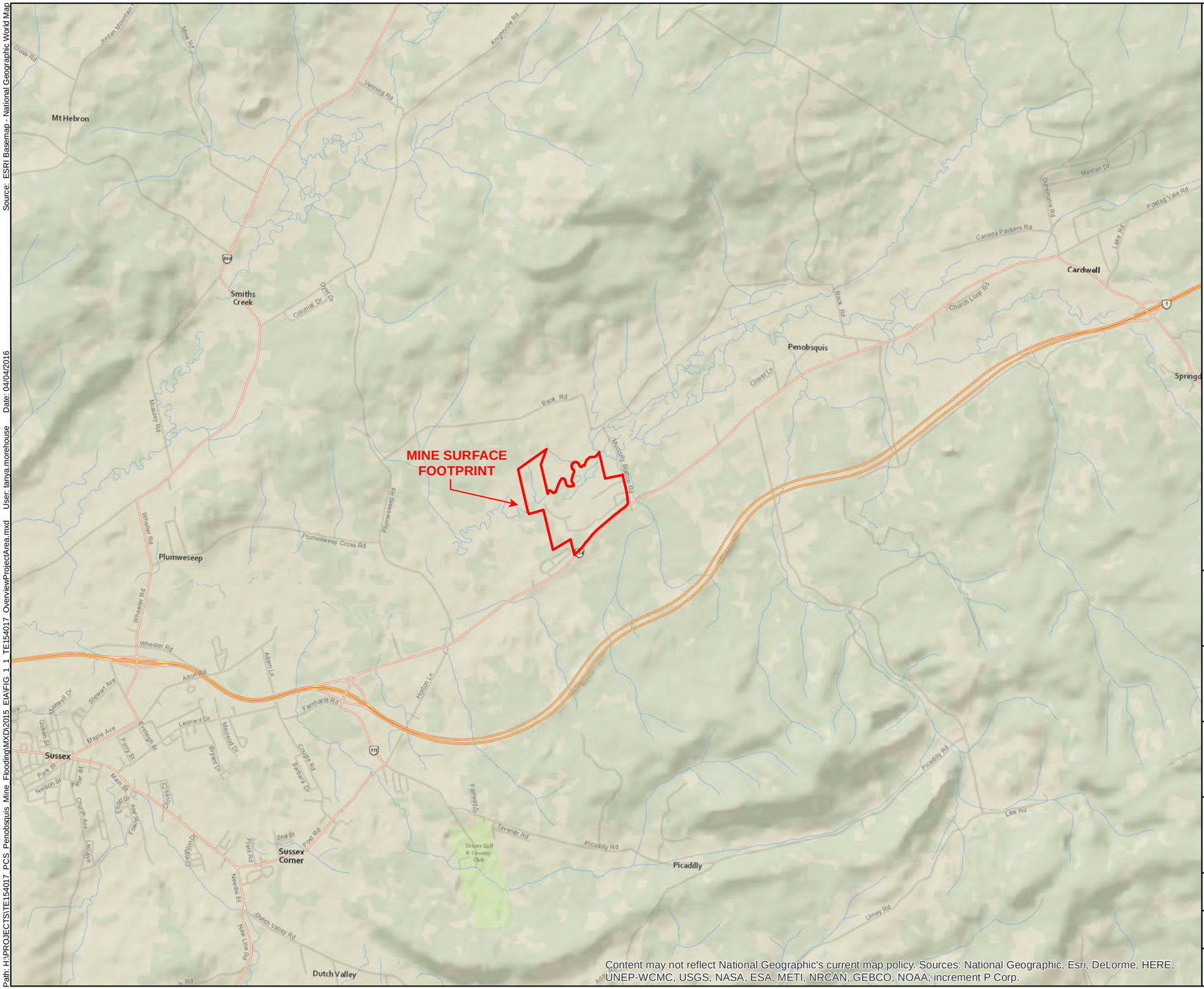
Mining operations at the Picadilly mine were suspended indefinitely in January 2016. The site will be maintained in a 'care and maintenance' mode; decommissioning of the Picadilly site is not included in the scope of this EIA. At such a time when PotashCorp removes all surface facilities and fully decommissions both mine sites, reclamation of the entire mine will be undertaken according to regulatory requirements at that time. Considering that in the near future there will be no reason to access the underground mine workings at Penobsquis, it is proposed that the management of the underground inflow (brine pumping to the surface) be stopped, the mine be allowed to flood naturally and the shafts be capped or plugged.

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler) was retained by PotashCorp to provide environmental and engineering consulting services and to prepare this Environmental Impact Assessment (EIA) report in support of the registration of the Project under the New Brunswick EIA process.

1.1 Background

Shaft sinking began at the Penobsquis mine deposit in 1978. It was developed by the Potash Company of America in 1981, purchased by Rio Algom in 1987 and acquired by PotashCorp in 1993. At depths of approximately 400 to 700 metres below ground surface (mbgs), potash was extracted using a cut-and-fill mining method and salt by room and pillar until late November 2015. Salt was extracted, crushed, and screened underground before being hoisted to surface to be treated with an anti-caking agent prior to shipping. The potash ore was processed onsite with the final products either shipped via rail to the PotashCorp marine terminal at Port Saint John for exportation or trucked to local customers. The mine workings extend approximately 7 kilometres (km) northeast from the surface mine site (Figure 1.3).

Since 1998, groundwater has been infiltrating the underground workings of the Penobsquis mine. This inflow has required management since that time, which includes storage underground using void spaces from mining and/or pumping to the surface in order to prevent flooding of the underground workings. The current surface management of the inflow water includes temporary storage in a brine pond and trucking to the Courtenay Bay Potash Terminal & Brine Disposal Facility in Saint John, PotashCorp's Cassidy Lake facility, for ultimate discharge into the Bay of Fundy approximately 5 km southeast of St. Martins, NB.



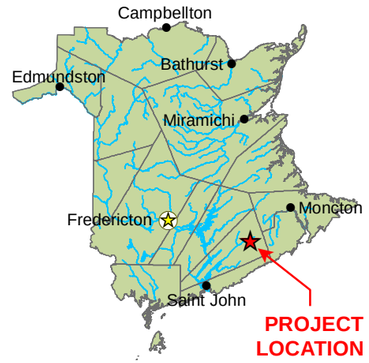
Source: ESRI Basemap - National Geographic World Map Date: 04/04/2016 User: tanya.morehouse Path: H:\PROJECTS\TE154017_PCS_Penobsquis_Mine_Flooding\MXD\2015_EIA\FIG_1_1_TE154017_OverviewProjectArea.mxd

LEGEND:

Penobsquis Mine Surface (PID 30259402)

N
W E
S

0 500 1,000 2,000 3,000
Metres



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CLIENT:

PotashCorp New Brunswick Penobsquis

PotashCorp New Brunswick

amec foster wheeler

PROJECT:

ENVIRONMENTAL IMPACT ASSESSMENT
MINE DECOMMISSIONING
PENOBSQUIS POTASH DEPOSIT

TITLE:

OVERVIEW PROJECT AREA

DATUM:	DWN BY:	DATE:
NAD 83 CSRS	TM	March 30, 2016
PROJECTION:	CHK'D BY:	SCALE:
UTM Zone 20 North	CD	1:50,000
PROJECT NO:	REV NO:	FIGURE NO:
TE154017		1.1

LEGEND:

- Railway Network
- Penobsquis Mine Surface (PID 30259402)
- SNB Property Boundary (Not Intersected by McCully Field)
- Structures for Decommissioning

N W E S

0 100 200 400
Metres

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PROJECT:

ENVIRONMENTAL IMPACT ASSESSMENT
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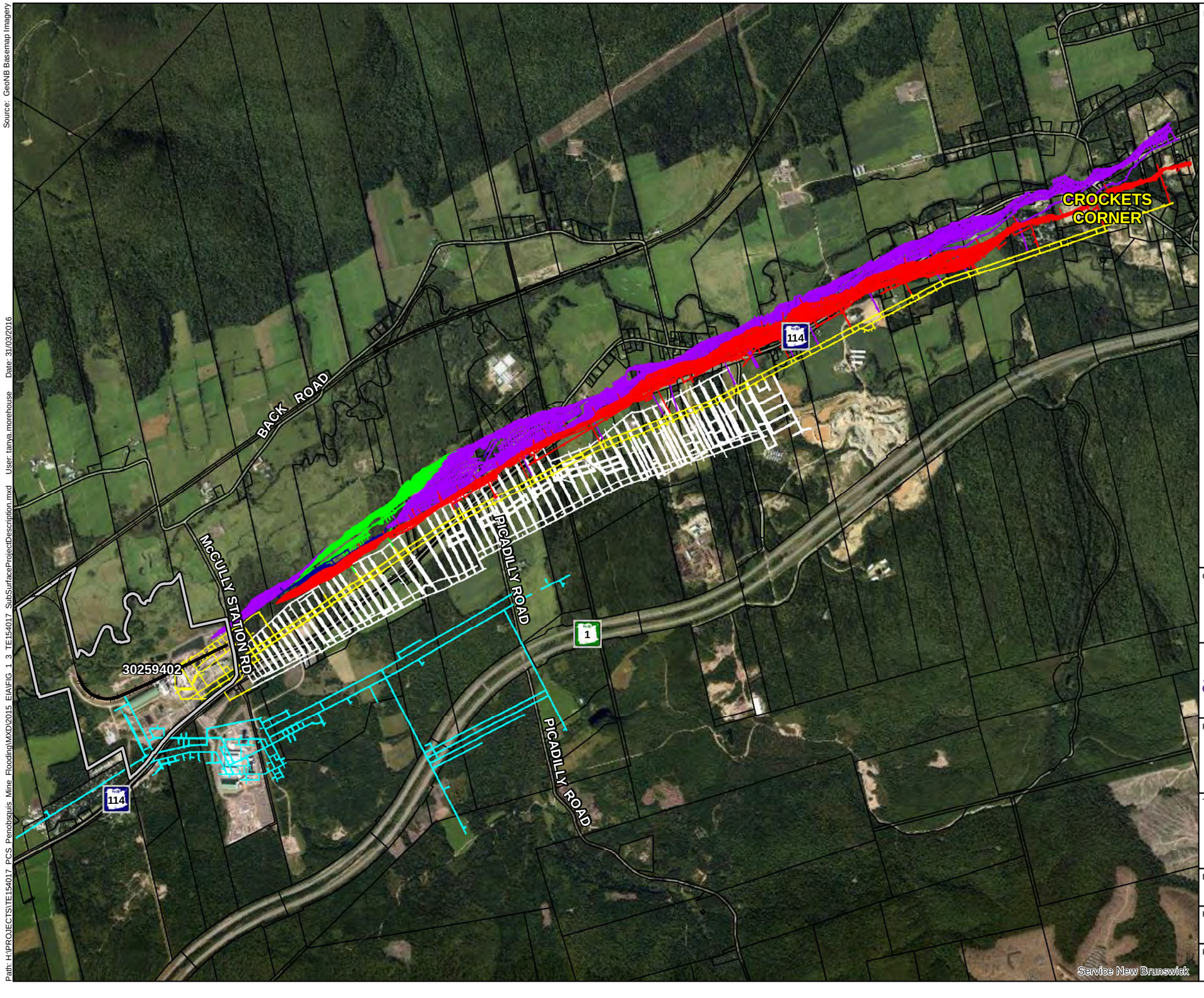
PENOBSQUIS POTASH DEPOSIT

TITLE:

MINE SURFACE
SITE DESCRIPTION

DATUM:	DWN BY:	DATE:
NAD 83 CSRS	TM	March 31, 2016
PROJECTION:	CHK'D BY:	SCALE:
UTM Zone 20 North	CD	1:6,000
PROJECT NO:	REV NO:	FIGURE NO:
TE154017		1.2

Source: ESRI Basemap - National Geographic World Map Date: 18/04/2016 User: tanya.morehouse Path: H:\PROJECTS\TE154017 PCS Penobsquis Mine Flooding\MXD\2015 EIA\FIG 1_2 TE154017 SurfaceProjectDescription.mxd



Source: GeoNB Basemap Imagery

Date: 31/03/2016

User: tanya.morehouse

Path: H:\PROJECTS\TE154017_PCS_Penobsquis_Mine_Flooding\MXD\2015 EIA\Fig 1_3 TE154017 SubSurfaceProjectDescription.mxd

LEGEND:

- Railway Network
- Penobsquis Mine Surface (PID 30259402)
- SNB Property Boundary (Not Intersected by McCully Field)

PENOBSQUIS MINE WORKINGS

SALT: White
1500: Red
1900: Purple
19 - 2: Green
Access: Yellow

PICADILLY MINE WORKINGS - Blue

N
W E
S

0 200 400 800 1,200
Metres

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PotashCorp New Brunswick Penobsquis

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PROJECT:

ENVIRONMENTAL IMPACT ASSESSMENT
MINE DECOMMISSIONING
PENOBSQUIS POTASH DEPOSIT

TITLE:

MINE UNDERGROUND EXTENT
SITE DESCRIPTION

DATUM:	DWN BY:	DATE:
NAD 83 CSRS	TM	March 30, 2015
PROJECTION:	**CHK'D BY:**	**SCALE:**
UTM Zone 20 North	CD	1:25,000
PROJECT NO:	**REV NO:**	**FIGURE NO:**
TE154017		1.3

1.2 Project Rationale

The decommissioning of the Penobsquis mine site, which includes a combination of controlled and natural flooding, will allow partial remediation of the surface facilities; create a safer worksite; conclude the necessity for the drilling/grouting operation; remove the need for transportation of brine by truck to the Courtenay Bay Potash Terminal in Saint John; and the cessation of pumping of brine from the Penobsquis mine site to Cassidy Lake.

1.3 Regulatory Framework

The Project will be undertaken in accordance with all applicable legislation, regulatory approvals, and relevant guidelines. Table 1.1 provides a list of environmental legislation, approvals, and guidelines which may be applicable to the proposed Project.

1.4 Report Organization

This report describes:

- Baseline environmental conditions within both the surface and subsurface Study Areas.
- Project-related activities and potential impacts on the receiving environment.
- Mitigative and/or monitoring measures to be employed during deconstruction and/or flooding phases to minimize or eliminate potential impacts.

The EIA report consists of the following sections:

- Section 1.0 - Introduction;
- Section 2.0 - Project Description;
- Section 3.0 - Approach and Methodology;
- Section 4.0 - Environmental and Socio-Economic Setting;
- Section 5.0 - Environmental Impacts and Associated Mitigation;
- Section 6.0 - Environmental Monitoring and Management;
- Section 7.0 - Public Consultation; and
- Section 8.0 - Conclusion.

Table 1.1 Environmental Legislation and Guidelines which may be Applicable to the PotashCorp Project

Acts or Regulations	Section	Requirement	Department or Agency
Provincial – Approvals, Regulations and Guidelines			
(i) *Mining Act*	S.68	Permission or authority required for mining activities.	New Brunswick Department of Energy and Mines (NBDEM)
(ii) *Clean Environment Act*	Regulation 87-83	EIA - Authority or permission required prior to carrying out an undertaking (as defined in Schedule A of the Regulation).	New Brunswick Department of Environment and Local Government (NBDELG)
(iii) *Clean Environment Act* – Water Quality Regulation	Regulation 82-126	Approval required to release contaminants that may cause water pollution.	NBDELG
(iv) *Clean Water Act*	Regulation 90-80	Watercourse and Wetland Alteration.	NBDELG
(v) *Clean Air Act*	Regulation 97-133	Permission or authority required for the release of contaminant into the air.	NBDELG
(vi) *Community Planning Act*	S.81	Development Officer must approve any development where any community development scheme is in effect.	NBDELG
(vii) *Species at Risk Act* (NBSRA)	Regulation 96-26	Compliance with established prohibitions on persons in terms of impacts on specific endangered species of flora and fauna and their habitat.	New Brunswick Department of Natural Resources (NBDNR)
	S1.5	Designates species of flora and fauna that are subject to prohibitions within the NBSRA.	NBDNR
(viii) *Topsoil Preservation Act* – Regulation 95-66 under *Topsoil Preservation Act*	S.3 (1) (Reg)	Permit required for removal of topsoil from a site.	Minister of the Department of Agriculture and Aquaculture and Fisheries (NBDAAF)
(ix) *Transportation of Dangerous Goods Act*	S.4(1)	Permit required for the transportation of dangerous goods.	New Brunswick Department of Public Safety
(x) *Motor Vehicle Act*	S.261	Permit required for vehicles carrying excess of maximum load under Act. All loads are to be properly secured during transit.	New Brunswick Department of Public Safety
(xi) *Highway Act*	S.36(7)	Special permit under subsection 13 required to operate a vehicle exceeding road weight restriction.	New Brunswick Department of Transportation and Infrastructure
(xii) *Pipeline Act, 2005*	29.1-29.6 30.1-30.4	Take all necessary precautions for ground disturbance over or near pipeline. Pipeline will require inspection by New Brunswick Energy and Utilities Board (NBEUB).	NBEUB
(xiii) *Fish and Wildlife Act*	S.90(1)	Permission or authority required for the capture of fish and wildlife for scientific research.	New Brunswick Department of Natural Resources (NBDNR)
(xiv) *Municipality Act*	Regulation 89-108	Blasting Code Approval Regulation.	NBDELG

Table 1.1 Environmental Legislation and Guidelines which may be Applicable to the PotashCorp Project

Acts or Regulations	Section	Requirement	Department or Agency
(xv) New Brunswick Wetlands Conservation Policy		No net loss of wetland function.	NBDELG
(xvi) Guidelines for Decommissioning (Abandonment) of Water Wells		Monitoring wells must be decommissioned when they are no longer in active use. Permission and Plan Approval required by the Department.	NBDELG
(xvii) *Ontario Mining Act*	240/00 S.11, 21, 24	Requires a Closure Plan and adherence to the minimum rehabilitation measures listed in Section 24.	Ministry of Northern Development and Mines
Federal Acts / Regulations			
(i) *Migratory Birds Convention Act (MBCA)*	S 6	Prohibits activities that will result in negative effects on migratory birds (listed under the MBCA) or their eggs, nests and young.	Environment Canada
	S 5.1	Prohibition of deposit of a deleterious substance into migratory bird habitat.	Environment Canada
(ii) *Species at Risk Act (SARA)*		Prohibits activities that will result in negative effects on Species at Risk (listed in Schedule 1 of SARA) or their Critical Habitat (as identified in a species Recovery Plan).	Environment Canada
(iii) *Fisheries Act*	35 (1); 36(3)	Prohibits any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery, including the release (or permitting to release) any deleterious substance of any type in water frequented by fish; or in any place under any conditions where the deleterious substance may enter any such water.	Department of Fisheries and Oceans Canada (DFO)

2.0 PROJECT DESCRIPTION

Prior to commencement of deconstruction, a site assessment will be conducted to provide a pre-project assessment of the landscape, soils, and vegetation and to provide a guide and measure for future restoration.

Specific activities related to the decommissioning of the site will be managed in accordance with the requirements of the *New Brunswick Mining Act*. Decommissioning of the monitoring wells will be conducted as described by the "*Guidelines for Decommissioning (Abandonment) of Water Wells*" under the authority of the New Brunswick Department of Environment and Local Government (NBDELG) once monitoring is no longer a requirement (NBDELG, undated).

Site decommissioning will ensure that the site will be left clean and safe. Where necessary, groundwater and/or soils testing will be undertaken to ensure that the site has been remediated to meet all applicable regulatory requirements.

The following subsections describe each component of decommissioning of the Penobsquis mine site.

2.1 Underground Mine Working Activities

2.1.1 End of Potash and Salt Extraction

Potash extraction ended at Penobsquis in November of 2015, with salt extraction finishing in January of 2016. Salt production is anticipated to continue at the Picadilly mine until early spring of 2016, with the salt fines being placed underground at Penobsquis until then. These salt fines are currently being placed into the upper potash stopes as backfill in order to minimize the volume of void space remaining underground.

2.1.2 Underground Equipment Inventory

Equipment left in the underground mine, such as vehicles, will have batteries removed, be drained of petroleum, oil and lubricant products (POLs). POLs will be brought to surface and disposed of according to regulatory requirements, and equipment will be catalogued and left for burial. Equipment that can be salvaged will be brought to the surface for sale or recycling. A hazardous materials survey will be conducted on the remaining underground components, as described in Section 6.0.

2.1.3 Grouting

Underground grouting operations have been ongoing since 1998. A reduced grouting effort began in April 2016 and a monitoring program is currently in place to assess whether the reduction in grouting is impacting the rate of the inflow. The monitoring infrastructure will continue to be maintained as long as the mine workings are safely accessible.

The mass amount of brine flowing into and being removed from the mine will be carefully balanced and monitored daily while the grouting is reduced. The reduction in the level of grouting will proceed based on the reaction of the inflow.

2.1.4 Mine Flooding and Cessation of Brine Management

Brine management, through disposal via the pipeline, will continue and the inflow will be monitored such that, if required, grouting can recommence for as long as the mine workings are safely accessible. Once all underground activities at the Penobsquis mine have ceased, the management of brine will be reduced and eventually stop. Gradually, the inflow will be directed to the lower salt stopes within the underground mine workings (lowest level – the 2100 level). The mine workings will begin to fill the lower levels first, from the bottom up, and eventually reach equilibrium with the hydraulic pressure of the inflow. It is anticipated that the inflow water will occupy the void space left behind after backfilling has stopped. It is possible that dissolution of salt and potash minerals could occur during flooding and would create new void space for the freshly generated brine. Once the pressure equilibrium between the inflow water and brine/water within the mine workings has been reached, and the dissolution of salt and potash has reached equilibrium, the mine workings will have then reached a physical and chemical equilibrium.

2.1.5 Shaft Plugging and Capping

The decommissioning strategy for the two Penobsquis mine shafts is currently being investigated. An options evaluation is currently underway and a preferred option will be chosen and presented to the NBDEM for review and approval.

A study is currently underway to determine the level of mitigation that may need to be applied to these shafts during flooding. The detailed plan to address the decommissioning of the mine shafts is outside the scope of this EIA; however, it is understood that the plan will follow the *Ontario Mining Act* regulations and require consultation, review and approval from the NBDEM.

2.2 Deconstruction of Non-Essential Surface Infrastructure

All buildings and other above-ground operations resources at the Penobsquis site that are non-essential to Picadilly operations, including, but not limited to; utilities, buildings, and ponds, will be decommissioned (Figure 1.2).

2.2.1 Utilities

Electrical services supplying the shafts and other structures need to be decommissioned prior to deconstruction. All underground utilities such as natural gas tie-in lines, sewage lines and the brine disposal pipeline will be mapped and provided to contractors prior to any site decommissioning events. The brine disposal pipeline and natural gas tie-in lines will remain active for the life of the Picadilly mine. At such a time that the Picadilly mine is decommissioned, they will be decommissioned according to the *New Brunswick Pipeline Act* and the NBEUB standards at that time. Where necessary, groundwater and/or soils testing will be undertaken to ensure that the site subsurface meets applicable criteria. If impacted groundwater or soils are encountered, the site will be remediated to meet all applicable regulatory requirements.

In addition, there is currently a service pipe rack corridor connecting the Penobsquis and Picadilly mine sites. The corridor runs below Route 114 and includes:

- two potash concentrate slurry pipelines that permit transfer of concentrate from Picadilly to the Penobsquis plant;
- a brine disposal pipeline that permits transfer of brine from the Picadilly plant to the brine ponds located on the Penobsquis mine site;
- a slurry transfer line that permits transfer of hot salt slurry from Penobsquis to the Picadilly plant;
- a coarse tailings slurry transfer line that permits transfer of tailings from Picadilly to the Penobsquis plant;
- a slimes slurry transfer line that permits transfer of slimes (i.e. fine tailings) from Picadilly to the Penobsquis plant;
- a brine transfer line that permits transfer of brine from the Penobsquis plant to the Picadilly plant; and
- an ore slurry line that permits transfer of ore from the Penobsquis plant to the Picadilly plant.

These pipelines will be deactivated according to NBEUB requirements once they are no longer necessary.

2.2.2 Shaft and Headframe Deconstruction

Two (2) monolithic shaft head frames above the mining shafts formerly used for production will be removed from the Penobsquis deposit's site. Mining shafts contain components such as the following:

- Koepe hoist;
- collar and bin (hopper) houses;
- ventilation plenum and fan arrangement at the shaft collar;
- shaft;
- shaft liner;
- mine service lines;
- shaft conveyances;
- shaft station(s);
- loading pocket; and
- shaft bottom arrangement.

Equipment that is economically feasible to remove from the service shafts will be brought to the surface for reuse or recycling prior to demolition.

2.2.3 Demolition of Offices and Storage Buildings

Facilities that require decommissioning and removal include, but are not limited to:

- east and west salt domes;
- salt annex;
- salt loading transfer belt;
- salt loading transfer building;
- salt belt gallery;
- tailings reclaim building;
- tailings storage shed;
- mine maintenance shed; and
- the #5 belt gallery.

Removal of such structures will require demolition of the structures and the disposal of siding, roofing, structural steel, bins, electrical system components, piping, tanks, chutes and concrete. Disposal of all non-hazardous materials will be taken to a provincially approved facility. All hazardous materials will be taken to appropriate regulated and approved disposal facilities.

2.3 Decommissioning Milestones

Milestones have been scheduled as follows:

- reduction of grouting and drilling: April 2016;
- brine pumping to surface: Ongoing until EIA Determination;
- evaluation of shaft decommissioning options: April - July 2016;
- shaft decommissioning: To be determined; and
- removal of surface infrastructure no longer required by Picadilly operations: 2018 - 2022.

3.0 APPROACH AND METHODOLOGY

This Project is listed as an undertaking under Schedule A of the New Brunswick EIA Regulation and therefore requires a Provincial assessment. Guidelines and requirements for the New Brunswick EIA process, as well as information resources, are described in "*A Guide to Environmental Impact Assessment in New Brunswick*" (NBDELG, 2012a).

To facilitate the review of identified issues, an understanding and description of the environment within which the activities will occur, or potentially have an influence on, was developed from a review of existing information. Potential positive and negative interactions between Project activities and the environment were identified. Where negative interactions were anticipated and potential effects were a concern, methods for mitigating the potential effects were proposed. For the purposes of impact assessment, the interactions (effects) between project outputs, or activities, and Valued Environmental Components (VECs) are described as either positive or negative, their significance of potential interactions is determined, and the likelihood of the interactions are also considered.

Generally, the literature presents the EIA as a complete process, which should begin at the earliest stages of planning and remain in force throughout the life of a project, moving through a series of stages:

- Describing the project and establishing environmental baseline conditions.
- Scoping the issues and establishing the boundaries of the assessment.
- Assessing the potential environmental effects of the project, including residual and cumulative effects.
- Identifying potential mitigative measures to eliminate or minimize potential adverse effects.
- Monitoring and follow-up programs.

The impact assessment focused on the evaluation of potential interactions between Project components and activities, and VECs that were identified through an issues scoping process. Issues scoping was used to identify important issues of the development and focuses the EIA on high-priority issues (Kennedy and Ross, 1992). As suggested by Beanlands and Duinker (1983), VECs were determined on the basis of perceived public concerns related to environmental, social, cultural, economic, or aesthetic values. They were also chosen to reflect the scientific concerns of the professional community.

Issues were derived from recent experience with comparable projects, consultation with key stakeholders, the scientific community and individuals knowledgeable about the Study Area, and the professional expertise of the Study Team. A public Open House will be held in May 2016.

The EIA approach includes a number of steps as follows.

3.1 Assembling Project Baseline Information

A project description is developed including construction and operation activities (in the case of the assessment for this Project, the EIA will be examining the deconstruction and decommissioning activities). A description of existing environmental conditions is prepared to allow assessment of the potential effects of the various project activities on the environment as well as the potential effects of the environment on the project.

3.2 Issues Scoping

Issues are identified during the development of the EIA document and comments are received from regulatory bodies and members of the public. The concerns of the public potentially affected by the project are identified. These include concerns expressed by the public at large, community groups and stakeholders, scientific community, and governments during public consultation. As a result of this "social scoping" effort (Beanlands and Duinker, 1983), environmental issues or Environmental Components of Concern (ECC) that may be affected by the project are identified, by professionals in the field and by the public, and pathways between the ECCs and project activities are identified. Where pathways cannot be identified, the ECC or issue is deemed not to be affected by the Project and, therefore, is no longer part of the analysis.

3.3 Approach to the Selection of VECs

A critical element of the EIA is the delineation of the project through identification of spatial and temporal bounds. The approach to identification of VECs and the approach to bounding are described below.

3.3.1 Identification of VECs

Consideration is given to the possibility of project activities to interact with each VEC. The determination that significant effects may be possible is based upon regulatory requirements, previous experience and our professional judgment.

Two approaches are taken for identifying VECs, upon which the assessment focuses. First, those parameters for which provincial and federal regulations are in place are identified. Second, a scoping exercise is conducted, based upon previous EIA experience with similar project components, consultation, and available information related to the environment near the project site.

3.3.2 Approach to Bounding

Temporal bounds delineate the time period(s) over which project-related impacts / effects can be expected. Spatial bounds delineate the physical area(s) in which VECs may be affected by project activities.

The temporal bounds of this Assessment include pre-project studies performed prior to the proposed mine flooding (cessation of inflow management) and the proposed monitoring programs in the Study Area during and post-flooding.

Spatial bounds for the project effects on most VECs typically include the immediate environs of the Project Footprint, access roads and areas potentially affected by down-gradient movement of groundwater, surface water, and air. For socio-economic components of the environment, bounding extends to communities that have a stake in the potential effects resulting from the proposed project.

The spatial bounds of this Project include the surficial and the subsurface Project footprints (the surface infrastructure to be removed and the underground mine workings to be flooded).

3.4 Approach to Determination of Significance

The assessment or determination of the significance of potential effects is based on the framework/criteria provided in Canadian Environmental Assessment Agency (the Agency) guidance document Responsible Authority's Guide (1994) which summarizes the requirements that have been applied to similar projects in the past, and which have been widely accepted by government and regulatory agencies in Canada.

The Reference Guide entitled "*Determining Whether A Project Is Likely To Cause Significant Adverse Environmental Effects*" included in the Responsible Authority's Guide (the Agency, 1994) was used as the basis for determining the significance of identified potential effects. This determination consists of the following steps:

- determine whether the environmental effect is adverse;
- determine whether the adverse environmental effect is significant; and
- determine whether the significant environmental effect is likely.

For the purposes of the EIA, an effect is defined as the change effected on a VEC(s) as a result of project activities. A project-induced change may affect specific groups, populations, or species, resulting in modification of the VEC(s) in terms of an increase or decrease in its nature (characteristics), abundance, or distribution. Effects will be categorized as either negative (adverse) or positive. Any adverse effects will be determined to be significant or non-significant in consideration of assessment criteria discussed above. The Assessment will focus on those interactions between the VECs and project activities which are likely or significant.

4.0 ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING

This section provides a description of the environmental and the socio-economic setting for the Project, and includes those components of the environment potentially affected by the proposed Project. The Project location and the surrounding area (the Study Area) are depicted in Figure 4.1.

The description of the environmental setting typically encompasses the 1 km Study Area surrounding the Project. Since the underground component of the Penobsquis deposit is approximately 7 km in length, the radius of the surface Study Area has been set at 5 km from the centre of the underground mine working extent, which captures the entire surface area above the underground mine workings as well as a minimum of 1 km beyond (Figure 4.1). The Study Area description has been prepared to provide information on environmental and socio-economic components which may potentially be affected by the Project, or which may influence or place constraints on the execution of project-related activities.

The Subsurface Study Area (SSA), examining the hydrogeological environment, includes the underground mine workings and a 1 km perimeter around its extent.

The following subsections describe the components of the environmental (bio-physical) setting of the Project, including the atmospheric environment, its physiography and drainage, geology (including mine workings), hydrology, hydrogeology, wetland resources, mineral resources, flora, fauna, archaeological and heritage resources, designated areas and other critical habitat features.

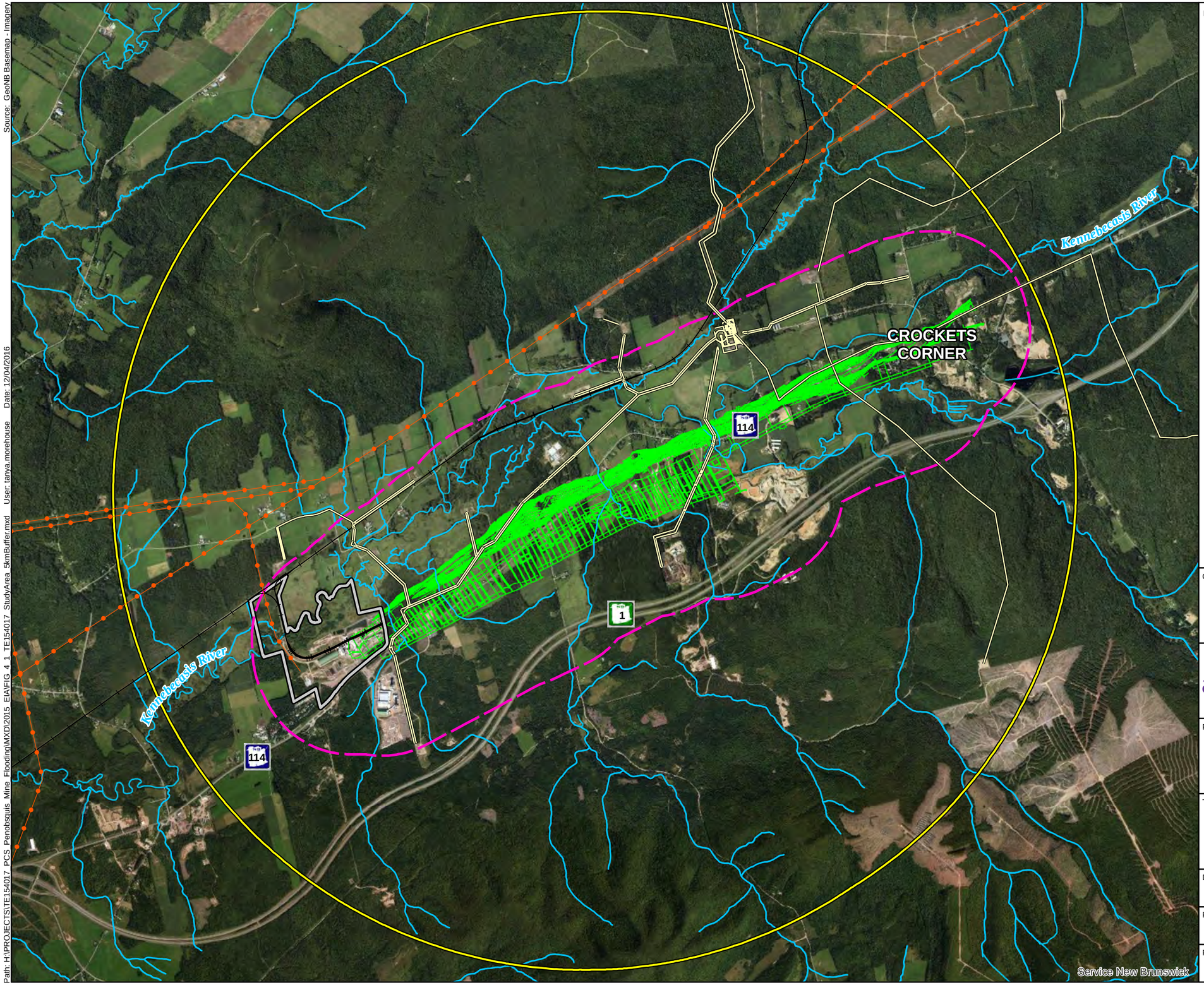
4.1 Study Area Definition

The Study Area was based on:

- location and areal extent of the underground Penobsquis mine workings (as projected to surface);
- depth of the Penobsquis underground mine workings;
- the location and size of the surface Penobsquis mine facility; and
- biophysical setting.

The Project Study Area was divided into surface and subsurface environments as follows:

- Study Area: a radial surface Study Area of 5 km, centred over the underground mine workings footprint. This surface area includes the surficial mine infrastructure, the surface area covering the underground mine footprint and a minimum 1 km surrounding.
- SSA: the three dimensional (3D) extent of the 7 km underground mine workings at a depth of approximately 700 mbgs as well as a 1 km areal perimeter surrounding it.



LEGEND:

- Corridor Resources Gathering System
- Penobsquis Mine Workings (Underground Extent)
- Watercourse
- Transmission Line
- Railway Network
- Subsurface Study Area (1km Buffer)
- Surface Study Area (5km Buffer)
- Penobsquis Mine Surface (PID 30259402)

N W E S

0 500 1,000 2,000
Metres

CLIENT:

PotashCorp New Brunswick Penobsquis

PotashCorp New Brunswick

amec foster wheeler

PROJECT:

ENVIRONMENTAL IMPACT ASSESSMENT
MINE DECOMMISSIONING
PENOBSQUIS POTASH DEPOSIT

TITLE:

STUDY AREA
(5 km Buffer)

DATUM:	DWN BY:	DATE:
NAD 83 CSRS	TM	March 30, 2016
PROJECTION:	CHK'D BY:	SCALE:
UTM Zone 20 North	CD	1:40,000
PROJECT NO:	REV NO:	FIGURE NO:
TE154017		4.1

Path: H:\PROJECTS\TE154017_PCS_Penobsquis_Mine_Flooding\MXD\2015_EIA\FIG_4_1_TE154017_StudyArea_5kmBuffer.mxd User: tanya.morehouse Date: 12/04/2016 Source: GeoNB Basemap - Imagery

4.2 Atmospheric Environment

Air quality is influenced by the concentrations of air contaminants in the atmosphere. Air contaminants are emitted by both natural and anthropogenic sources and are transported, dispersed or concentrated by meteorological and topographical conditions. Air contaminants eventually settle or are washed out of the atmosphere by rain and are deposited back to the earth. In some cases, contaminants may be redistributed into the atmosphere by wind. The information in this section is based on the most up-to-date results available from the monitoring station operated by the Air Quality Branch of the NBDELG nearest the Project: Moncton, NB.

4.2.1 Air Quality Regulations

Air quality in New Brunswick is routinely monitored by the provincial and federal governments at various stations, usually located in or near population centres. Both the air quality standards under Schedule B of the *New Brunswick Clean Air Act* and the New Brunswick Air Quality Objectives (NBAQOs) established by the Province under the same Act provide Guidelines and Objectives that apply to various components, including Total Suspended Particulate (TSP): 120 micrograms per cubic metre (µg/m^3) per 24 hour averaging period and 70 µg/m^3 per 1 year averaging period. Table 4.1 lists the NBAQOs established under the provincial *Clean Air Act*.

Table 4.1 Air Quality Guidelines in New Brunswick

Pollutant	Averaging Period			
	1-hour	8-hour	24-hour	1 year
Carbon monoxide (CO)	30 ppb*	13 ppb		
Hydrogen sulphide (H_2S)	11 ppb		3.5 ppb	
Nitrogen dioxide (NO_2)	210 ppb		105 ppb	52 ppb
Sulphur dioxide (SO_2)***	339 ppb		113 ppb	23 ppb
Total Suspended Particulate			120 µg/m^3	70 µg/m^3

Source: NBDELG, 2015
*ppb – parts per billion
** The standards for SO_2 are 50% lower in Saint John, Charlotte, and Kings Counties.

The following describe each component for which NBAQOs and / or Canadian Standards are set.

- **Carbon Monoxide (CO)**

CO is formed from the incomplete combustion of carbon compounds. The NBDELG has set an air quality guideline for CO of 30 parts per billion (ppb) for a 1-hour averaging period. Due to the relatively small size and density of the population in New Brunswick, there were no exceedances of NBAQOs for carbon monoxide in Moncton or any of the other provincial monitoring sites in 2013.

- **Hydrogen Sulphide (H_2S)**

This component is used by the Provincial mobile air quality trailer to measure total reduced sulphur (TRS) in industrial areas such as Saint John and the AV Nackawic Mill, where TRS odour is a concern. TRS is not monitored in areas like Moncton where the odour is not produced.

- **Nitrogen Oxides (NO and NO_2)**

Nitric oxide (NO) is released in the exhaust of internal combustion engines and furnaces. NO is an unstable compound and is readily converted to NO_2, which contributes to the formation of acid rain and is a primary precursor pollutant in the formation of smog. NBDELG has set an air quality guideline of 210 ppb, 105 ppb and 52 ppb per 1 hour, 24 hour and 1 year averaging periods, respectively. No exceedances of NO_2 standards were recorded during 2013 in Moncton, nor since monitoring began at this location in 1998 (NBDELG, 2012b and 2015). There were no exceedances of the NBAQOs for NO_2 at any monitoring station in the Province in 2013.

- **Sulphur Dioxide (SO_2)**

Sulphur dioxide is produced by burning oil and coal for energy production and space heating; each containing sulphur as an impurity in various concentrations. Other potential sources of SO_2 to the environment include oil refineries, pulp and paper mills, and vehicles. Industries in New Brunswick are responding by using lower or near-zero sulphur fuels as well as reducing production and electricity-generation rates. NBDELG has established an episode control program in Saint John, which requires SO_2 is to be monitored by some industries as part of their Approval to Operate. This parameter is not monitored in Moncton, or other New Brunswick locations that do not have heavy industry (NBDELG, 2012b).

- **Particulate Matter (PM)**

Particulate matter (PM) refers to those particulates in the air, such as smoke, soot, and dust that do not settle readily and thereby remain suspended. PM is a broad class of chemically and physically diverse substances that can either be in a solid or liquid state, or in a combination of these two states. PM greater than 10 micrometres (µm) in size creates problems such as visibility reduction, soiling, material damage, and vegetation damage.

Particulate matter becomes a potential human health hazard when the particle size is equal to, or less than, 10 µm in diameter (PM_{10}) (NBDELG, 2001). These particles are typical of dust granules that are invisible to the naked eye as individual specks. Such particles are commonly generated from building materials, combustion, human activities and outdoor sources, including atmospheric dust and combustion emissions from mobile and stationary sources. PM_{10} data for Moncton is not monitored.

Particles of 2.5 µm or less ($PM_{2.5}$) are small enough to inhale into the lungs and are believed to cause respiratory and cardiovascular problems. These particles are visible as clouds of smoke and are typically high in sulphates, nitrates, carbon and heavy metals, being produced by fossil fuel combustion, vehicle exhaust and industrial emissions (NBDELG, 2001).

In 2012 all Canadian provinces, with the exception of Quebec, agreed to participate in a new federal air quality management system adopted by the Canadian Council of Ministers of the Environment (CCME) as part of the revised *Canadian Environmental Protection Act*. The Air Quality Management System is a comprehensive approach for improving air quality in Canada and is the product of collaboration by the federal, provincial and territorial governments and

stakeholders and replaces the Canada-Wide Standards (CWS) that had been in place since 2000. It includes:

- New Canadian Ambient Air Quality Standards (CAAQs) to set the bar for outdoor air quality management across the country.
- Industrial emissions requirements that set a base of performance for major industries in Canada.
- A framework for air zone management within the provinces and territories that enables action tailored to specific sources of air emissions in a given area.
- Regional airsheds that facilitate coordinated action where air pollution crosses a border.
- Improved intergovernmental collaboration to reduce emissions from the transportation sector.

Standards for fine PM and ground-level ozone have been developed, which are illustrated in Table 4.2. CAAQs are currently in development for NO_2 and SO_2.

Table 4.2 Canadian Ambient Air Quality Standards for Fine Particulate Matter ($PM_{2.5}$) and Ozone

Pollutant	Averaging Time	Standards (numerical values)		Metric
		2015	2020	
$PM_{2.5}$	24-hour (calendar day)	28 µg/m^3	27 µg/m^3	The 3-year average of the annual 98th percentile of the daily 24 hour average concentrations.
$PM_{2.5}$	Annual (calendar year)	10 µg/m^3	8.8 µg/m^3	The 3-year average of the annual average concentrations.
Ozone	8-hour	63 parts per billion (ppb)	62 ppb	The 3-year average of the annual 4th highest daily maximum 8 hour average concentrations.

Source: CCME, 2012a

The new federal Air Quality Management System is designed to address the challenges of air quality management, including cross-jurisdictional issues, and deliver a Canada-wide approach that provides flexibility to deal with regional differences in air quality issues while, at the same time, ensuring a level of consistency so that Canadians can be assured of good air quality outcomes. As part of this approach, CCME has also created an Air Zone Management Framework (AZMF) which categorizes provincial regions by existing air quality and management goals. The Project Study Area lies within the Central Air Zone of New Brunswick, which is considered "green" and whose mandate is to retain low $PM_{2.5}$ levels (CCME, 2012b). In this Zone, threshold values of 0 to 10 µg/m^3 for daily average and 0 to 4 µg/m^3 for annual average $PM_{2.5}$ have been established, which are much lower than the CAAQs (NBDELG, 2015).

$PM_{2.5}$ is measured in Moncton using Beta Attenuation Mass (BAM) monitoring technology. In 2013 the annual average value for $PM_{2.5}$ in Moncton was 5.6 µg/m^3 and the daily metric averaged 14 µg/m^3 – both below the CAAQs of 10 µg/m^3 and 28 µg/m^3, respectively (NBDELG, 2015).

4.2.2 Climatology

The climate of the Study Area is described below. The information is based upon climate normals using the latest data gathered from 1981 to 2010 at the Environment Canada weather station nearest the Study Area, Sussex, NB (Environment Canada, 2016a).

The climate of New Brunswick is typically continental. This is due to the westerly air flows, dominant in the region, having passed over the interior of the continent and not over a temperature-moderating ocean (Hinds, 2000). During the winter, the air mass is cold and unaltered with a January daily mean temperature of -8.5°C and, in the summer, the air mass is predominantly warm continental, with a July daily mean temperature of 19.2°C. The extreme maximum and minimum temperatures recorded were +37.2 and -44.4°C, respectively (Environment Canada, 2016a). Comparison against the previous 1971-2000 Climate Normal Data for Sussex illustrates that the daily mean temperature and extreme maximum temperature has not changed. According to the New Brunswick Climate Change Action Plan 2014-2020; however, annual average temperatures have increased by 1.5°C in New Brunswick over the past 100 years (Government of New Brunswick, 2014).

The coastal areas of New Brunswick experience a large amount of fog that often moves far inland as a result of the abutment of the warm Gulf Stream with the cold Labrador Current. The average annual precipitation in the Study Area is 1169.9 mm, of which 926.1 mm is in the form of rain (Environment Canada, 2016a).

Carbon Dioxide (CO_2) is a chemical compound present in the Earth's atmosphere, best known as a greenhouse gas (GHG). It is projected to account for approximately half of the anticipated world temperature increase. Major contributors of CO_2 are stationary sources (such as power plants) and mobile sources (particularly vehicles that burn fossil fuels; specifically oil, gasoline, and diesel). Both Canada and the Province of New Brunswick have Climate Change Action Plans that list reduced future emission targets and methods for achieving them. New Brunswick's goal for 2020 is to lower 1990's emissions levels by 10% (Government of New Brunswick, 2014).

As a party to the United Nations Framework Convention on Climate Change (UNFCCC), Canada is required on an annual basis to prepare and submit a national inventory of anthropogenic greenhouse gas (GHG) emissions from sources (e.g. fuel combustion, industrial processes) and removals of GHG emissions by sinks (e.g. growing plants and trees). The most recent dataset available (2013) estimates Canada's GHG emissions to be at 726 megatonnes, 78% of which were CO_2 resulting from the combustion of fossil fuels (Environment Canada, 2015).

The Government of Canada intends to develop a framework for the collaboration of all provinces to implement carbon pricing policies and achieve a new national target. Canada also aims to fulfill the G20 commitment to phase-out subsidies for the fossil fuel industry (Environment Canada, 2016b).

4.3 Physiography and Drainage

The Study Area is located within the Anagance Ridges, a subdivision of the Caledonian Highlands physiographic division (Rampton et al., 1984). This division has a complex geomorphology and geology, underlain primarily by Precambrian rocks and by folded and faulted Carboniferous rocks. This physiographic region is typically characterized by ridge and valley topography. Parallel northeast - southwest structural trends are present within the central and western portions of the Anagance Ridges which are also present within the Study Area. Typically these features can give rise to ridgetop elevations of 300 m common in the northeast while mean sea level is present in the southwest. Consequently, the overall drainage is to the southwestern portion of this zone.

Major streams and rivers such as the Kennebecasis, Hammond, Anagance and Petitcodiac Rivers as well as Bellisle Creek parallel the structural trend over most of their course. Drainage within the Anagance Ridges is described as generally good with the exception of broad valleys filled with glacial drift of alluvium and intertidal sediments (Rampton et al., 1984). Geology at the site is that of the Lower Carboniferous, specifically the Mabou Group comprising mudstone, feldspathic sandstones and conglomerate with minor calcrete (Hinds, 2008a; Hinds, 2008b). The Study Area is covered by a glacial till of varying thickness, texture and stoniness, which is occasionally overlain by a thin (<0.5 m) veneer of marine silt and clay. The Kennebecasis River lies within a broad floodplain composed of alluvial sand and gravel. There are also some local areas of glacially deposited sand and gravel called “kames” (Rampton et al., 1984).

As shown on Figure 4.1, the Study Area is located within the Kennebecasis River Valley between two long parallel ridges trending northeast-southwest. The highlands located approximately 4 km northeast of site (the Dunsinane Syncline and Mount Pisgah), have an elevation of nearly 260 metres above sea level (masl), while approximately 4.5 km to the southwest, Picadilly Mountain peaks at approximately 175 masl and is connected to the Springdale syncline approximately 7 to 8 km to the northeast by a topographic high located southeast of the site.

The Kennebecasis River and its surrounding wetland boarder the northeastern and northwestern portions of the mine workings footprint within the Study Area. Consequently, the overall drainage from the two highlands north and south of the Study Area empties to the Kennebecasis River - the dominant surface water body in the area. The River channel meanders through fluvial deposits along the floodplain as the water flows toward Sussex, approximately 7 km downstream. The Kennebecasis River eventually combines with the Saint John River and then continues to the Bay of Fundy.

The following subsections focus on the SSA, which is the 3D extent of the underground mine workings, as well as a 1 km perimeter surrounding it (Figure 4.1).

4.3.1 Surficial and Bedrock Geology

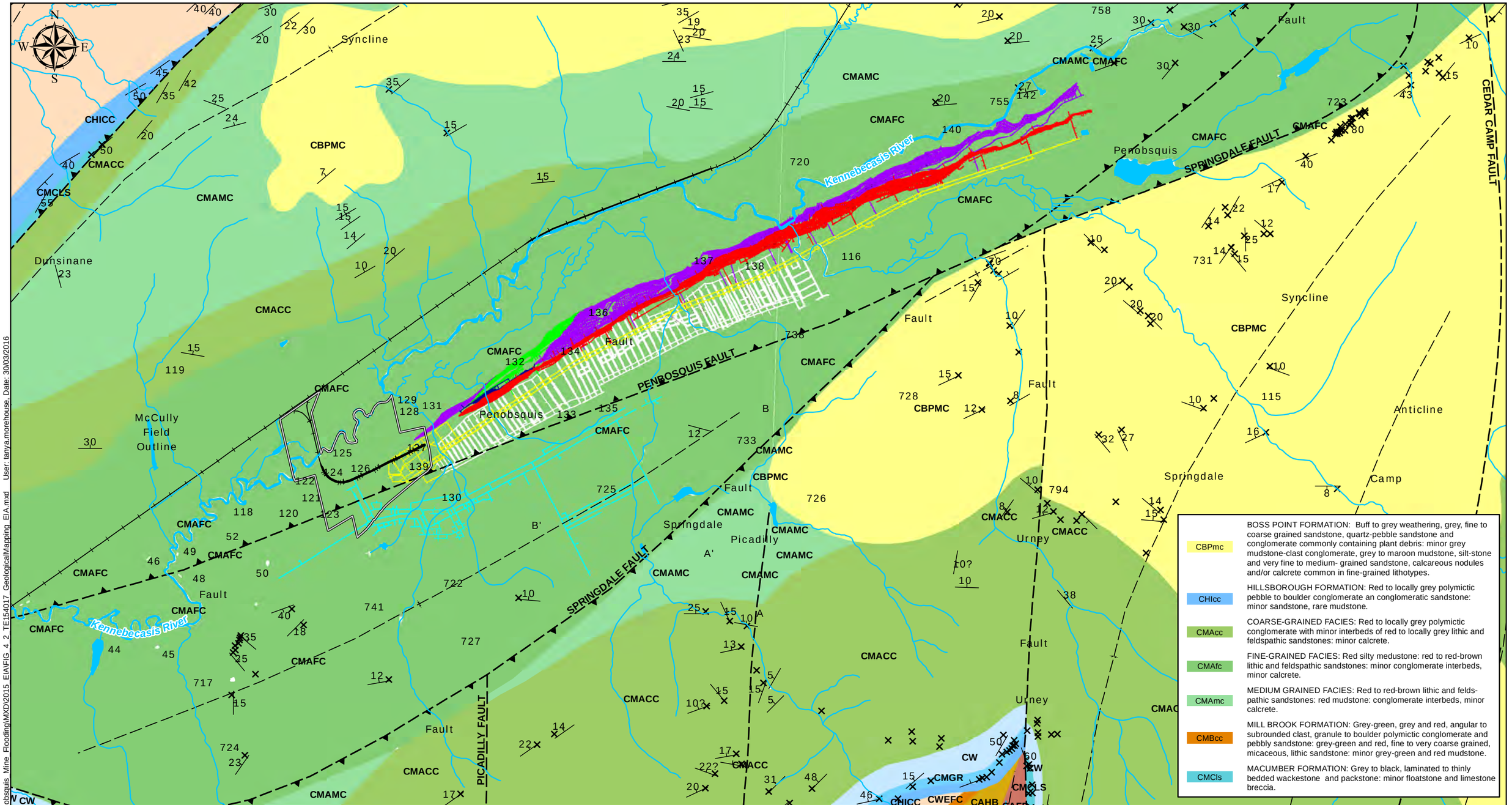
Based on surficial mapping, the alluvium terraces and floodplains found within the SSA and the Kennebecasis River Valley are host to sands and silts (minor clays) which are sometimes covered by thin till veneer (Pronk, 2005a). The northwest and southeast flanks of the SSA are covered with the reddish brown Boss Point till (observed clasts mainly derived from the Boss Point formation). There are also isolated pockets of ice-contact sand and gravel deposits located both along Highway 1 and also at the southwestern end of the site. Other smaller isolated glaciofluvial outwash deposits of sands and gravel have also been mapped to the southwest near Plumweseep and to the northeast near Crockets Corner.

The bedrock beneath the surficial cover of the SSA and within the Kennebecasis River Valley is comprised entirely of sedimentary rock formations. Based on the available geological mapping (Hinds, 2008a) the bedrock surface beneath the SSA is predominately the fine grained facies of the Lower Carboniferous Mabou Group sediments (Figure 4.2). Extending northeast of the SSA, the Mabou group transitions into the medium grained facies Upper Carboniferous Boss Point Formation of the Cumberland Group, whereas southeast the Penobsquis thrust fault marks the contact with the Boss Point Formation. Southwest beyond the SSA the bedrock transitions into the Lower Carboniferous, medium and coarse grained facies of the Upper Carboniferous Mabou Group and northwest the transition is similar, with the exception of the absence of the medium grained facies of the Mabou group.

4.3.2 Stratigraphy and Location of Mine Workings

As indicated previously, a significant portion of the Project Study Area is below ground surface. This subsection presents the main geological formations that are typically present within the SSA, their relationship to one another and also those formations which host the potash and salt resources. The location of the mine workings as they occur with depth are thereby considered in 3D (Figure 4.2).

The NBDEM Industrial Minerals Summary data (NBDEM, 2016) references Wilson et al. 2005 as the most recent for the geology of the Penobsquis salt/potash deposit. Based on this, as well as other historical resources, the summary indicates that the uppermost and youngest bedrock in the SSA are the Upper Carboniferous-aged Mabou Group sediments. Underlying the Mabou Group is the older Windsor Group sediments which are host to the potash and salt deposits. Continuing down from the top of the Windsor, its upper-most member is the Clover Hill Formation evaporate sequence which contains the upper anhydrite and Penobsquis Salt members. Continuing down, the Clover Hill Formation is underlain by the Cassidy Lake Formation which is comprised primarily of halite and sylvinite (potash) with minor anhydrite, carnallite, and borate mineralization and is the formation which was actively mined at Penobsquis. The Formation is further subdivided into several members which are from the top down: the Upper Halite, Potash Member, Middle Halite and Basal Halite. The Cassidy Lake Formation is then underlain by the Upperton, Parleeville/Gays River/Macumber Members, respectively, to complete the Windsor Formation sequence.



LEGEND:

- Bedding - Tops Known (inclined)
- Bedding - Tops Unknown (inclined)
- Cleavage (inclined)
- Outcrop
- Bedding - Tops Known (horizontal)
- THRUST FAULT
- FAULT
- ANTICLINE
- SYNCLINE

Penobsquis Mine Surface (PID 30259402)

PENOBSQUIS MINE WORKINGS
SALT: White
1500: Red
1900: Purple
19 - 2: Green
Access: Yellow

PICADILLY MINE WORKINGS - Blue

CLIENT: PotashCorp New Brunswick Penobsquis

PotashCorp New Brunswick

amec foster wheeler

SCALE: 0 200 400 800 1,200 1,600 Metres
1:35,000

DATUM: NAD 83 CSRS

PROJECTION: UTM Zone 20 North

PROJECT No: TE154017

PROJECT: ENVIRONMENTAL IMPACT ASSESSMENT MINE DECOMMISSIONING PENOBSQUIS POTASH DEPOSIT

TITLE: GEOLOGICAL MAPPING OF SSA

DWN BY: TM

CHK'D BY: VB

DATE: March 29, 2016

REV NO:

FIGURE: 4.2

Path: H:\PROJECTS\TE154017_PCS_Penobsquis_Mine_Flooding\MXD\2015_EIA\FIG_4_2_TE154017_GeologicalMapping_EIA.mxd User: tanya.morehouse, Date: 30/03/2016

Figure 4.3 presents the same geological information as Figure 4.2, displaying the extents of the Penobsquis Mine workings with the addition of two insets which are depicting:

- A generic cross section through the Penobsquis potash deposit.
- A detailed 3D illustration of the Penobsquis mine workings, accessing the salt and potash members of the Cassidy Lake Formation with:
  - shafts and access ways shown in yellow;
  - upper and lower salt stopes in white;
  - potash stopes as green (19-2 stope);
  - lower 1900 level stopes in purple; and
  - upper 1500 level stopes in red.

The underground workings of the Penobsquis and Picadilly mines are separated by a salt unit 300 m in thickness.

4.3.3 Potential for Seismic Activity

New Brunswick is within the Northern Appalachians Seismic Zone, which contains low level seismic activity, with values ranging from 1.0 - 6.0 magnitude (MN) on the Richter Scale (average ~3.0 MN). The largest recording was 5.7 MN in Miramichi (1982). The most recently "felt" events have occurred as an earthquake "swarm" during February 2016 where lightly felt recurring earthquakes were recorded as high as 3.3 MN near McAdam. There are a number of old geologic fault lines associated with the Kingston Uplift, whose last movement are estimated at approximately 300 million years ago. In summary, the potential for seismic activity in the Study Area is low (Natural Resources Canada, 2016).

There is a series of underground micro seismic geophones in the Penobsquis Mine. These geophones are installed to detect small events for the purposes of ground stability within the mine.

4.3.4 Mineral Occurrences, Mining Claims, and Aggregate Resources

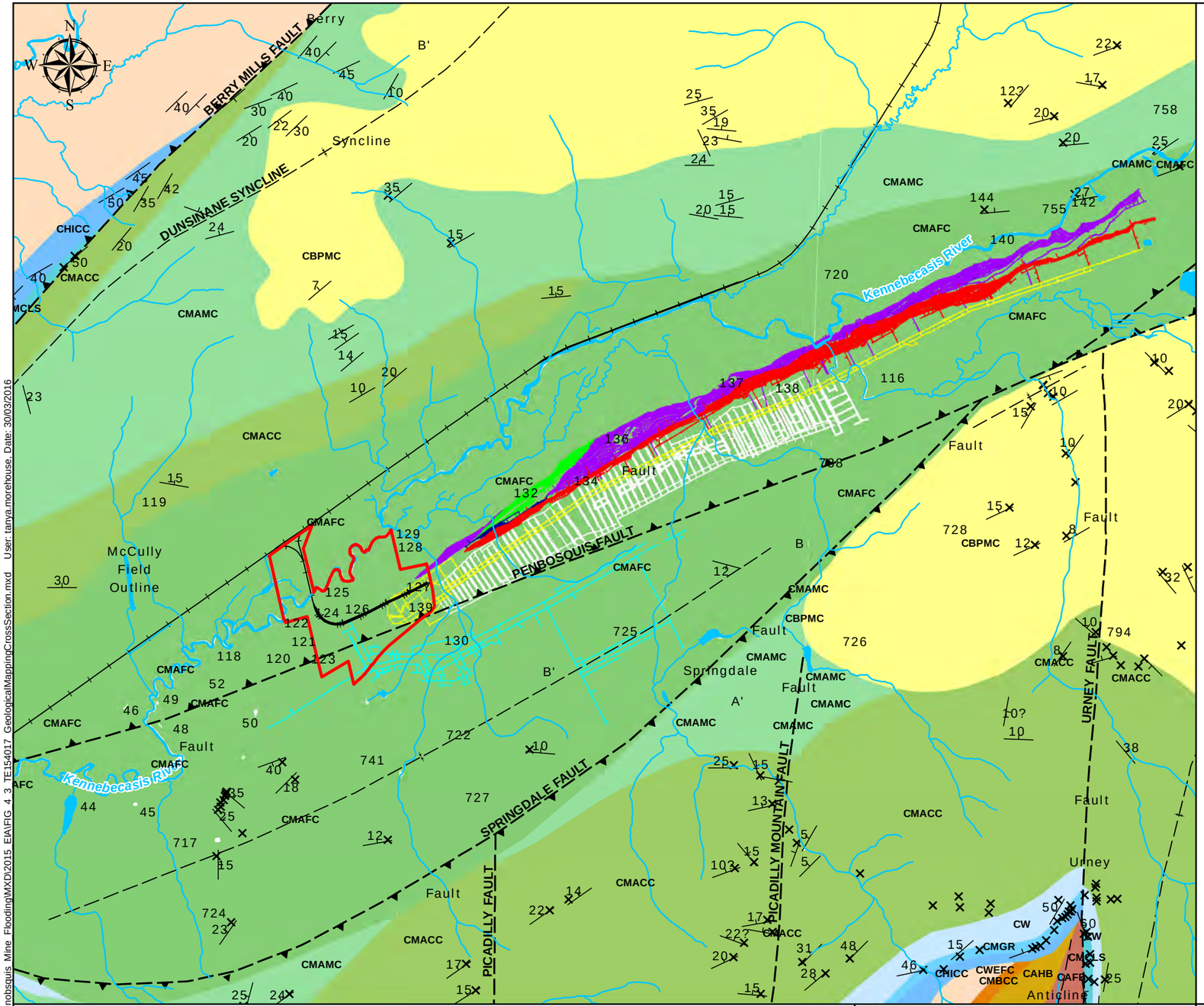
The Project occurs within the PotashCorp Mining Lease. Leases for aggregate resources, such as gravel, are also present within the Study Area.

4.4 Hydrology (Surface Water)

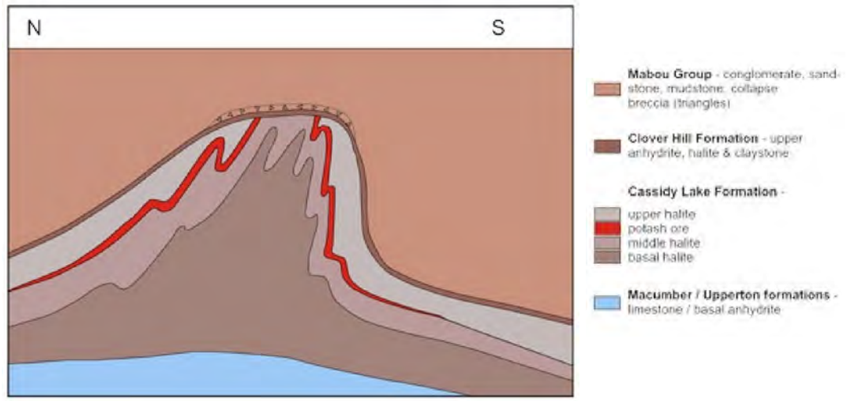
The following sections describe the hydrological and hydrogeological conditions of the Study Area, including water quality for both surface and groundwater resources.

4.4.1 Surface Water Quantity

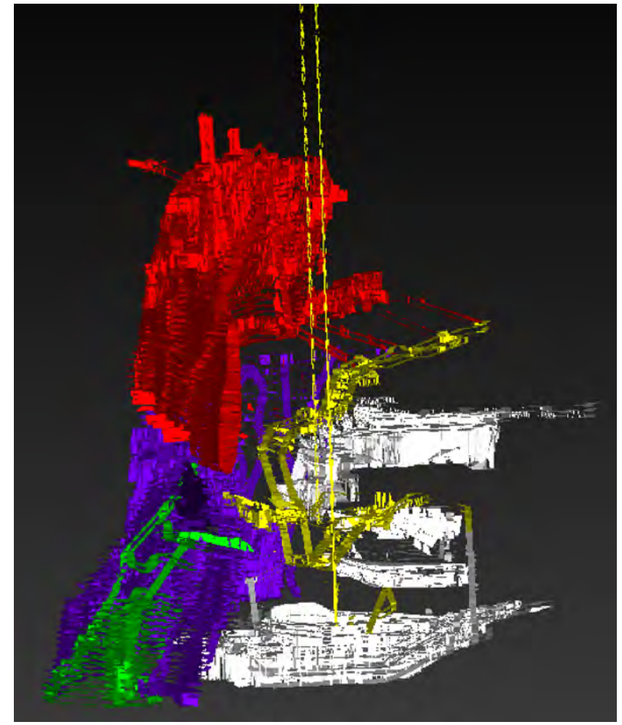
The Study Area falls within the hydrometric subdivision 1AP as defined by Environment Canada (1986). All surface runoff from this subdivision drains into the Kennebecasis River, which eventually drains into the Saint John River and then into the Bay of Fundy. There are no protected watersheds located within the Study Area (NBDELG, 2016a).



SCHEMATIC SECTION THROUGH THE PENOBSQUIS EVAPORATE DEPOSIT



PENOBSQUIS UNDERGROUND MINE WORKINGS 3D MODEL



LEGEND:

- Bedding - Tops Known (inclined)
- Bedding - Tops Unknown (inclined)
- Cleavage (inclined)
- Outcrop
- Bedding - Tops Known (horizontal)
- THRUST FAULT
- FAULT
- ANTICLINE
- SYNCLINE
- Penobsquis Mine Surface (PID 30259402)

PENOBSQUIS MINE WORKINGS
SALT: White
1500: Red
1900: Purple
19 - 2: Green
Access: Yellow

PICADILLY MINE WORKINGS - Blue

CLIENT:
PotashCorp New Brunswick Penobsquis

PotashCorp New Brunswick

amec foster wheeler

SCALE:
0 200 400 800 1,200 1,600
Metres
1:40,000

DATUM:
NAD 83 CSRS

PROJECTION:
UTM Zone 20 North

PROJECT No:
TE154017

PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT
MINE DECOMMISSIONING
PENOBSQUIS POTASH DEPOSIT

TITLE:
GEOLOGICAL MAPPING OF PENOBSQUIS POTASH DEPOSIT

DWN BY: TM
CHK'D BY: VB
DATE: March 29, 2016
REV NO:
FIGURE: 4.3

Path: H:\PROJECTS\TE154017_PCS_Penobsquis_Mine_Flooding\MXD\2015_EIA\FIG_4_3_TE154017_GeologicalMappingCrossSection.mxd User: tanya.morehouse, Date: 30/03/2016

The average annual precipitation in the Study Area as measured in Sussex is 1169.9 millimetres (mm), of which approximately 243.8 centimetres (cm) is in the form of snowfall (Environment Canada, 2016a). High seasonal water flows are generally experienced in April and May as a result of snowmelt. The stream flow typically decreases through the summer as a result of high evaporation and depleting groundwater storage. Flow typically increases in the fall due to lower temperature and reduced evaporation.

4.4.2 Surface Water Quality

Surface water quality in the Study Area is dependent primarily on geology, watershed size, topography and vegetation. The chemical quality of watercourses in New Brunswick is generally excellent for human consumption. Calcium bicarbonate-type waters predominate, although mixed chemical influences are known to occur in the Province (Environment Canada, 1989). Total Dissolved Solids (TDS) concentrations in the lower Saint John River Basin are typically low to moderate, ranging from 17 to 115 milligrams per litre (mg/L) (Environment Canada, 1989). The headwaters of the Kennebecasis River are characterized as low in calcium carbonate.

The Kennebecasis Watershed Restoration Committee (KWRC), a non-profit organization, monitors the water quality of the Kennebecasis River and its tributaries annually. The most recent results published for the upper Kennebecasis sub-watershed, which contains the Study Area, showed significant levels of *Escherichia coli (E. coli)* ranging in levels of 100 to 2000 Most Probable Number per 100 millilitres (MPN/100 mL) during July. Chloride levels in this section of the watershed ranged from 2.46 to 40.4 mg/L and specific conductance from 65 to 269 micro siemens per centimetre (µS/cm) (KWRC, 2014). The Kennebecasis watershed as a whole is relatively healthy, but vulnerable to changes given the number of geological land types and anthropological land uses that surround the Kennebecasis River and its tributaries.

4.4.3 Watercourses

The upper Kennebecasis River flows in a southwesterly direction through the Study Area, collecting freshwater from a myriad of tributaries within a 5 km radius of the Project's underground footprint, including Stone Brook and McLeod Brook. The Kennebecasis River is fed by numerous second and third-order tributaries, draining an approximate area of 1100 square kilometres (km^2) to the Saint John River where it empties into the Bay of Fundy (Environment Canada, 1986).

4.5 Hydrogeology (Groundwater)

4.5.1 Groundwater Quantity

Based on their study of a representative portion of the Maritimes Carboniferous Basin which extends into the Study Area, Rivard et. al (2008a) indicated that the glacial tills, which overlie the sedimentary rocks within the Maritimes Carboniferous Basin, are considered poor aquifers. However, unconsolidated sandy and gravelly sediments can form aquifers with significant potential, such as those observed in the communities of Sussex and Sussex Corner approximately 5 km southwest of the Study Area. The surficial mapping (Pronk, 2005b) indicates that the largest yielding wells in the Sussex and Sussex Corner well fields are established within glaciofluvial outwash deposits that extend into the Study Area.

With respect to bedrock, the Rivard (2008b) study also suggests that as hydrostratigraphic units (aquifers), the Mabou Group and the Boss Point formations exhibit poor and variable aquifer potential, respectively. However, while considered to be variable, with aquifer quality from good to poor, the Boss Point formation, which lies just northeast of the Study Area, was considered to be the best aquifer within the Moncton Basin by Carr (1964). Carr also noted that the base of the Boss Point formation, and contact with the finer Mabou group, was often a source of springs, an example of which can be seen at Springdale, approximately 1.5 km east of the SSA perimeter.

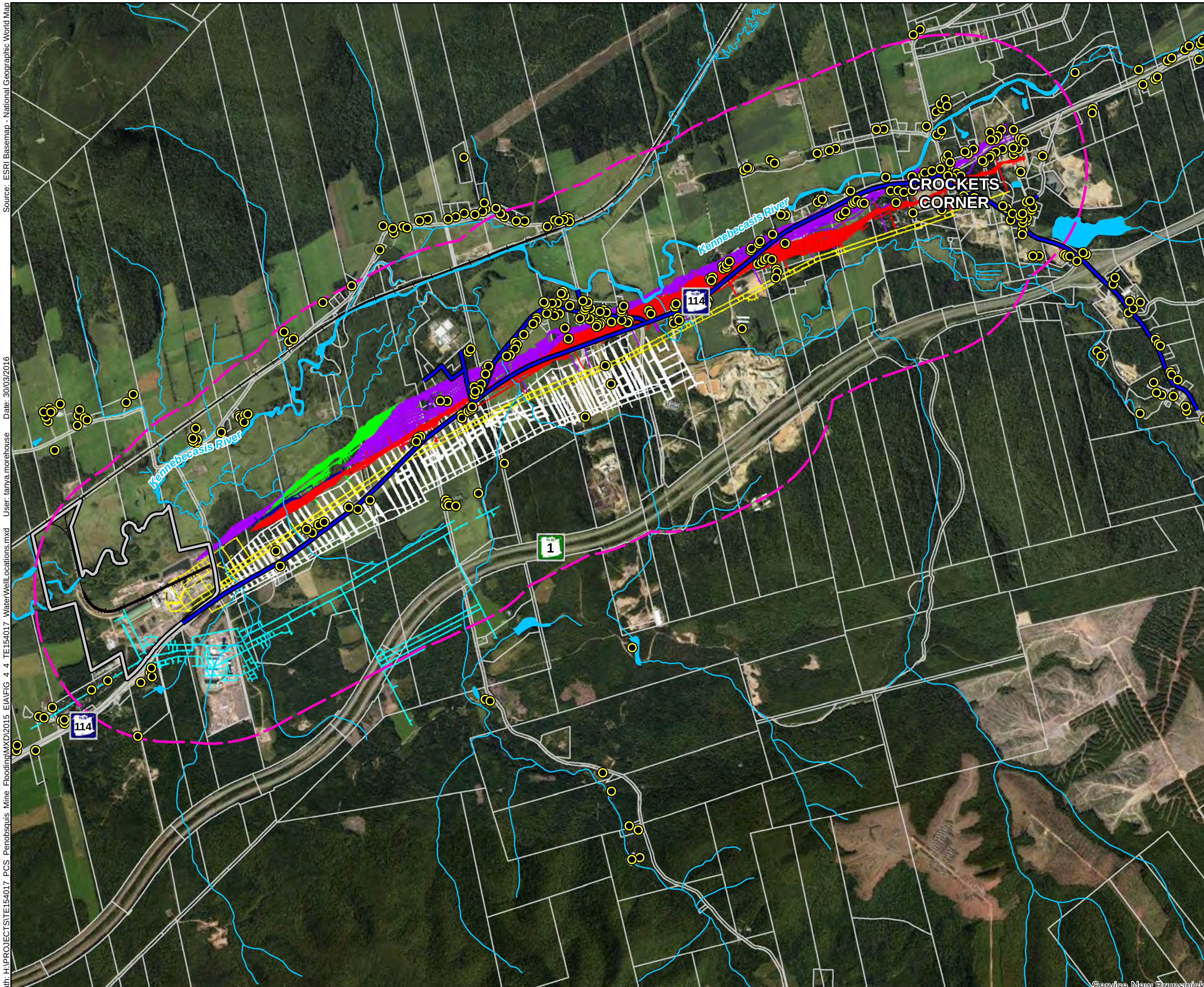
The nearest protected wellfield is the Penobsquis Wellfield on Fundy Park Road (NBDELG, 2016b), the Zone C boundary being on the opposite site of Route 1 from the Project, approximately 8 km from the nearest underground shaft. The Penobsquis Wellfield is the source for a municipal supply that was developed and commissioned in 2012. The source is a 60 gallon per minute (gpm) well located adjacent to an existing artesian spring along the Fundy Park Road, which became a protected wellfield under the *Clean Water Act* in 2012 (schedule A.37) (NBDELG, 2016b). The Penobsquis Regional Water System extends along Route 114 to the mouth of McCully Station Road (J. Russell, pers. comm., 2013). The Penobsquis Wellfield supplies the communities of Springdale, Crocketts Corner and Penobsquis.

Figure 4.4 illustrates the potential locations of stand-alone groundwater wells that may have been historically developed in and around the SSA for other public or private uses such as farms, industrial, and commercial establishments. These are locations where a structure exists (according to aerial imagery) and may have had or still has a potable well. Of these potential well locations it is assumed that private wells for domestic use were the most common.

4.5.2 Groundwater Quality

Mandatory testing for water quality of all newly drilled or redrilled domestic water wells in New Brunswick was introduced under the "Potable Water Regulation" of the *Clean Water Act* in September of 1994. The standard tests required under the "Potable Water Regulation" analyse the water for both inorganic and bacteriological substances using the *I analytical package at the NBDELG Analytical Services Laboratory.

The Province maintains a database of these results and has used 10,500 samples analysed between 1994 and 2007 to produce the New Brunswick Groundwater Chemistry Atlas (New Brunswick Department of Environment (NBENV), 2008). The database can also be searched for these results, and more current results, by region in New Brunswick using the Online Well Log System (OWLS). The water quality test results provided are in aggregate form and do not identify the individual well from which the sample was taken, but queries can be submitted to view results for specific areas. Using a property identification number (PID) from the centre of the Project Study Area (being the centre of the underground mine extent) (PID 30282156) a search of the database displays records for 69 wells drilled within the 5 km Study Area between 1994 and 2016, though only 39 of these display sample analysis results (NBDELG, 2016c).



Path: H:\PROJECTS\TE154017_PCS_Penobsquis_Mine_Flooding\MXD\2015_EIA\FIG_4_4_TE154017_WaterWellLocations.mxd User: tanya.morehouse Date: 30/03/2016 Source: ESRI Basemap - National Geographic World Map

LEGEND:

- Potential Potable Water Locations
- Watercourse
- Railway Network
- Penobsquis Water Distribution System
- Subsurface Study Area (1km Buffer)
- Penobsquis Mine Surface (PID 30259402)

PENOBSQUIS MINE WORKINGS
SALT: White
1500: Red
1900: Purple
19 - 2: Green
Access: Yellow

PICADILLY MINE WORKINGS - Blue

N W E S

0 200 400 800 1,200 1,600
Metres

The map shown here has been created with all due and reasonable care and is strictly for use with Amec Foster Wheeler Project Number: TE154017. This map has not been certified by a licensed land surveyor, and any third party use of this map comes without warranties of any kind. Amec Foster Wheeler assumes no liability, direct or indirect, whatsoever for any such third party or unintended use.

CLIENT:

PotashCorp New Brunswick Penobsquis

PotashCorp New Brunswick

amec foster wheeler

PROJECT:

ENVIRONMENTAL IMPACT ASSESSMENT MINE DECOMMISSIONING PENOBSQUIS POTASH DEPOSIT

TITLE:

MAPPING OF POTENTIAL DOMESTIC WATER WELL LOCATIONS

DATUM:	DWN BY:	DATE:
NAD 83 CSRS	TM	March 29, 2016
PROJECTION:	CHK'D BY:	SCALE:
UTM Zone 20 North	VB	1:30,000
PROJECT NO:	REV NO:	FIGURE NO:
TE154017		4.4

The New Brunswick Department of Health has adopted the Guidelines for Canadian Drinking Water Quality (GCDWQ) established by Health Canada (Health Canada, 2014) to assess groundwater quality (New Brunswick Department of Health, 2016). Groundwater quality data was available for 39 samples collected from wells within the Study Area. The percentage of samples in compliance with the GCDWQ compared against the provincial database is presented in Table 4.3.

Table 4.3 Summary of Selected Groundwater Quality Parameters

Parameter	*Percentage Samples in Compliance in New Brunswick	**Percentage Samples in Compliance Within Study Area
Arsenic	94.1	96.6
Barium	98.6	96.6
Cadmium	99.9	100
Chromium	99.8	100
Fluoride	95.0	100
Lead	97.3	100
Nitrate	99.4	100
Selenium	98.9	100
Uranium	97.9	100
Chloride	96.7	86.2
Iron	71.2	79.3
Manganese	60.2	86.2
pH	86.3	93.1
Sodium	96.6	96.6
Zinc	99.9	100

Sources: *NBENV, 2008.
**NBDELG, 2016c

Comparison of Study Area results against those for the Province as a whole show that the water chemistry in the Study Area is quite good for those with wells drilled since 1994. Drill reports for the 119 records show well depths ranging from 21 to 91 m. Average bedrock level is 11.7 m with the well drillers' logs commonly recording clays, sands and gravels as the overburden types and shales, conglomerates, sandstones and siltstones being the common bedrock types encountered in the subsurface Study Area (NBDELG, 2016c).

In 2006, NBENV launched a program called "Know Your H_2O" to promote drinking water quality awareness. During the period of July 2006 to November 2007, all private well owners could submit a water test for total coliform bacteria and *E.coli* at no cost. It was determined during this program that one third (35.6%) of the private wells sampled yielded results above the GCDWQ for coliform while 4.4% had *E.coli* (NBENV, 2009). According to OWLS for the 39 wells within the area studied, 40.6% of the newly drilled wells had Total Coliform and 6.7% of them had *E.coli*. Turbidity, which can harbour bacteria, was above the 1.0 nephelometric turbidity units (NTU) Guideline in 58.6% of those wells (NBDELG, 2016c).

4.5.2.1 Previous Domestic Water Well Surveys

Numerous well water sampling programs have been conducted in the region for other projects which took place between 2006 and 2008. A summary report was compiled for the NBENV which reviewed survey results for 76 sampling locations (AMEC Environment & Infrastructure, A division of AMEC Americas Limited (AMEC)[1], 2014).

The averages determined for parameters pre-project and post-project surveys for programs conducted 2006 to 2008 were compared against the GCDWQ, Provincial data available for Penobsquis at that time (J. Bowers, pers. comm., 2008) and historical New Brunswick data (Boyle et. al, 1994). Despite the fact that many of properties surveyed were using springs and shallow dug wells, well water quality was comparable to that of Provincial data obtained from wells drilled since 1994.

Prior to the commencement of Project activities, further water quality analyses are being considered for drinking water wells near the SSA that do not currently have access to the Penobsquis Municipal System (Section 6.0).

4.5.3 Wetland Resources

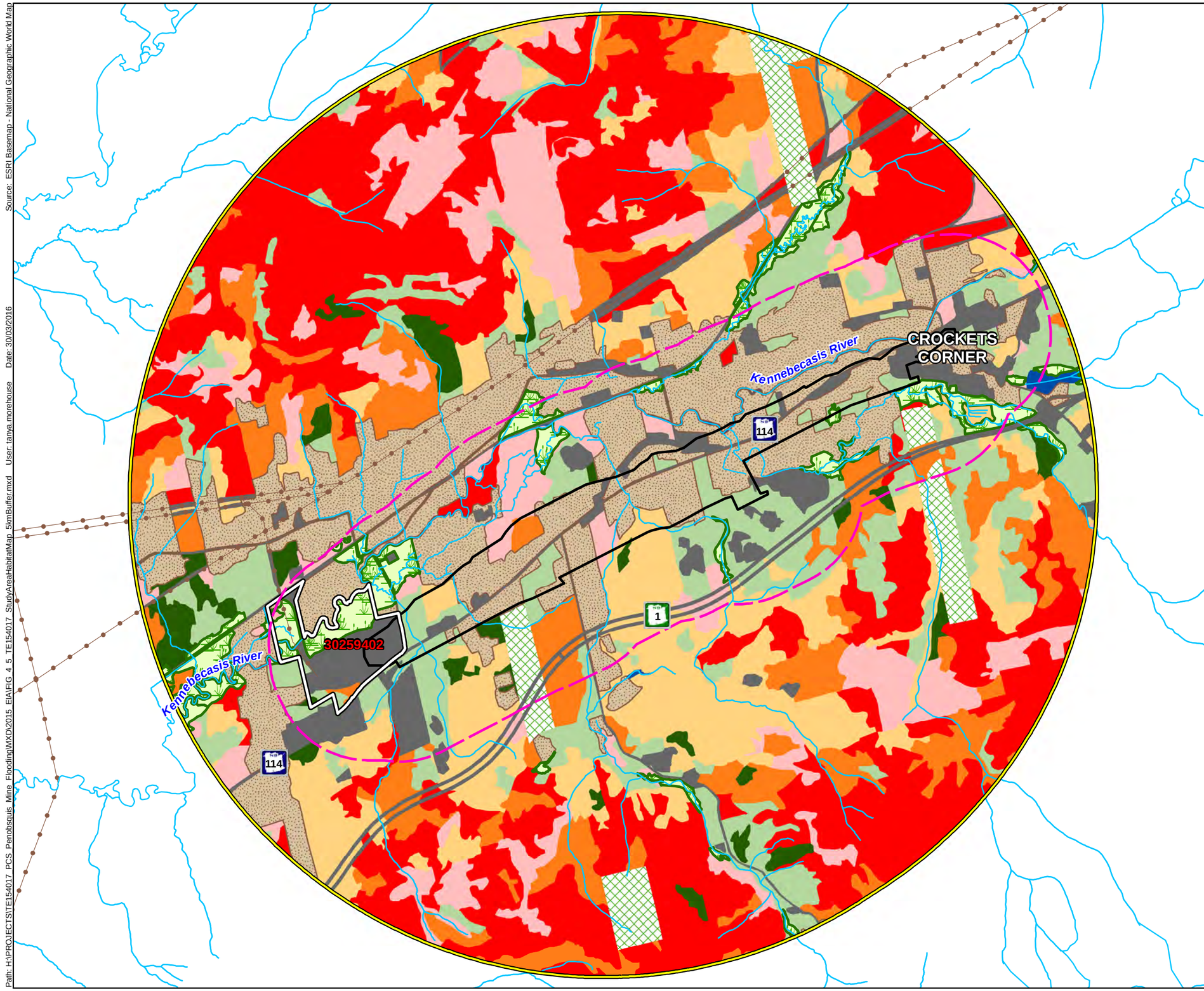
Wetlands in New Brunswick have been given specific protection under both the *Clean Environment Act* and the *Clean Water Act*. The New Brunswick EIA Regulation requires registration of "all enterprises, activities, projects, structures, works, or programs affecting two hectares (ha) or more of bog, marsh, swamp, or other wetland". NBDELG requires a permit under the Watercourse and Wetland Alteration (WAWA) Regulation for any alteration within 30 m of the bank of a watercourse or wetland.

Provincially-regulated wetlands within the Study Area associated with the Kennebecasis River and its tributary, Stone Brook, are illustrated on Figure 4.5 (Service New Brunswick (SNB), 2016). These wetlands are essentially freshwater in nature with some saline influences causing brackish conditions. Wetland areas in proximity to both the Picadilly and Penobsquis mines have been delineated during past projects.

4.6 Biological Environment (Flora and Fauna)

Southern NB supports a variety of flora and fauna. Rowe (1972) identifies most of southeastern NB, where the Study Area is located, as being within the Eastern Lowland Forest Region. In this region, level land and impeded drainage are widespread, encompassing stands of black spruce (*Picea mariana*), red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*), or mixed-woods, in which these species are associated with eastern white pine (*Pinus strobus*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*) and white birch (*Betula papyrifera*). In areas of poorly drained terrain, open peat bogs are interspersed with predominantly black spruce and tamarack (*Larix laricina*) forests. The majority of the Study Area is comprised of old hardwood, edge and field habitat as well as mixed wood. The surficial Project Footprint is located on an existing potash mine (Figure 4.5).

[1] On 1 January, 2015 AMEC's name officially changed to Amec Foster Wheeler.



Source: ESRI Basemap - National Geographic World Map Date: 30/03/2016 User: tanya.morehouse Path: H:\PROJECTS\TE154017_PCS_Penobsquis_Mine_Flooding\MXD\2015_EIA\FIG 4_5_TE154017_StudyAreaHabitatMap_5kmBuffer.mxd

LEGEND:

Forest Habitat Type
- Hardwood
- Old Hardwood
- Mixedwood
- Old Mixedwood
- Softwood
- Old Softwood

Non Forest Habitat Type
- Edge
- Field
- J.D. Irving Ltd.
- Submerged Crown Land
- GeoNB Regulated Wetland
- Watercourse
- Transmission Line
- Penobsquis Underground Mine Workings (Approximate Extent)
- Penobsquis Mine Surface (PID 30259402)
- Subsurface Study Area (1km Buffer)
- Surface Study Area (5km Buffer)

N W E S

0 500 1,000 2,000
Metres

CLIENT:
PotashCorp New Brunswick Penobsquis

PotashCorp New Brunswick

amec foster wheeler

PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT
MINE DECOMMISSIONING
PENOBSQUIS POTASH DEPOSIT

TITLE:
STUDY AREA
HABITAT MAP
(5 km Buffer)

DATUM:	DWN BY:	DATE:
NAD 83 CSRS	TM	March 30, 2016
PROJECTION:	CHK'D BY:	SCALE:
UTM Zone 20 North	CD	1:40,000
PROJECT NO:	REV NO:	FIGURE NO:
TE154017		4.5

There are no areas designated as Old Spruce Fir Habitat (OSFH) located within the Study Area. There are 57 known native species of mammals (Dilworth, 1984), approximately 350 resident and migratory bird species (Squires, 1976), and 25 species of amphibians and reptiles, including various species of salamanders, frogs, turtles, and snakes (Gorham, 1970) that inhabit New Brunswick. Vegetative communities are the main determinant of habitat for most area wildlife species.

Approximately 350 resident and migratory bird species have been reported in New Brunswick (Squires, 1976). Bird species diversity in temperate regions is, in part, a function of foliage height diversity (i.e., the greater the height diversity, the greater the number of species using that habitat) (MacArthur and MacArthur, 1961). This is particularly true in deciduous forest stands. Species diversity is also related to floral species diversity (Morrison, 1991). Thus, grasslands would support limited species diversity, while a successional deciduous forest may support relatively higher species diversity.

Bird mortality is reported to be greatest during the first year of life. Therefore, breeding and fledgling populations are considered to be the life stages most sensitive to potential disturbance. Erskine (1992) summarizes the results of breeding bird surveys conducted in New Brunswick to the date of publication. According to this reference, a total of 110 species of birds have been reported to potentially use breeding habitat within and adjacent to the Study Area.

4.7 Species at Risk

The following section focuses on Species at Risk (i.e., endangered, threatened, of special concern, and rare species), which are of concern due to potential disturbance as a result of project development. Available information on the known occurrence of floral and faunal Species at Risk in the Study Area was compiled and reviewed to determine their presence relative to the Project footprint. Sources included published and unpublished listings of occurrences of such species and these are described below.

Under the federal SARA, the listing process begins with a species assessment that is conducted by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). SARA uses the COSEWIC scientific assessment when making the listing decision. Once a species is added to Schedule 1 it benefits from all the legal protection afforded, and the mandatory recovery planning required under SARA. The Act provides federal legislation to prevent wildlife species from becoming extinct and to provide for their recovery. The status of species protected under SARA can be found at the Species at Risk Public Registry (SARPR) (2016).

The Province of New Brunswick provides additional species protection through its own NBSRA, which was adapted from the repealed *Endangered Species Act* in 2012. Under this Act, an endangered species (or sub-species) is defined as any indigenous species of fauna or flora threatened with imminent extinction or imminent extirpation throughout all, or a significant portion, of its range and designated by regulation as endangered. This Act prohibits the killing of, or interference with, any member of an endangered species, or the habitat of an endangered or regionally endangered species.

The Atlantic Canada Conservation Data Centre (ACCDC) is part of the NatureServe network, a non-government agency which maintains conservation data for the Atlantic Provinces. An information request was submitted to the ACCDC 25 January, 2016 for a list of occurrences of rare and endangered flora and fauna within and near the proposed Study Area (Appendix A). S1, S2, and S3 ranked species are considered to be extremely rare to uncommon within its range in the Province. S4 and S5 ranked species are considered to be widespread and their occurrences are fairly common to abundant. The response to this request and explanations of the S-Ranks are included in Appendix A.

4.7.1 Plant Species at Risk

The ACCDC (Appendix A) identifies the following regionally rare or uncommon plant species as occurring within a 5 km radius of the Project Footprint (Table 4.4).

Table 4.4 Plant Species of Conservation Concern Occurring within the 5 km Radial Study Area

Common Name	Scientific Name	ACCDC Rank	Habitat
Downy Rattlesnake-Plantain	*Goodyera pubescens*	S1	Dry upland oak or pine woods
Matted Spikerush	*Eleocharis intermedia*	S3	Salt marsh
Field Sedge	*Carex conoidea*	S3	Edge of low meadow and dirt road.
Tender Sedge	*Carex tenera*	S3	Edge of salt springs.
Salt Grass	*Distichlis spicata*	S3,S4	Coastal, salt-marsh.

ACCDC, 2016 (Appendix A)

None of these five plant species are listed by either SARA or the NBSRA (SARPR, 2016; NBDNR, 2016a). One of these plant species, the downy rattlesnake-plantain, is listed by Canada's Wild Species Program as "may be at risk" in New Brunswick, Nova Scotia and Quebec (SARPR, 2016). The Project Footprint of the Penobsquis mine itself is currently industrialized; therefore none of the species listed above are expected to exist in the surficial Project Footprint.

4.7.2 Mammal Species at Risk

The ACCDC has listed the Eastern cougar (*Puma concolor pop. 1*) as being SU (undetermined) but observed once within 5 km of the Project. The Eastern Cougar was listed under the previous *New Brunswick Endangered Species Act*, which was repealed; the species has not been included on the current NBSRA. Controversy has ensued over the years regarding the existence of the Eastern cougar, as well as its distinction as a subspecies as DNA testing of those captured proved to be that of cats that had escaped from captivity (Hinterland Who's Who, 2016). COSEWIC also lists the Eastern cougar as "Data Deficient" (COSEWIC, 2016).

The NBSRA lists the Canada lynx (*Lynx canadensis*) as Regionally Endangered within the Province, though the ACCDC has not identified its presence as observed within 5 km of the Project and COSEWIC lists this species as "Not At Risk" (SARPR, 2016). The Study Area is not known to represent limiting or critical habitat for either the cougar, which prefers large tracts of undisturbed land, or the lynx who follows snowshoe rabbit (Hinterland Who's Who, 2016).

4.7.3 Bird Species at Risk

Table 4.5 lists the ACCDC (Appendix A) bird Species at Risk identified as occurring within a radius of 5 km of the Study Area.

In New Brunswick, migratory birds typically nest during the “sensitive nesting window” of 1 May to 1 August, and begin migration in late September.

Further discussion regarding the regional migratory birds is presented in Section 4.8.

Three birds known to be observed in the Study Area are listed as “Threatened” under SARA Schedule 1: the Canada warbler, the chimney swift and the olive-sided flycatcher.

The Canada warbler inhabits areas of dense understorey of mature deciduous or mixed woodlands and shrubby areas near streams and swamps. The cause of its decline is attributed to significant loss of wintering habitat in South America (SARPR, 2016). Chimney swifts are insectivorous birds that prefer to be nearby water, but are found in various habitats. They typically nest in the trunks of large, hollow trees and occasionally on cave walls, in rocky crevices or in chimneys (COSEWIC, 2016). The olive-sided flycatcher can be found in northern and mountainous coniferous forests (Stokes and Stokes, 1996).

The birds listed by COSEWIC as “Threatened” in Table 4.5 are songbirds. Bank swallows breed as colonies, burrowing into sand or gravel banks and barn swallows in the roofing rafters of buildings and would not be anticipated to be found breeding in the Study Area. The bobolink and Eastern meadowlark; however, nest in dry grassy habitats – especially hay fields left unmown for a year or longer (COSEWIC, 2016). There is a possibility that nests could be encountered during monitoring activities in grassy areas of the Study Area within the sensitive nesting window.

The NBSRA designates the harlequin duck (*Histrionicus histrionicus*), peregrine falcon (*Falco peregrinus anatum*), and piping plover (*Charadrius melodus melodus*) as Endangered in New Brunswick. Although listed under COSEWIC as “Not as Risk”, the NBSRA designates the bald eagle (*Haliaetus leucocephalus*) as Regionally Endangered in New Brunswick. The ACCDC reports that the bald eagle has been observed within the 5 km Study Area, although the observed location has not been revealed in order to prevent exploitation. NBDNR does not have any knowledge of nests in the area (NBDNR, pers.comm., 2016). Bald eagles nest in tall trees, typically white pines, near open water containing fish.

Table 4.5 Potential Bird Species of Conservation Concern Occurring within the 5 km Radial Study Area

Common Name	Scientific Name	ACCDC Rank*	Other Protection / Listing
Barn Swallow	*Hirundo rustica*	S3 (Breeding)	COSEWIC: Threatened
Bank Swallow	*Riparia riparia*	S3 (Breeding)	COSEWIC: Threatened
Bobolink	*Dolichonyx oryzivorous*	S3S4 (Breeding)	COSEWIC: Threatened
Brown Thrasher	*Toxostoma rufum*	S2 (Breeding)	
Brown-headed Cowbird	*Molothrus ater*	S3 (Breeding)	
Canada Warbler	*Wilsonia canadensis*	S3S4 (Breeding)	SARA: Threatened
Chimney Swift	*Chaetura pelagica*	S2S3 (Breeding)	SARA: Threatened
Cliff Swallow	*Petrochelidon pyrrhonota*	S3S4 (Breeding)	
Eastern Kingbird	*Tyrannus tyrannus*	S3S4 (Breeding)	
Eastern Meadowlark	*Sturnella magna*	S1S2 (Breeding)	COSEWIC: Threatened
Eastern Wood-Pewee	*Contopus virens*	S4 (Breeding)	COSEWIC: Special Concern
Evening Grosbeak	*Coccothraustes vespertinus*	S3S4 (Breeding), S4S5 (Non Breeding)	
Great Crested Flycatcher	*Myiarchus crinitus*	S3 (Breeding)	
Horned Lark	*Eremophila alpestris*	S2 (Breeding)	
Killdeer	*Charadrius vociferous*	S3 (Breeding)	
Northern Mockingbird	*Mimus polyglottos*	S3 (Breeding)	
Olive-sided Flycatcher	*Contopus cooperi*	S3S4 (Breeding)	SARA: Threatened
Purple Martin	*Progne subis*	S1S2 (Breeding)	
Scarlet Tanager	*Piranga olivacea*	S3S4 (Breeding)	
Sedge Wren	*Cistothorus platensis*	S1 (Breeding)	COSEWIC: Not At Risk
Vesper Sparrow	*Pooecetes gramineus*	S2 (Breeding)	
Willow Flycatcher	*Empidonax traillii*	S1S2 (Breeding)	
Wood Thrush	*Hylocichla mustelina*	S1S2 (Breeding)	COSEWIC: Threatened

Source: *ACCDC 2016 (Appendix A)

Many of the birds listed in Table 4.5 are migratory birds, breeding in the region within the sensitive nesting window. Five of those birds are known to breed one to two weeks outside that window: killdeer, chimney swift, eastern wood-pewee, horned lark and barn swallow. The ACCDC mapping illustrates that the observations for all five of these birds were located in the northeast sector of the 5 km Study Area, approximately 6 km from the outer perimeter of the Penobsquis mine's surficial Project Footprint where deconstruction of infrastructure will be conducted. All of the birds listed in Table 4.5 with COSEWIC or SARA designations were also observed in this same area, with the exception of the eastern meadowlark. The eastern meadowlark was observed approximately 3.5 km from the outer perimeter of the mine's surface Project Footprint. The only activities related to the Project that are proposed to occur beyond the perimeter of the Penobsquis mine property, with the exception of the underground components, are related to environmental monitoring (Section 6.0).

4.7.4 Herpetile Species at Risk

The ACCDC report for the Study Area does not include any observations of amphibian or reptile species within 5 km of the Project (Appendix A).

There are no amphibian species in New Brunswick listed under SARA as Schedule 1. There are; however, two reptiles: the snapping turtle (*Chelydra serpentina*) whose status is "Special Concern" and the wood turtle (*Glyptemys insculpta*) whose status is "Threatened". The snapping turtle is the largest freshwater turtle in Canada, reaching up to 40 cm in length in addition to a tail that is almost as long as the carapace. Though numbers are decreasing in central and western Canada, the snapping turtle remains abundant in eastern Canada. Wood turtles are colonial and gather in large numbers when nesting. The species nests next to water on open sandy areas, such as high riverbanks, roadsides, rail embankments, and in wetlands. Wood turtle populations are threatened by human capture, as well as nest destruction and water contamination (SARPR, 2016). The ACCDC report for the Study Area did not contain any observations of either the snapping turtle or wood turtle (Appendix A).

4.7.5 Invertebrate Species at Risk

Invertebrates are typically the most diverse group of fauna present in a given ecosystem, and represent a key component of the food web. The ACCDC lists the zebra clubtail (*Stylurus scudderi*) dragonfly as being observed within the 5 km radial Study Area. The ACCDC has designated this species as S3 (uncommon in province) and it is has no protection under SARA, COSEWIC or the NBSRA. The zebra clubtail is considered rare, but secure due to its expansive range throughout the northeastern United States and Canada.

Both the NBSRA and COSEWIC identify the Maritime ringlet butterfly (*Coenonympha nipisiquit*) as Endangered in New Brunswick. This butterfly has an extremely restricted range, and a small population. It is threatened by loss and degradation of habitat. In 2006, the New Brunswick Maritime Ringlet Recovery Strategy was implemented by NBDNR (New Brunswick Maritime Ringlet Recovery Team, 2005). This butterfly is strictly limited to salt marsh habitats and the ACCDC has no record of it being observed within the Study Area.

4.8 Migratory Birds

Migratory birds are protected under the federal MBCA which covers all seabirds (except cormorants and pelicans), all waterfowl, all shorebirds and most land birds. Birds that are not protected by the Act include grouse, quail, pheasants, ptarmigan, raptors, crows, jays and kingfishers. Under this Act, no person shall deposit, or permit to be deposited oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds, and no person shall possess, buy, sell, exchange or give a migratory bird or nest or make it the subject of a commercial transaction, without lawful excuse, and no person shall disturb, destroy or take a nest, egg, nest shelter, eider duck shelter, or duck box of a migratory bird without a permit. It is important to note that no permits can be issued for the incidental take of migratory birds caused by development projects or other economic activities. In addition, section 5.1 of the MBCA describes prohibitions related to deposit of substances harmful to migratory birds:

> "*5.1 (1) No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area.*
>
> *(2) No person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance — in waters or an area frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds.*"

In New Brunswick, migratory birds typically nest during the "sensitive nesting window" of 1 May to 1 August, and begin migration in late September. Migratory routes are dependent on several factors including: origin, species, and time of day that migration occurs.

The following literature and information sources were reviewed and / or contacted:

- Maritime Breeding Bird Atlas (2nd Atlas, 2011);
- ACCDC (Appendix A); and
- NBDNR.

Once the above sources were consulted, all of the bird species that could potentially occur in the Study Area were compiled in a species list. Within the MBBA 2nd Atlas (MBBA, 2011), which was compiled over the period of 2006 to 2010, the Study Area lies within Region #12, Saint John, and more specifically in Square #20LR17 (Penobsquis). There were 152 bird species identified in the Saint John area. Within the Penobsquis area, 108 were identified as possible, probable or confirmed breeders. Most of these species nest within the sensitive nesting window.

Twenty-seven of these species are protected under the MBCA, being listed in Occasional Paper 1 by the Canadian Wildlife Service (Canadian Wildlife Service, 1991) and have been known to breed outside the sensitive breeding window (MBBA, 2011). Five of those birds are listed by the ACCDC as occurring in the Study Area, as shown in Table 4.6.

Table 4.6 Migratory Bird Species Potentially Breeding in the Study Area Outside the Sensitive Nesting Window

Species	Habitat*	Breeding Dates**
Killdeer	Open fields and pastures; nests on the ground	Mid April – Early Aug
Barn Swallow	Nests inside barns or beneath overhanging structures	Mid May – Early Sept
Chimney Swift	Nests inside barns or beneath overhanging structures	Mid June – Early Sept
Eastern Meadowlark	Nests in open fields, concealed in tall grass	June – Early Aug
Horned Lark	Dry grass in open fields with little to no concealment	Mid April through July

*NatureServe, 2016
**MBBA, 2011.

The ACCDC mapping illustrates that the observations for all five of these birds were located in the northeast sector of the 5 km Study Area, approximately 6 km from the outer perimeter of the Penobsquis mine's surficial Project Footprint where deconstruction will be conducted. All the birds listed in Table 4.5 with COSEWIC or SARA designations were also observed in this same area, with the exception of the Eastern meadowlark. The Eastern meadowlark has been observed approximately 3.5 km from the outer perimeter of the mine's surface Project Footprint.

Geographic information system (GIS) digital datasets were supplied by NBDNR to derive potential habitat types (NBDNR, 2007). GeoNB (SNB, 2016) was used to map New Brunswick regulated wetlands while in-house data was used to update edge area to include some industrialization that has occurred since 2007, such as natural gas well pads and the Picadilly mine. The criteria for habitat type were derived by combining habitat criteria used by NBDNR, reviewing the Maritime Breeding Bird Atlas (MBBA, 2011) habitat criteria, and by incorporating information related to habitat preference as detailed on the SARPR website. From available mapping, 11 broad habitat types were identified as occurring within the Study Area (Figure 4.5):

- softwood;
- old softwood;
- hardwood;
- old hardwood;
- mixed wood;
- old mixed wood;
- edge;
- field;
- J.D. Irving land;
- waterbodies (submerged Crown land); and
- wetland.

In order to determine the amount of habitat affected by the 5 km Project Study Area, the total area in square metres (m^2) was calculated for each habitat type. The surficial Project Footprint of the Penobsquis mine property consists of approximately 1043462.4 m^2 (1.04 km^2) of potential migratory bird habitat within the NBDNR datasets, which is currently industrialized. The 5 km

radial Study Area is comprised of the following amounts of these habitat types as listed in Table 4.7.

Table 4.7 Migratory Bird Habitat Present Within the 5 km Radial Study Area

Habitat Type	Study Area (m^2)	Surficial Project Footprint (m^2)
Field	12,919,020.44	1,043,462.4
Edge	5,083,288.68	
Hardwood	7,591,962.42	
Mixed wood	10,944,476.44	
Softwood	8,921,402.44	
Old Hardwood	21,210,047.04	
Old Mixed wood	8,573,141.84	
Old Softwood	1,631,892.22	
J.D. Irving	2,007,455.13	
Waterbody	352,846.49	
Wetland	2,266,618.41	
Total	**81,502,151.54**	**1,043,462.4**

From Table 4.7 it is apparent that the most prevalent habitat within the Study Area is old hardwood (26%) followed by field habitat (16%) and mixed wood (13%).

The species listed in Table 4.6 nest in open fields or in manmade structures. There is, therefore, potential for migratory birds to be present within structures to be decommissioned in the surficial Project Footprint as well as in the field areas that overlay the underground mine extent that may be used for monitoring activities, especially during the “sensitive nesting window”.

4.9 Fish, Fish Habitat and Fisheries Resources

The Kennebecasis River transverses the Study Area, flowing in a southwesterly direction within 1 km of the Penobsquis mine’s northern underground extent (Figure 4.1). According to the KWRC, a total of 24 fish species can be found within the Kennebecasis River Watershed (NBDENV, 2007). Of those, the Kennebecasis River system is best known for recreationally fishing salmonid species such as Atlantic salmon and brook trout. The Province has classified the Kennebecasis watershed as having “good” water quality using the Water Quality Index (WQI), which assesses the water chemistry against the CCME Guidelines for Freshwater Aquatic Life (1999).

In June 2006, a fish habitat survey was conducted in the Kennebecasis River prior to installation of the Corridor McCully Transmission Line, just northeast of the peak of Penobsquis Loop Road near the centre of the Study Area (the watercourse crossing was labelled WC-55) (AMEC, 2006). Though the water level was too high to perform electrofishing at that time, the habitat survey surmised that it appeared to be good brook trout habitat. The surveyed section of the watercourse consisted of riffles, runs and pools with an average wet width and depth of approximately 10 m and 65 centimetres (cm), respectively. Substrate in the surveyed section of this watercourse consisted of 1% boulder, 2% rock, 41% rubble, 17% gravel, 31% sand and 7% fines with medium embeddedness. Undercut banks and overhanging vegetation, which provide good cover for

species such as brook trout, were moderately abundant in the surveyed area. Large woody debris was also present, but only in a few of the units surveyed. The slope of the riparian zone of this watercourse was low with moderate amounts of erosion occurring on the banks. Dissolved oxygen was 8.9 mg/L, the pH was 7.6, and the water temperature was 15.0℃ on 29 June, 2006.

In 1996, a "no kill" management zone was established upstream of McCully Station road (KWRC, 2009). It was hypothesized that creation of a "no kill" zone in that area would protect and therefore increase the survival rate of larger spawning "sea-run" brook trout that summer in that area. A follow-up report (KWRC, 2009), indicated that there has been a statistically significant decrease in brook trout populations since 1996; the cause; however, is yet to be confirmed.

The federal *Fisheries Act* protects fish that are part of commercial, recreational or aboriginal fisheries as well as fish that support such a fishery. Section 36 (3) states that no person shall permit the deposit of a deleterious substance of any type in water frequented by fish, or in any place under any conditions where the deleterious substance may enter any such water.

The ACCDC report included species at risk data from DFO showing that the Outer Bay of Fundy population of Atlantic salmon (*Salmo salar pop. 7*) is known to be present in the Study Area. COSEWIC designates the Outer Bay of Fundy Atlantic salmon as Endangered, although it does not have SARA status (SARPR, 2016). In its "General Status of Wildlife Report", NBDNR lists anadromous Atlantic salmon as Sensitive (assessed in 2006) (NBDNR, 2016b).

Recreational fishing continues to be an important part of the Kennebecasis River system and is vigorously pursued by many residents and non-residents alike. The following Table 4.8 listing current species within the Kennebecasis River Watershed was provided in Appendix J of the most recently published *KWRC Water Quality Report* (KWRC, 2014).

Table 4.8 Fish Species within the Kennebecasis River Watershed

Family	Common Name	Genus-Species
Acipenseridae	Shortnose Sturgeon	*Acipenser brevirostrum*
Anguilidae	American Eel	*Anguilia rostrata*
Catostomidae	White Sucker	*Catostomus commersoni*
	Long Nose Sucker	*Catostomus catostomus*
Clupeidae	Alewife (Gaspereau)	*Alosa pseudoharengus*
	American Shad	*Alosa sapidissma*
Cottidae	Slimy Sculpins	*Cottus cognatus*
Cyprinidae	Creek Chub	*Semotilus atromaculatus*
	Pearl Dace	*Semotilus margarita*
	Blacknose Dace	*Rhinichthys atratulus*
	Fine-scale Dace	*Chrosmus neogaeus*
	Common Shiner	*Notropis cornutus*
	Golden Shiner	*Notemigonus crysoleucas*
Esocidae	Chain Pickerel	*Esox niger*
Gadidae	Burbot	*Lota lota*
Gasterosteidae	Fourspine Stickleback	*Apeltes quadracus*
	Threespine Stickleback	*Gasterosteus aculeatus*

Family	Common Name	Genus-Species
	Ninespine Stickleback	*Pungitius pungitius*
Ictaluridae	Brown Bullheads	*Ictalurus nebulosus*
Percichthydae	Striped Bass	*Morone saxatilis*
Petromyzontidae	Sea Lamprey	*Petromyzon marinus*
Salmonidae	Brook Trout	*Salvelinus fontinalis*
	Atlantic Salmon	*Salmo salar*
	Rainbow Trout	*Oncorhynchus mykiss*

Source: KWRC, 2014

4.10 Designated Areas and Other Critical Habitat Features

A number of natural areas within the Province of New Brunswick have been either formally protected or inventoried as sites of potential significance, and are recommended for protection as Conservation Areas or Significant Natural Areas. The areas identified below are referred to as "Designated Areas" in this report.

Categories under the heading Significant Natural Areas include:

- Environmentally Significant Areas (ESAs);
- critical natural areas;
- nature reserves; and
- national and provincial parks.

All of the Conservation Areas and Significant Natural Areas listed above have been identified by Federal and / or Provincial regulatory authorities as areas for consideration and protection.

4.10.1 Environmentally Significant Areas (ESAs)

ESAs in New Brunswick are designated by NBDELG as having at least one of the following characteristics (NatureTrust NB (NTNB), 2011):

- considered to be ecologically fragile with respect to human activities;
- provide habitat for rare / endangered species;
- have unique, or especially distinctive, natural features of biological, ecological, geological, or aesthetic value; and/or
- have been enhanced through implementation of specific habitat management strategies aimed at specific species and/or ecosystems.

There are three ESAs located within 5 km of the Study Area according the ACCDC report. Located approximately 4.5 km northwest of the surficial Project Footprint is the Mount Pisgah Hemlocks ESA. Established in 1995, it has forest significance as it contains small patches of hemlock along the ridge top. Approximately 4.8 km southeast of the Study Area centre is the Springdale River Shore & Spring ESA, which is near the source of the Penobsquis Regional Water System (Appendix A). The Picadilly Mountain Hardwood Ridge ESA sits on the southern border of the 5 km radius of the Study Area.

4.11 Socio-economic Setting

The following sections describe the socio-economic setting of the Study Area.

4.11.1 Population and Labour Force

The proposed Project is located in the community of Penobsquis, NB in the Parish of Cardwell, Kings County. This region comprises the Study Area's socio-economic component of the EIA. The total area encompassed by the Parish is 312 km^2.

The major commercial centre nearest Penobsquis is comprised of Sussex Corner and Sussex, approximately 4 and 5 km southwest of the Penobsquis mine property, respectively. The smaller Village of Petitcodiac is located approximately 25 km northeast of the Penobsquis mine property and provides some commercial needs, but not to the extent that Sussex does. Table 4.9 shows the population of Cardwell PAR, and the Towns of Petitcodiac and Sussex (Statistics Canada, 2011) as per the 2011 census.

Cardwell parish (PAR) experienced a population decrease (4.4%) between 2006 and 2011 (Statistics Canada, 2011). The Town of Sussex grew by 1.7%, the Town of Petitcodiac by 4.5% and Kings County (CT) by 5.8%.

Table 4.9 Census Population by Study Area Municipality

Municipality	Area (km^2)	2006	2011	% Change
Cardwell (PAR)	311.72	1479	1414	-4.4
Petitcodiac (Village)	17.22	1368	1429	4.5
Sussex (Town)	9.03	4241	4312	1.7
Kings (CT)	3483.4	65,824	69,665	5.8

Statistics Canada, 2011 Canadian Census.

4.11.2 Local Economy

Sussex is the main industrial and commercial centre for the area. The Town is centrally located among the three major cities in New Brunswick – Saint John, Moncton and Fredericton. In the areas adjacent to the Study Area there is little in terms of industry and commerce compared to the nearby urban centres. Therefore, it is expected that a large number of people in this region commute to work.

4.11.3 Existing Land Use

4.11.3.1 Industrial

PotashCorp is considered a major industry in the region. Cargill Limited is one of Canada's largest agricultural merchandisers and processors, with interests in meat, egg, malt, and oilseed processing; livestock feed, salt manufacturing, as well as crop input products, grain handling and merchandizing. Corridor, also present in the vicinity of the Study Area, is an Eastern Canadian oil and natural gas exploration and development company that collects, processes and supplies natural gas to New England markets via the Maritimes and Northeast Pipeline. Corridor also operates a natural gas processing plant and a natural gas gathering system in the region, which

is currently utilized by the PotashCorp Picadilly mine site. Weeks Construction operates a large quarry.

4.11.3.2 Commercial

Commercial land use is concentrated in the nearby urban centres. However there are some commercial establishments scattered throughout the Study Area. Establishments include retail of baked goods and a Freddy's New Frenchy's Ltd. There is one restaurant in Penobsquis, the Timberland, as well as a seasonal take-out. There are also services for storage rental, construction, auto repair and a potable well driller.

4.11.3.3 Residential

The Cardwell Local Service District (LSD) is rural in nature. As such, it is predominantly comprised of forested area, agricultural land and scattered rural homes, concentrated along transportation routes. According to a desktop analysis, there are 352 buildings within the 5 km radial Study Area (Figure 4.4) (SNB, 2015). The nearest residence is a trailer located at the former Animaland Park, approximately 525 m from the Penobsquis mine property.

4.11.3.4 Cultural / Institutional

Cultural / institutional land uses may include hospitals and nursing homes, churches, educational facilities, museums, and theatres. In general, the towns of Sussex and Petitcodiac serve as the cultural and institutional centres for this area.

There are four churches in Petitcodiac, one in Penobsquis and 11 in Sussex.

There are no schools in Penobsquis. Children commute by bus to the schools in Sussex where there are two elementary schools (one of which is located in Sussex Corner), a middle school, a regional high school, and the Sussex Christian School which accommodates pre-school aged children to Grade 12.

Post-secondary schools in Sussex include extension courses in the Town offered by the University of New Brunswick and the New Brunswick Community College, as well as Kingswood University which offers Bachelor and Master degrees in Christian Education.

There are no cultural or institutional land uses in the form of museums or theatres within the Study Area.

4.11.3.5 Recreational

The Study Area is rural in nature. There are three campgrounds and two motels listed in Penobsquis, which are close to hiking trails and have other amenities such as pools, mini golf, playgrounds, etc. The Pine Cone Motel & Trailer Park (PID 30209555) is directly adjacent to the Penobsquis mine property.

Being that Penobsquis has a large proportion of natural forest, as well as several streams, it is likely that local residents utilize these resources for recreational activities such as hiking, four wheeling, snowmobiling (winter), and fishing.

4.11.3.6 Agricultural Land

There are traditional farming communities within a small portion of the Study Area and surrounding region. Many of the businesses previously listed relate to farming and farming supply sales.

4.11.3.7 Traffic Circulation

The following transportation corridors are located within the Study Area:

- **Highway**

The Study Area is traversed by Route 114 which contains direct access to the Route 1 Highway as well as various tertiary roads. The Penobsquis mine site is connected to Route 114 via McCully Station Road. Currently the amount of brine being pumped to the surface from the Penobsquis mine site is above the brine transport pipeline's requested flow rate, resulting in an average of 90 water trucks per day transporting excess brine from the Penobsquis mine site to the Courtenay Bay Potash Terminal & Brine Disposal Facility.

- **Rail**

PotashCorp's Penobsquis mine site contains an access to the Canadian National Railway (CNR) approximately 1 km south of the mainline. The CNR mainline crosses the Study Area in a southwest – northeast heading, approximately 1 km north of the underground mine workings.

- **Air**

There are local airports in Havelock and Sussex. These facilities are civil airports, open to public use, with unpaved runways and are, therefore, suitable only for lighter aircraft. The nearest airport serving domestic and international commercial passenger and cargo flights is in Moncton.

4.11.3.8 Utility Corridors

- **Electricity**

There are no electrical generation facilities in or near the Study Area. The NB Power corridor traverses the northwest sector of the Study Area approximately 1.5 km above the northern boundary of the underground mine extent. A transmission line enters the northwest side of the Penobsquis mine site's property.

- **Water / Sewer**

Sewer needs for the area are provided by individual septic systems. The Penobsquis Municipal Water System originates at Springdale Brook and follows approximately the same route as the Project Area along Route 114 from the Fundy Park Road to the Penobsquis mine at McCully Station Road (J. Russell, pers. comm., 2013), providing potable water to those residents along its path who elect to use it. There are approximately 352 buildings within the 5 km Study Area radius which potentially have domestic water wells.

- **Natural Gas**

PotashCorp operates a gas processing facility that supplies energy to both the Penobsquis and Picadilly mine sites. PotashCorp uses natural gas for boilers, dryers, space heating, refrigeration

and mine ventilation. Since this resource will continue to be used by the Picadilly mine, the decommissioning of the Penobsquis mine site will not include these pipelines or the processing facility.

4.11.4 Emergency and Medical Services

The Study Area is within the Saint John region of the Horizon Health Care Health Network. The nearest facility to the Study Area is the Sussex Health Centre which is a 25-bed facility providing ambulatory clinics as well as emergency care and ambulance service to the Saint John Regional Hospital 24 hours/day, 7 days/week (Horizon Health Network, 2016). Sussex also has a Primacy Medical Clinic and access to the New Brunswick Extra Mural Program.

Petitcodiac has a daytime health care centre, which provides the services of 2 local doctors. In addition, the Greater Moncton Area has two hospitals, the Moncton Regional Hospital and the Dr. Georges L. Dumont Hospital, both located in the City of Moncton. These facilities serve as referral centres for patients from other parts of the Province.

Emergency services for the Study Area are provided through the 911-service. Penobsquis has a Volunteer Fire Department that serves the region. This department is small and, therefore, in situations where additional help is required, the Petitcodiac Volunteer Fire Brigade and the Sussex Fire Department are called. Fire hydrants are available along the watermain of the Penobsquis Regional Water System, one of which is located in front of the Penobsquis mine on Route 114. Police protection is provided by the Royal Canadian Mounted Police (RCMP).

4.12 Heritage and Archaeological Resources

An Archaeological Impact Assessment (AIA) is one component of an EA.[2] The objectives of an AIA are to identify, inventory and evaluate all sites of archaeological, historical, and architectural significance within the Project Study Area (focusing on the Project footprint) and to assess the potential effects of the Project on these archaeological and heritage resources. Amec Foster Wheeler has conducted numerous AIAs within the Project Study Area associated with other projects (AMEC, 2005; AMEC, 2006; AMEC, 2007; AMEC, 2008a; AMEC, 2008b; AMEC, 2008c; AMEC, 2008d; AMEC, 2009; AMEC, 2010; AMEC, 2013a, AMEC 2013b). Previous investigations have included both the specific area of the mine site infrastructure and surrounding area. The proposed removal of the mine site surface infrastructure will impact surface and subsurface soils that were previously impacted during the construction and expansion of this facility. As a result, only highly disturbs soils with low potential for archaeological resources will be impacted by these activities. Archaeology is, therefore, not considered to be a VEC for this specific activity.

However, the proposed groundwater monitoring component for this Project will require the use of existing well pads and possibly the construction of new monitoring well pads and associated access roads (Section 6.0). Should new construction be included in the groundwater monitoring

[2] Prior to 2012, AIAs were referred to as Heritage Resource Impact Assessments (HRIA). This change in terminology is due to a provincial regulatory change resulting from the presentation of revised regulatory guidelines (ASNB, 2012).

component of the Project, regulatory AIA investigations would be triggered. However, archaeological constraints for the Project Study Area have been identified through previous investigations in this area (AMEC, 2005; AMEC, 2006; AMEC, 2007; AMEC, 2008a; AMEC, 2008b; AMEC, 2008c; AMEC, 2008d; AMEC, 2009; AMEC, 2010; AMEC, 2013a, AMEC 2013b). The following will present a brief review of the previous research conducted in the Study Area. Should new construction be proposed for this component of the Project, AIA investigations will be conducted prior to construction, in accordance with regulatory requirements (Archaeological Services New Brunswick (ASNB), 2012).

4.12.1 Background Desktop Review

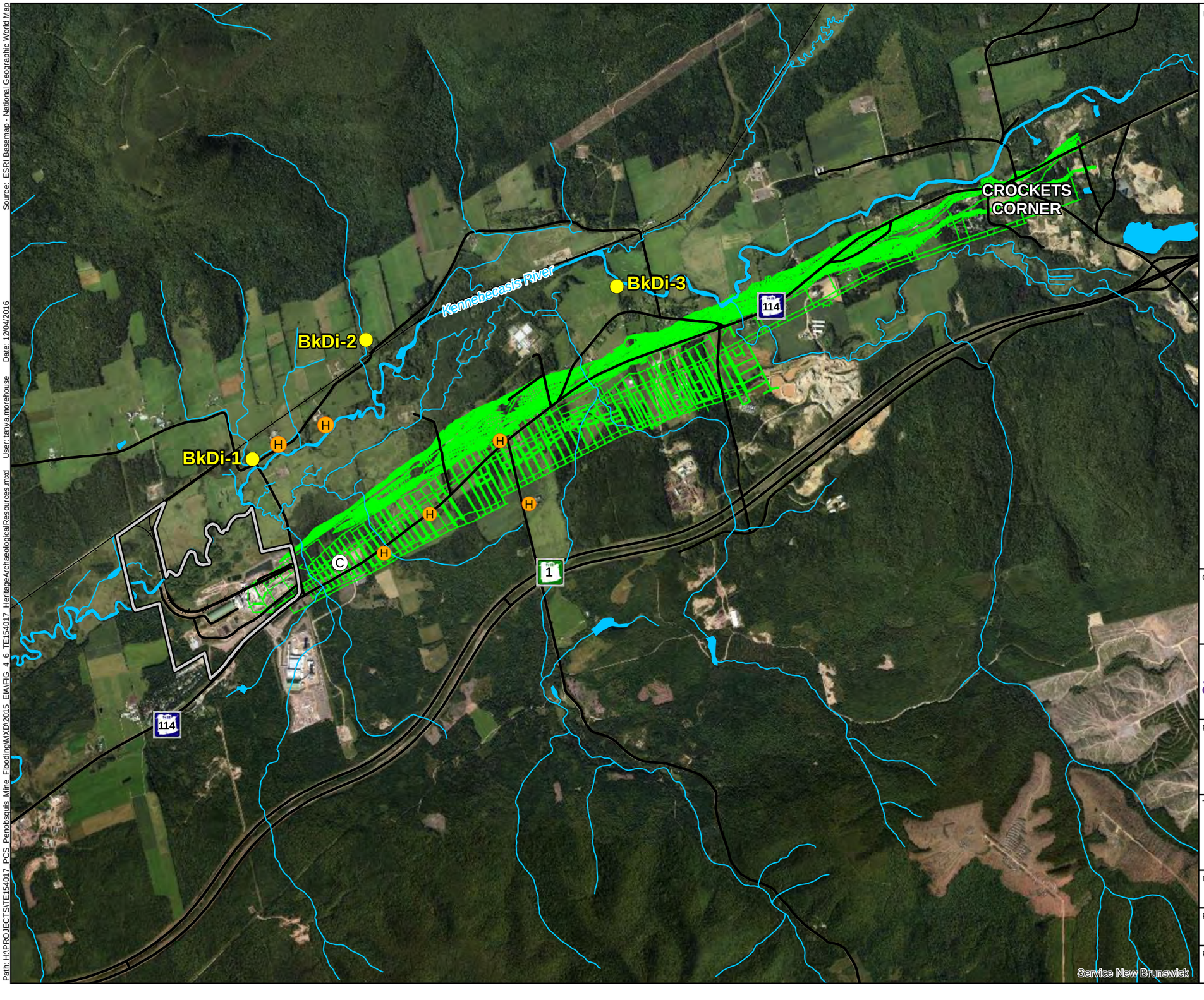
Past and present transportation routes are considered to be high potential areas for heritage and archaeological resources. Watercourses were the primary transportation routes of the past, while roads are the primary transportation routes of the more recent past and present. The Kennebecasis River is a substantial New Brunswick waterway and is documented to have been used in the Prehistoric and Historic past for habitation, food procurement, and transportation for the Natives (First Nations) and European settlers.

- **Potential Prehistoric Archaeological Resources**

Ganong (1899) identified a prehistoric portage route in the general vicinity of the Study Area: the Kennebecasis – Anagance[3] portage. This portage route was described as one that leaves the Anagance River a ½ mile west of Anagance Station, and runs directly southwest to the Kennebecasis River – a distance of 2 miles (Ibid.). This pedestrian transportation route is located outside the Project Study Area. However, there is a documented Native site that was identified by the Kennebecasis River in the Project Study Area (AMEC, 2005; AMEC, 2006; AMEC, 2007). This registered archaeological site (BkDi-3), located just north of the Penobsquis Loop Road (Figure 4.6) provides physical confirmation that there was a prehistoric Native presence along the Kennebecasis River.

There are numerous historical references to the presence of First Nations peoples in the Study Area when the Loyalists arrived in the late 1700s. The significant numbers of indigenous Maliseet in the area resulted in the New England Company opening and operating a provincial “Indian School” in Sussex Vale (present-day Sussex Corner), from the 1790s to the 1820s (University of New Brunswick Archives, 2007; Thomson, 1984). Reportedly, Native “encampments” were along the shorelines of the rivers in this area up until the late 1800s, and the Natives were known to travel up and down the waterways of the Kennebecasis, Anagance, and Petitcodiac Rivers (Aiton, 1967). Therefore, there is potential for historic Native archaeological resources (“Protohistoric”) in the vicinity of the Kennebecasis River.

[3] “*Anagance* is the Maliseet word for “portage” (Ganong, 1899:246).



LEGEND:

- Registered Archaeological Site
- Historic Structure
- Pioneer Cemetery
- Watercourse
- Railway Network
- Road Network
- Penobsquis Mine Workings (Underground Extent)
- Penobsquis Mine Surface (PID 30259402)

N W E S

0 200 400 800 1,200 1,600
Metres

The map shown here has been created with all due and reasonable care and is strictly for use with Amec Foster Wheeler Project Number: TE154017. This map has not been certified by a licensed land surveyor, and any third party use of this map comes without warranties of any kind. Amec Foster Wheeler assumes no liability, direct or indirect, whatsoever for any such third party or unintended use.

CLIENT:

PotashCorp New Brunswick Penobsquis

PotashCorp New Brunswick

amec foster wheeler

PROJECT:

ENVIRONMENTAL IMPACT ASSESSMENT
MINE DECOMMISSIONING
PENOBSQUIS POTASH DEPOSIT

TITLE:

HERITAGE AND ARCHAEOLOGICAL RESOURCES

DATUM:	DWN BY:	DATE:
NAD 83 CSRS	TM	March 29, 2016
PROJECTION:	CHK'D BY:	SCALE:
UTM Zone 20 North	VB	1:30,000
PROJECT NO:	REV NO:	FIGURE NO:
TE154017		4.6

Source: ESRI Basemap - National Geographic World Map Date: 12/04/2016 User: tanya.morehouse Path: H:\PROJECTSITE\te154017_PCS_Penobsquis_Mine_Flooding\MXD\2015_EIA\FIG_4_6_TE154017_HeritageArchaeologicalResources.mxd

- **Potential Historic Archaeological and Heritage Resources**

The general area surrounding the Study Area was settled in the late 1780s by the United Empire Loyalists through land grants from King George III.

As a result of previous investigations conducted in this area (AMEC, 2005; AMEC, 2006; AMEC, 2007), two previously unregistered historic sites were identified in the Project Study Area: sites BkDi-1 and BkDi-2. Site BkDi-1 is located near the Kennebecasis River, just north of the "T" intersection of McCully Station Road and Back Road. Site BkDi-2 is located on the north side of Back Road, approximately 1,200 m east of the intersection with McCully Station Road. Figure 4.6 indicates the location of these two known historic sites. Both of these sites have historic stone foundation features associated with them. While the age of Site BkDi-2 is unknown, BkDi-1 was confirmed through subsurface investigations to be a late 1700s to early 1800s historic habitation site. While the Canadian Register of Historic Places (2012) identifies 21[4] historic places in Sussex and the New Brunswick Register of Historic Places (2012) identifies 22, there are no historic places registered in the Penobsquis-McCully area. The closest designated national historic site to the Project Study Area is the former Intercolonial Railway Station in Sussex. There are no provincially or nationally designated historic sites within the proposed Study Area (S. Finley, pers. comm., 2005 - 2009; Parks Canada, 2012). There is one identified cemetery, the Pioneer Cemetery (Est. 1801) within the Study Area (Figure 4.6). Historical aerial photographs of the Project Study Area indicate building structures and settlement clearings on the present-day Route 114, Picadilly Road, and Back Road. The Canadian Inventory of Historic Buildings (CIHB) and previous field surveys of the Project Study Area identified numerous historic structures located along these historic transportation routes (Figure 4.6).

While there is elevated potential for archaeological and heritage resources within the Study Area, there is low potential for these resources within the impact area associated with the decommissioning of the mine site infrastructure. No further investigations are recommended for those Project activities. However, new construction activities may be proposed for the water monitoring component of the Project (Section 6.0). While the potential for archaeological resources will be considered for the placement of possible new well pad locations and access roads, additional AIA investigations will be required for any new construction activities within the Project Study Area.

4.12.2 Palaeontological Resources

In order to conduct a desktop review of potential palaeontological resources within the Study Area, the Bedrock Geology of New Brunswick (New Brunswick Department of Natural Resources and Energy, 2000) and the New Brunswick Fossil Database Project (2007, 2011, and 2012) were reviewed as well as other geological survey publications. In addition, Provincial Geologist Clinton St. Peter was consulted regarding the geology and potential resources within the Project Study Area (pers. com., 2005).

[4] The national register also identified two additional "Historic Places" with the word "Sussex" in their names, which are not actually located within the Sussex area.

The Project Study Area is underlain by Early Carboniferous “terrestrial sediments” of the Mabou Group (New Brunswick Department of Natural Resources and Energy, 2000). There are numerous recorded accounts of fossils (Plantae and Shelly) identified within a 20 km radius of the Study Area in other formations (Horton Group - Albert and Weldon formations and Sussex Group – Gautreau formation). However, since the surface decommissioning activities are being conducted on industrialized land, no impacts are anticipated.

4.12.3 First Nations / Aboriginal Communities

The Project is not proposed to overlap a present day First Nations community. Geographically, the closest First Nation community is the Mi’kmaq Nation at Fort Folly. However, the Study Area is located within traditional Wolastoqiyik (Maliseet) territory. The closest Wolastoqiyik community is the Oromocto First Nation. PotashCorp is committed to informational exchange relationships with a representative of the Oromocto First Nation, as well as the provincial aboriginal organizations, the Union of New Brunswick Indians (UNBI), and the New Brunswick Aboriginal Affairs Secretariat. These organizations have representation from both the Wolastoqiyik and Mi’kmaq peoples. Should new construction be proposed to facilitate the proposed groundwater monitoring component of the Project, these communities and organizations will be informed.

5.0 ENVIRONMENTAL IMPACTS AND ASSOCIATED MITIGATION

Spatial bounds for the Project effects on most VECs typically include the immediate environs of the Project Footprint and areas potentially affected by down-gradient movement of groundwater, surface water, and air. For socio-economic components of the environment, bounding extends to communities that have a stake in the potential effects resulting from the proposed Project.

The temporal bounds of this Study include pre-project studies and monitoring performed prior to mine flooding as well as the planned groundwater and surface water monitoring to be conducted during and post mine flooding. The intention of the monitoring programs is early detection of changes and are considered part of impact mitigation.

The anticipated decommissioning milestones are as follows:

- reduction of grouting and drilling: April 2016;
- brine pumping to surface: Ongoing until EIA Determination;
- evaluation of shaft decommissioning options: April – July 2016;
- shaft decommissioning: To be determined; and
- removal of surface infrastructure no longer required by Picadilly operations: 2018 - 2022.

An NBDNR mapped wetland and a portion of the Kennebecasis River are located on the Penobsquis mine property (Figure 4.5). The Kennebecasis River and its tributaries also flow southeasterly through the Study Area, often within 500 m of the northern underground mine extent. No unique or critical habitat for migratory birds or raptors was observed or reported. The surficial component of the Project involves a previously industrialized property which will be partially remediated to pre-mine conditions.

As a result of ceasing the management of the inflow, flooding of the mine will occur. Filling of the mine workings will occur over a period of time as the inflow accumulates into the void spaces left within the mine workings. The upper level salt and potash stopes are strategically being filled with water and fine salt to minimize potential void spaces as part of the brine management plan. Once these upper level areas are filled, the overflow of water will be directed to the lower salt level which becomes the final controlled storage area of the mine. The mine workings in lower salt levels were excavated at a slight decline as the mine advanced east in order to facilitate water flowing naturally to the far end of the mine, away from the shafts. This slope will ensure the water drains away from the shaft pillar area for as long as possible.

The analysis of the identified ECCs and the list of VECs within the Study Area's spatial and temporal bounds are presented in Table 5.1. As per the EIA methodology described in Section 3.0, VECs were determined on the basis of potential public concerns related to environmental, social, cultural, economic or aesthetic values as well as the scientific concerns of the professional community.

These VECs and pathways were further analysed against potential interactions with Project components resulting in a summary of potential environmental impacts. Table 5.2 is a summary of these potential impacts, coupled with associated mitigation activity. PotashCorp will conduct its operations in accordance with all applicable regulations and guidelines prescribed by NBDEM and the NBDELG.

Table 5.1 Issues Scoping/Pathway Analysis Summary Matrix - Valued Environmental Components (VECs): Decommissioning of PotashCorp Penobsquis Mine Site

Environmental Resources	Environmental Components of Concern (Biophysical and Socio-Economic)	Pathway of Concern		Possible Pathway	VEC		Project Works		Rationale for Inclusion/Exclusion as Valued Environmental Component (VEC)
		Yes	No		Yes	No	Surface Deconstruction	Mine Flooding	
Atmospheric Environment	Ambient Air Quality	X		• Building deconstruction. • Equipment operation. • Accidental release of hazardous materials.	X		X		Included as a VEC – Potential impact to surrounding residents/wildlife.
	Climatology		X	No possible pathway identified.		X			Excluded as a VEC – No pathway of concern identified.
Terrestrial Environment	Physiography and Drainage	X		• Increased subsidence. • Seismic activity.	X			X	Included as a VEC – Potential impacts to land topography.
	Hydrology and Hydrogeology	X		• Mine flooding (changes in groundwater levels or quality). • Accidental release of hazardous materials above or below ground.	X		X	X	Included as a VEC – Protected by statute/regulation.
	Wetland Resources	X		• Mine flooding (changes in surface water quality).	X		X	X	Included as a VEC – Protected by statute/regulation.
	Mineral Resources	X		• Mine flooding.	X			X	Included as a VEC – Resource will be sterilized by flooding.
Biological Environment	Species at Risk	X		• Habitat or population disturbance. • Accidental release of hazardous materials.	X		X	X	Included as a VEC – Protected by statute/regulation.
	Wildlife	X		• Habitat or population disturbance. • Accidental release of hazardous materials.	X		X	X	Included as a VEC – Protected by statute/regulation.
	Migratory Birds	X		• Habitat or population disturbance. • Accidental release of hazardous materials.	X		X	X	Included as a VEC – Protected by statute/regulation.
	Fish, Fish Habitat, and Fisheries Resources	X		• Mine flooding (changes in surface water quality).	X			X	Included as a VEC – Protected by statute/regulation.
	Designated Areas and Other Critical Habitat Features		X	No possible pathway identified.		X			Excluded as a VEC – No possible pathway.
Socio-Economic Setting	Population and Labour Force	X		• Mine closure.	X		X	X	Included as a VEC – Impact to regional employment.
	Industry and Commerce	X		• Mine flooding.	X			X	Included as a VEC – Resource will be sterilized by flooding.
	Existing Land Use	X		• Mine flooding has potential to affect land subsidence and or seismic activity.	X			X	Included as a VEC – Potential impacts to land topography.
	Community and Emergency Services		X	No possible pathway identified.		X			Excluded as a VEC – No pathway of concern identified.
	Heritage and Archaeological Resources	X		• Groundwater monitoring component of proposed environmental management.	X			X	Included as a VEC – Potential impacts to resources.

Table 5.2 Summary of Potential Environmental Effects

Environmental Components of Concern (ECC)	Possible Pathway	Potential Impact	Mitigation
Air Quality	Building deconstruction Equipment Operation Accidental release of hazardous materials	Fugitive dust Equipment/vehicle emissions Noise	• Control dust with the use of water. • Cover piles of soil to prevent particulate release. • Maintain equipment to limit particulate exhaust releases. • Control speed of vehicles. • Plan to conduct work activities that are likely to result in an increase in noise emissions during daytime hours (7am – 7pm) wherever possible, as described in Section 6.0 of this EIA. • Minimize heavy truck traffic and associated noise where possible.
Physiography and Drainage	Mine flooding	Increased seismicity Continued subsidence	• A micro seismic array is currently located within the mine workings of the Penobsquis and Picadilly mines. • Five new micro seismic monitoring stations have been proposed in order to monitor the salt barrier between the Penobsquis and Picadilly mines. • This array is capable of collecting pre-project information and detecting seismic events and their location within the SSA. • Pre-project subsidence data has been collected since 1989 and is planned to be collected on an annual basis over the temporal bounds of the Project, at minimum. • Subsidence is typically further reduced once non-compressible brine in open mine workings fills the void spaces.
Hydrology, Hydrogeology and Wetland Resources	Deconstruction work near surface water supply Impacts to the groundwater levels and geological formations during mine flooding	Effects on surface water quantity and quality Effects on groundwater quality and quantity	• Suspend deconstruction activities during high water flow periods and extreme weather events. • Preserve existing vegetation to the extent possible. • Consider runoff, erosion and sediment controls to be maintained for the life of the Project. • Collect pre-project surface water quantity and quality data and merge with existing databases. • Collect monitoring data from surface water and continue to incorporate into database to aid in detection of impacts. • Collection of pre-project water levels and quality from drinking water wells near the SSA in locations currently without access to the Penobsquis Municipal system. See Section 6.0 of this EIA. • Collect pre-project groundwater levels and quality data and merge with existing data.

Environmental Components of Concern (ECC)	Possible Pathway	Potential Impact	Mitigation
			• Collect monitoring data (levels and quality) for groundwater and continue to merge with database to aid in the detection of impacts, as described in Section 6.0 of this EIA. • Maintain 300 m barrier (salt) between Penobsquis mine workings and Picadilly mine workings.
Wildlife	Deconstruction activities Equipment presence Presence of people	Alteration / displacement of habitat Noise / physical disturbance of wildlife Behavioural changes Mortality	• Schedule surface activities to occur during periods of lowest sensitivity to wildlife. • Abide by all relevant timing constraints for wildlife as identified by regulatory agencies. • No on-site employees will harass wildlife.
Migratory Birds	Deconstruction activities Equipment presence Presence of people	Alteration / displacement of habitat during breeding Noise / physical disturbance of wildlife Behavioural changes Mortality	• Schedule surface activities to occur outside the sensitive nesting window of May to September. • Abide by all relevant timing constraints for wildlife as identified by regulatory agencies. • No on-site employees will harass wildlife. • Adhere to MBCA stipulations.
Species at Risk	Deconstruction activities Equipment presence Presence of people	Alteration / displacement of habitat Noise / physical disturbance of wildlife Behavioural changes Mortality	• Report the discovery of any ground nests of any species at risk encountered during activities. • Schedule surface activities to occur outside the sensitive nesting window of May to September. • Abide by all relevant timing constraints for wildlife as identified by regulatory agencies. • No on-site employees will harass wildlife. • Adhere to MBCA stipulations.
Fish, Fish Habitat and Fishery Resources	Mine flooding	Saltwater intrusion, affecting water quality	• Develop and implement a surface water quality pre-project and follow-up monitoring plan.

Environmental Components of Concern (ECC)	Possible Pathway	Potential Impact	Mitigation
Population and Labour Force	Deconstruction activities Equipment/product transportation	Noise/disturbance Traffic Fugitive dust Employment loss	• Control speed of vehicles. • Plan to conduct work activities that are likely to result in an increase in noise emissions during daytime hours (7am – 7pm) wherever possible, as described in Section 6.0 of this EIA. • Minimize heavy truck traffic and associated noise where possible. • Some personnel transferred to Picadilly site. Picadilly suspension not included in scope of this EIA.
Heritage and Archaeological Resources	Construction of groundwater monitoring well pads and access roads	Disturbance of resources	• Archaeological mapping will be considered in the locating process through consultation with Amec Foster Wheeler's Senior Archaeologist. • New well pad construction will require regulatory AIA investigations.
Accidental Spills and Malfunctions	Accidental release of hazardous materials and contaminant migration	Contamination of local and downstream environment	• Adherence to maintenance schedules and daily pre-work inspection for vehicles and equipment on-site. • Adequate training must be provided for personnel responsible for transportation, storage, handling, or use of hazardous material. • Implement Hazardous Waste Audit and remove all hazardous wastes from underground facilities prior to mine flooding. • Appropriately sized spill kits must be available on-site for clean-up efforts. • Adherence to contingency plans developed by PotashCorp.

6.0 ENVIRONMENTAL MONITORING AND MANAGEMENT

In addition to the mitigation measures suggested in Section 5.0, monitoring programs are being proposed that can capture pre-project values of specific environmental components and allow assessment of changes that may occur during the implementation of the Project and/or after its completion. Monitoring programs are being proposed for the following:

- groundwater and domestic water wells;
- surface water;
- subsidence;
- microseismic activity; and
- noise.

A hazardous materials (HAZMAT) survey will also be conducted as part of the environmental management for this Project in order to ensure that all materials are properly handled in accordance with provincial regulations.

Environmental impact monitoring for this Project is primarily related to effects to groundwater quantity and quality as a result of the mine flooding. It is recommended that local surface water bodies also be monitored given their known or likely interaction and connectivity to groundwater. Subsidence of the ground surface and seismic events which are sometimes associated with underground mining operations have also been considered in connection to the planned flooding action. Removal of surface infrastructure may cause noise and/or dust. In addition, both surface and underground activities will result in the requirement to properly dispose of hazardous materials.

It is important that monitoring begins in advance of the decommissioning activities in order to document pre-project implementation conditions.

6.1 Groundwater Monitoring

Monitoring requirements for this Project are primarily related to potential effects on groundwater quantity and quality as a result of the mine flooding. Based on a review of the available information and construction of a 3D database of all the relevant mine, geological and hydrogeological features obtained from various sources, the locations of four (4) deep monitoring wells have been proposed.

In general the proposed monitoring well locations were selected to meet the following objectives:

- use of existing data sets to aid with confirmation and calibration of existing data.
- position monitoring points near the inflow area as the known area of interest.
- position monitoring points at such a depth to be able to observe both the potable aquifer (approximately 150 mbgs) and groundwater levels near the level of the mine workings (approximately 400 to 700 mbgs).

- capability to measure water levels and collect water samples at various discrete depths (multilevel).
- capability to install automated water level equipment (pressure transducers).
- capability to detect a change in conditions (groundwater levels and quality) in the groundwater between the mine workings and the potable aquifer.

The four wells will be drilled on relatively small, bermed well pads. Monitoring wells will be drilled to target depths of 300 mbgs in order to intersect the hydrogeological zones of interest. Drilling of the wells will be achieved through conventional air rotary methods. Following the drilling, a testing program involving both geophysical and hydrophysical tools will be completed to locate and/or confirm the stratigraphic zones of interest (ie, high/low flow zones, lithology, bedrock fracture locations). Following the mapping of these zones and characterization of the monitoring wells, the final multilevel system will be designed, constructed and installed.

After installation and equipment calibration, automated collection of groundwater data will be initiated. Analysis and assessment of the returned data will be performed to detect changes in water levels.

The initial two rounds of sampling of the installed multilevel wells, performed in two different seasons, will assist in defining the pre-project implementation groundwater quality as well as expanding and confirming the groundwater levels in the SSA. In addition, the results of the first two rounds will assist in defining how often the monitoring wells should be sampled prior to, during and for a period after flooding of the mine.

6.1.1 Domestic Water Well Monitoring

Private water wells near the SSA that do not currently have access to the Penobsquis municipal system should be included in a drinking water quality survey to be conducted by an approved third party consultant prior to commencement of decommissioning activities in order to establish pre-project implementation quality. Water samples will be analysed by a certified laboratory for a potable water suite of chemical and microbiological parameters.

At minimum the third party engineering firm retained by PotashCorp to conduct the sampling would:

- prepare and mail individual water quality results to landowners;
- assist landowners in interpretation of water quality results;
- notify landowner immediately if the water quality poses a significant human health risk;
- compare pre-activity test results against follow-up results;
- provide NBDELG with electronic copies of all landowner communication relating to well water quality; and
- prepare and submit to NBDELG a final report within 90 days of program completion.

After the development of the initial pre-project survey, re-testing of the nearby domestic water users will be determined based on the most recent data.

6.2 Surface Water Monitoring

With respect to surface water, the monitoring program has been designed to first identify the locations where interaction between surface water and groundwater is either suspected and/or known. These locations are the areas where changes to surface water quantity and quality are more probable in relation to the mine flooding. After an initial review of the current surface monitoring network there is the potential to establish an additional five to eight surface water sampling locations. These surface water monitoring locations would be intended for the collection of data concerning surface water quantity and quality in order to develop a pre-project data set and also to serve as locations to be monitored prior to, during and after the mine flooding proceeds.

6.3 Subsidence

At minimum the annual subsidence program currently undertaken at the Penobsquis mine is anticipated to occur annually prior to, during and for a period after flooding proceeds. The frequency and need for continued monitoring will be determined after a review of the results of two years post-project implementation monitoring and in conjunction with regulatory authorities.

6.4 Microseismic Monitoring

The monitoring of seismic events in the SSA, and as it relates to the mine flooding, will be achieved through the use of geophones located underground at the Picadilly mine as well as above ground at the locations proposed in Figure 6.1. The location of the microseismic geophones in Figure 6.1 will allow for the detection of events across the SSA with particular focus on the salt barrier - the 300 m thick salt unit separating Penobsquis and Picadilly.

6.5 Noise Monitoring

Generally, in rural settings, typical noise levels are 40 to 55 dBA (A-weighted decibels) Leq (energy equivalent sound level) at nighttime, depending on the dwelling density and proximity of dwellings to highways and railways.

The majority of noise emissions will be associated with the operation of heavy equipment and dismantling of buildings. Pre-project noise monitoring may be conducted before surface deconstruction activities begin. The nearest noise receptor is a residence located approximately 275 m from the centre of the Penobsquis mine's head frames.

LEGEND:

- Penobsquis Existing Surface Geophone Locations
- Picadilly Existing Underground Geophone Locations
- Picadilly Proposed Surface Geophone Location
- Penobsquis Mine Surface (PID 30259402)
- Watercourse
- Railway Network

PENOBSQUIS MINE WORKINGS

SALT: White
1500: Red
1900: Purple
19 - 2: Green
Access: Yellow

PICADILLY MINE WORKINGS - Blue

N
W E
S

0 500 1,000 2,000 3,000
Metres

The map shown here has been created with all due and reasonable care and is strictly for use with Amec Foster Wheeler Project Number: TE154017. This map has not been certified by a licensed land surveyor, and any third party use of this map comes without warranties of any kind. Amec Foster Wheeler assumes no liability, direct or indirect, whatsoever for any such third party or unintended use.

CLIENT:

PotashCorp New Brunswick Penobsquis

PotashCorp New Brunswick

amec foster wheeler

PROJECT:

ENVIRONMENTAL IMPACT ASSESSMENT
MINE DECOMMISSIONING
PENOBSQUIS POTASH DEPOSIT

TITLE:

MICRO SEISMIC
MONITORING LOCATIONS

DATUM:	DWN BY:	DATE:
NAD 83 CSRS	TM	March 31, 2016
PROJECTION:	CHK'D BY:	SCALE:
UTM Zone 20 North	VB	1:50,000
PROJECT NO:	REV NO:	FIGURE NO:
TE154017		6.1

Source: ESRI Basemap - National Geographic World Map Date: 13/04/2016 User: tanya.morehouse Path: H:\PROJECTS\TE154017_PCS_Penobsquis_Mine_Flooding\MXD\2015_EIA\FIG_6_1_TE154017_SeismicGeophones.mxd

Table 6.1 lists typical noise levels for construction/demolition equipment (United States Department of Transportation (USDOT), 2015). Due to the nature of the proposed Project, noise effects from surface activities will be localized to the PotashCorp Penobsquis property and will be in short duration in the context of the Project life cycle.

Table 6.1 Project Equipment and Associated Operational Noise Levels

Construction Equipment	Noise Levels (dBA, slow)[1] At 50 feet (approximately 15 m)
Backhoe	78
Blasting	94 (Spec.)[2]
Clam Shovel	87
Ground Compactor	83
Compressor (Air)	78
Concrete Mixer Truck	79
Concrete Pump Truck	81
Crane	81
Dozer	82
Excavator	81
Flat Bed Truck	74
Front End Loader	79
Grader	85 (Spec)[2]
Impact Pile Driver	101
Jackhammer	89
Paver	77
Pneumatic Tools	85
Welder/Torch	74

Notes: [1] Representative of the highest noise level, decibels on A scale (dBA) of sound level meter
[2] Construction Noise Control Specification 721.560

For public exposure in rural settings, the Province of New Brunswick does not have specific guidelines for environmental noise (with the exception of specific industries, such as oil and gas). Health Canada has not set threshold values for noise, but recommends that mitigation measures be employed if levels of 75 dB (decibels) are exceeded for more than a year (Health Canada, 2010). Health Canada also lists other advisements, as detailed below.

- The identification of all potential noise-sensitive receptors and their locations relative to the Project area, and the identification of areas in which receptors could be considered to have a reasonable expectation of "peace and quiet" (i.e. "quiet rural areas"). The identification of sensitive receptors may include residences, daycares, school, hospitals, places of worship, nursing homes, and First Nations and Inuit communities.
- A delineation of the distance of the Project to potential receptors using maps that indicate noise levels at various distances from the Project site and identify all affected receptors. If any potential receptors are excluded from the assessment, please provide a justification.
- The identification/assessment of pre-project sound levels (measured or estimated) for both daytime (Ld) and nighttime (Ln) at the receptor locations.

- A comparison of pre-project noise levels with predicted noise levels at sensitive receptor locations during decommissioning (during daytime and nighttime, and after mitigation, if warranted).
- Note that Health Canada uses the Alberta Energy and Utilities Board Noise Control Directive 038 (2007) for guidance on whether construction noise should be considered short-term with regard to the prediction of complaint levels. If project-related noise lasts for less than two months at receptors, it may be considered temporary, and community consultation is advised.

PotashCorp will be sensitive to noise generated during the overnight hours and shall schedule activities accordingly. Activities will be undertaken in keeping with the following:

- Use natural barriers (or alternative materials where appropriate) where possible to dampen noise.
- Use properly maintained equipment with appropriate noise reduction equipment such as mufflers.
- Advise nearby residents of significant noise-causing activities and schedule these events to reduce disruption to them where practical.
- Plan to conduct work activities that are likely to result in an increase in noise emissions during daytime hours (7am – 7pm) wherever possible (within constraints for those operations that are 24/7).
- Minimize heavy truck traffic and associated noise where possible.

If a noise complaint is received, PotashCorp will report the complaint to the Regulator and investigate the complaint, perform noise testing to determine the actual levels and implement noise abatement measures if required.

6.6 Hazardous Materials Survey

Prior to any reclamation activity, a HAZMAT survey will be performed to catalogue all solid and liquid wastes that will be produced at each site; including its origin, physical/chemical state, general character and probable constituents, as well as the nearest appropriate disposal facility for those materials. Proper cataloguing and disposal may require laboratory analysis of certain materials and will consider Transportation of Dangerous Goods (TDG) regulatory requirements.

A HAZMAT assessment will be conducted, which typically consists of collecting samples for laboratory analysis in order to identify and categorize wastes prior to disposal. The inspection would include investigation into the presence of:

- Asbestos-containing material (ACM) (such as insulation or wallboard).
- Lead-based paint (LBP) and other lead-containing materials or equipment.
- Mercury-based paint (MBP) and other mercury-containing materials or equipment (such as thermostats).

- Polychlorinated biphenyl (PCB)-based paint and other PCB-containing materials or equipment (such as caulking, electrical equipment, fluorescent lights or hydraulic fluids in heavy equipment).
- Sources of Ozone Depleting Substances (ODSs) (such as refrigerants and fire extinguishing chemicals).
- Other.

During all phases of decommissioning, it is anticipated that waste materials will exist, being either liquid or solid in nature. Liquid wastes are expected to include various products from the operation of equipment and POLs removed from equipment left underground. Methanol, ethylene, spent varsol and other organic solvents may also require disposal.

Solid waste generated may include concrete, steel and wood debris, electrical and plumbing components, signs, metal containers and canisters. These wastes will be collected and disposed in a manner consistent with the applicable local and provincial regulations. Materials that can be reused or recycled will be taken to the appropriate facilities. There are no building components known to contain hazardous materials such as PCBs or asbestos on site, with the exception of a minor amount in the laboratory.

Once the inspection and cataloguing is complete, a HAZMAT management plan will be developed to ensure hazardous materials are disposed of in accordance with applicable local and provincial requirements.

Major equipment such as friction hoists, ball mill, centrifuges, compactors, compressors, screens, rake mechanisms, overhead cranes, diesel generators and transformers will be salvaged. Other equipment such as pumps, conveyors, bucket elevators, dryers, boilers and fans will be sold for scrap. Rail and/or truck transport will be used to transport salvaged materials to steel foundries. Nuclear devices, such as density gauges, will be removed and returned to the Canadian Nuclear Safety Commission (CNSC).

Steel piles will be left in place and covered with soil. Concrete floor slabs will be removed.

7.0 PUBLIC CONSULTATION

PotashCorp is committed to stakeholder consultation and community and public engagement. As per the New Brunswick EIA Regulation, the availability of this EIA for review will be advertised in the local newspaper, the Kings County Record, and posted in public areas such as the Penobsquis Fire Hall, the NBDELG offices and the PotashCorp office. PotashCorp will work with NBDELG to determine the appropriate publications and timing.

7.1 Public Notice

The following information will be included in the Public Notice of Registration as per Appendix C of the "*Guide to Environmental Impact Assessment in New Brunswick*" (NBDELG, 2012a):

- a brief description of the proposed Project;
- information on how to view the Registration Document;
- a description of the Project's location;
- the status of the Provincial approvals process for the Project;
- a statement indicating that people can ask questions or raise concerns with the proponent regarding the environmental impacts;
- proponent contact information (name, address, phone number, email); and
- the date by which comments must be received.

7.2 First Nations Consultation

PotashCorp will consult First Nations and affiliated groups to discuss the Project in a direct, accommodating approach. Information will be shared in a manner agreed upon by both parties that appropriately covers the scope of the proposed Project and the concerns expressed will be documented and considered during the course of the Project's review process.

Through consultation on previous projects, PotashCorp has already established a contact list and approached Chiefs of First Nations Bands in New Brunswick including:

Bouctouche First Nation
Eel Ground First Nation
Eel River Bar First Nation
Elsipogtog First Nation
Esgenoopetitj First Nation
Fort Folly First Nation
Indian Island First Nation
Kingsclear First Nation
Madawaska Maliseet First Nation
Metepenagiag Mi'kmaq Nation
Oromocto First Nation
Pabineau First Nation
Passamaquoddy First Nation
Saint Mary's First Nation
Tobique First Nation
Woodstock First Nation

PotashCorp has already mailed letters to the Chiefs of all the First Nations communities listed above to notify them of the intention to register an EIA for this Project.

First Nations Crown consultation requirements and processes for this Project will require approval by federal and provincial Crown representatives on the Technical Review Committee (TRC) such as the:

- NBDELG;
- NBDNR; and
- DFO.

PotashCorp will collaborate with the TRC and First Nations communities to ensure that a transparent, comprehensive consultation process has been undertaken for this Project.

8.0 CONCLUSION

This EIA has been conducted for the proposed decommissioning activities to be performed at the Penobsquis mine site. The assessment presented in this report has considered potential effects on the environment resulting from the activities as described in Section 2.0. A description of the existing environment in the Study Area and SSA has been presented (Section 4.0) based on available information. The VECs identified by issues scoping and pathway analysis (Section 5.0) for which potential effects may be a concern include:

- ambient air quality;
- physiography and drainage;
- surface water;
- groundwater;
- mineral resources;
- species at risk, migratory birds and wildlife;
- migratory birds;
- fish, fish habitat and fisheries resources;
- labour, industry and commerce;
- existing land use; and
- heritage and archaeological resources.

The potential for environmental effects has been discussed in Section 5.0. Significant negative residual effects are not anticipated based on:

- available information and results of previous field investigations in the Study Area and SSA presented in Section 4.0;
- pre-project surveys and environmental monitoring and management plans that will be developed and conducted, some of which are discussed in Section 6.0 of this document;
- the Public and First Nations Communication Strategy described in Section 7.0; and
- the mitigation measures outlined in this EIA.

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Contact List

Contact Name	Organization/Agency	Contacted Regarding
Bowers, Jason	NBDELG	NB Well Water Quality
Finley, Scott	New Brunswick Department of Wellness, Culture and Sport (NBDWCS) Heritage Branch	Historic Places and Structures (2005, 2006, 2007, 2008, and 2009)
NBDNR (Multiple Officers)	NBDNR	Bald Eagle Nests (February, 2016)
Russell, Jeff	NBDELG	Penobsquis Regional Water System (2013)
St. Peter, Clinton	NBDNR	Palaeontological Resources (2005)

APPENDIX A

Atlantic Canada Conservation Data Centre Report

Atlantic Canada Conservation Data Centre
Centre de données sur la conservation du Canada Atlantique

DATA REPORT 5506: Penobsquis, NB

Prepared 1 February 2016
by J. Churchill, Data Manager

CONTENTS OF REPORT

Map 1. A 100 km buffer around the study area

1.0 PREFACE

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

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

1.1 DATA LIST

Included datasets:

Filename	Contents
PenobsquisNB_5506ob.xls	All Rare and legally protected *Flora and Fauna* within 5 km of your study area
PenobsquisNB_5506ob100km.xls	A list of Rare and legally protected *Flora and Fauna* within 100 km of your study area
PenobsquisNB_5506ma.xls	All *Managed Areas* in your study area
PenobsquisNB_5506sa.xls	All *Significant Natural Areas* in your study area
PenobsquisNB_5506ff.xls	Rare and common *Freshwater Fish* in your study area (DFO database)

1.2 RESTRICTIONS

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

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

1.3 ADDITIONAL INFORMATION

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

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

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

Animals (Fauna)
John Klymko, Zoologist
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Plant Communities
Sarah Robinson , Community Ecologist
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Data Management, GIS
James Churchill, Data Manager
Tel: (902) 679-6146
jlchurchill@mta.ca

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

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

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

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

Western: Duncan Bayne
(902) 648-3536
baynedz@gov.ns.ca

Western: Donald Sam
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Eastern: Donald Anderson
(902) 295-3949
andersdg@gov.ns.ca

Eastern: Terry Power
(902) 563-3370
powertd@gov.ns.ca

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

2.0 RARE AND ENDANGERED SPECIES

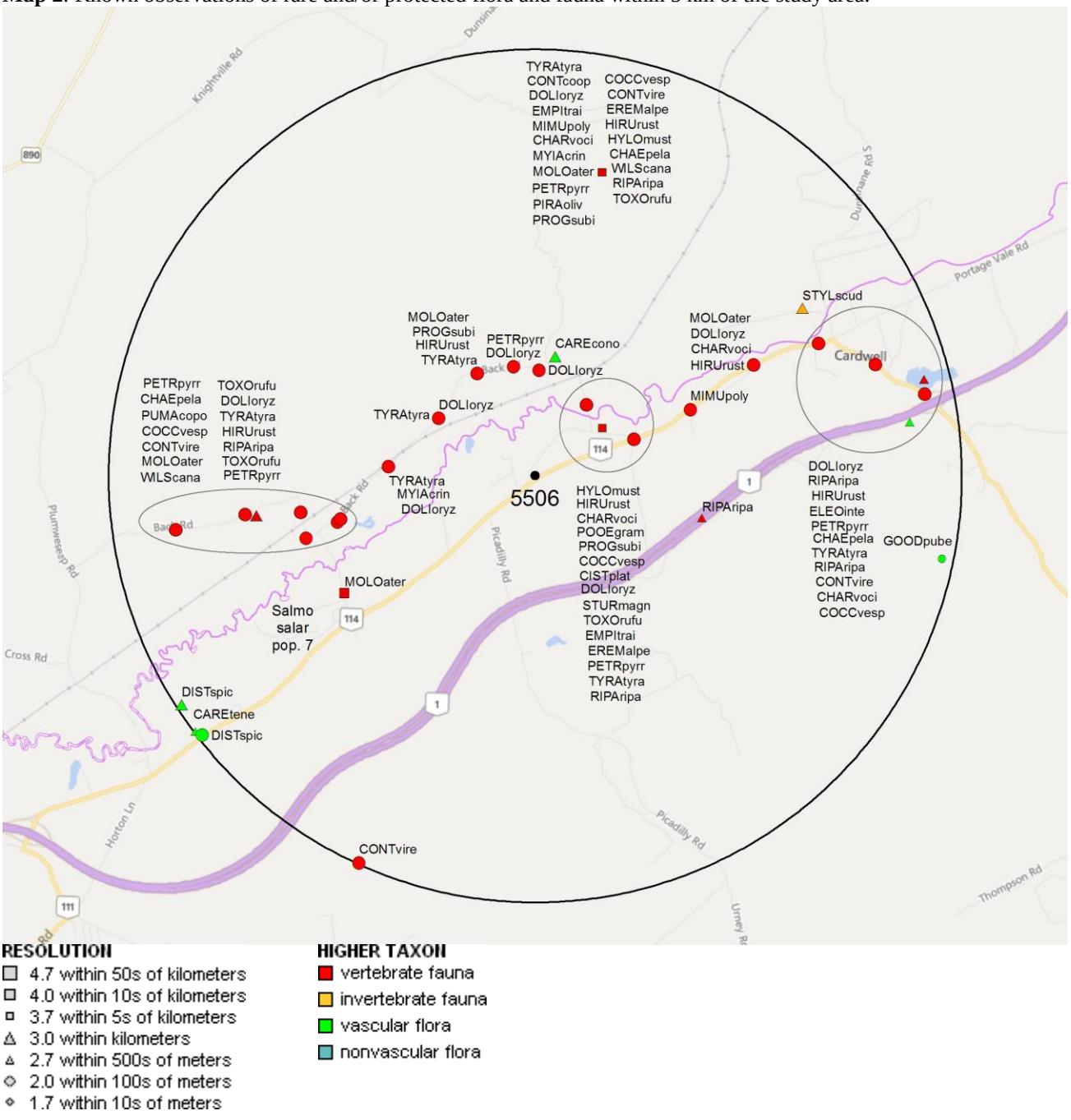
2.1 FLORA

A 5 km buffer around the study area contains 7 records of 5 vascular, no records of nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

A 5 km buffer around the study area contains 222 records of 24 vertebrate, 1 record of 1 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

Map 2: Known observations of rare and/or protected flora and fauna within 5 km of the study area.

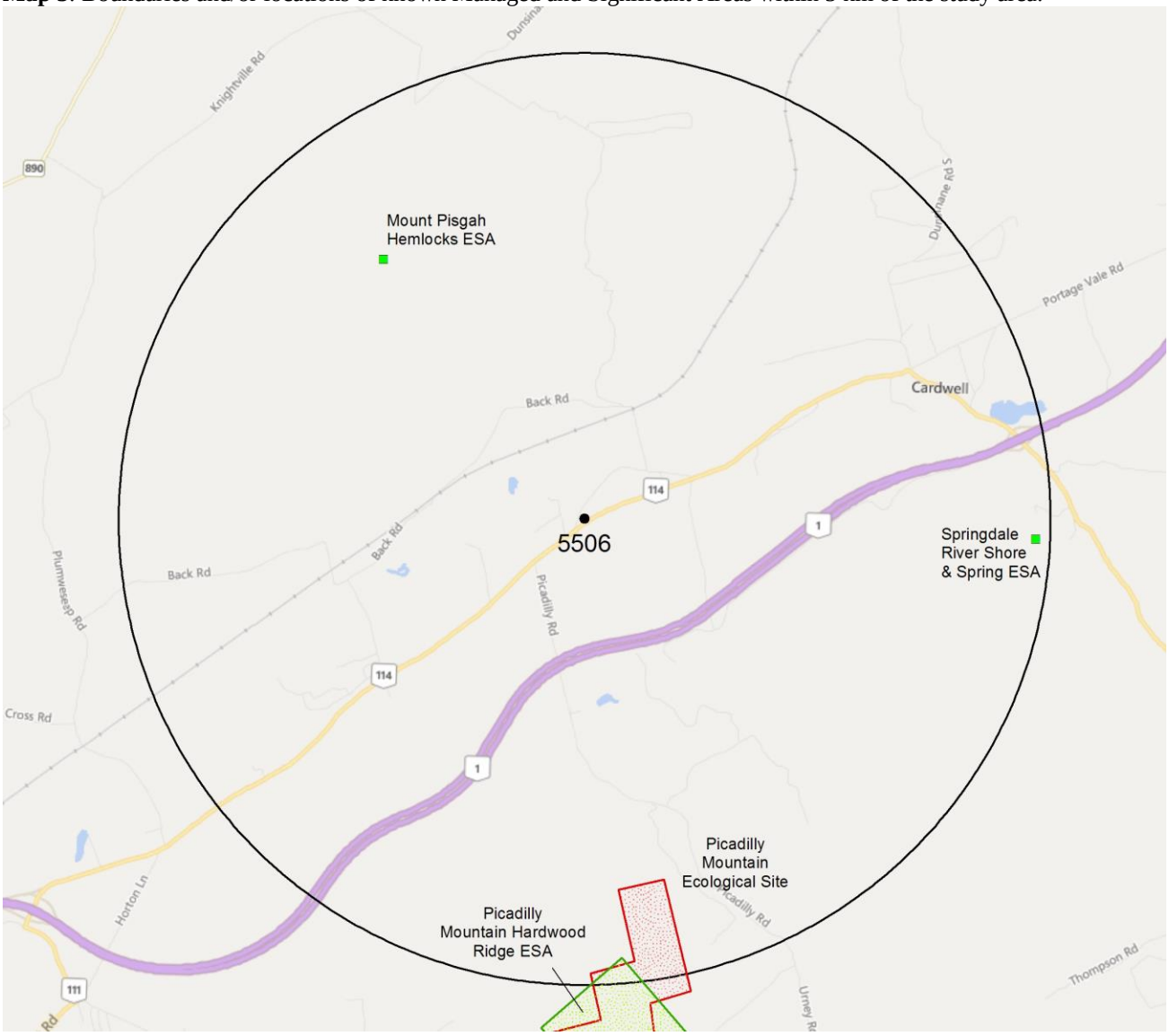


3.0 SPECIAL AREAS

3.1 MANAGED AREAS
The GIS scan identified 1 managed area in the vicinity of the study area (Map 3 and attached file: *ma*.xls)

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

Map 3: Boundaries and/or locations of known Managed and Significant Areas within 5 km of the study area.



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding "location-sensitive" species, section 4.3) within the 5 km-buffered area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community.

4.1 FLORA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S1	2 May Be At Risk	1	4.9 ± 0.0
P	*Carex conoidea*	Field Sedge				S3	4 Secure	1	1.4 ± 1.0
P	*Carex tenera*	Tender Sedge				S3	4 Secure	1	5.0 ± 0.0
P	*Eleocharis intermedia*	Matted Spikerush				S3	4 Secure	1	4.4 ± 0.0
P	*Distichlis spicata*	Salt Grass				S3S4	4 Secure	3	4.9 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	*Hylocichla mustelina*	Wood Thrush	Threatened		Threatened	S1S2B	2 May Be At Risk	2	1.0 ± 7.0
A	*Sturnella magna*	Eastern Meadowlark	Threatened		Threatened	S1S2B	2 May Be At Risk	1	1.0 ± 7.0
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B	1 At Risk	4	2.8 ± 0.0
A	*Hirundo rustica*	Barn Swallow	Threatened		Threatened	S3B	3 Sensitive	32	1.0 ± 0.0
A	*Riparia riparia*	Bank Swallow	Threatened			S3B	3 Sensitive	19	1.0 ± 0.0
A	*Contopus cooperi*	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3S4B	1 At Risk	1	3.6 ± 7.0
A	*Wilsonia canadensis*	Canada Warbler	Threatened	Threatened	Threatened	S3S4B	1 At Risk	2	3.6 ± 7.0
A	*Dolichonyx oryzivorus*	Bobolink	Threatened		Threatened	S3S4B	3 Sensitive	68	1.0 ± 0.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern		Special Concern	S4B	4 Secure	6	3.6 ± 7.0
A	*Cistothorus platensis*	Sedge Wren	Not At Risk			S1B	5 Undetermined	1	1.0 ± 7.0
A	*Puma concolor pop. 1*	Cougar - Eastern pop.	Data Deficient		Endangered	SU	5 Undetermined	1	3.3 ± 1.0
A	*Empidonax traillii*	Willow Flycatcher				S1S2B	3 Sensitive	4	1.0 ± 7.0
A	*Progne subis*	Purple Martin				S1S2B	2 May Be At Risk	7	1.0 ± 0.0
A	*Eremophila alpestris*	Horned Lark				S2B	2 May Be At Risk	2	1.0 ± 7.0
A	*Toxostoma rufum*	Brown Thrasher				S2B	3 Sensitive	6	1.0 ± 7.0
A	*Pooecetes gramineus*	Vesper Sparrow				S2B	2 May Be At Risk	1	1.0 ± 7.0
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	7	1.2 ± 0.0
A	*Myiarchus crinitus*	Great Crested Flycatcher				S3B	3 Sensitive	2	1.7 ± 0.0
A	*Mimus polyglottos*	Northern Mockingbird				S3B	3 Sensitive	2	2.0 ± 0.0
A	*Molothrus ater*	Brown-headed Cowbird				S3B	2 May Be At Risk	5	1.4 ± 0.0
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B	3 Sensitive	18	1.0 ± 0.0
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S3S4B	3 Sensitive	20	1.0 ± 0.0
A	*Piranga olivacea*	Scarlet Tanager				S3S4B	4 Secure	1	3.6 ± 7.0
A	*Coccothraustes vespertinus*	Evening Grosbeak				S3S4B,S4S5N	3 Sensitive	10	1.2 ± 0.0
I	*Stylurus scudderi*	Zebra Clubtail				S3	4 Secure	1	3.7 ± 1.0

4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species "location sensitive". Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting a 5 km buffer of your study area are indicated below with "YES".

New Brunswick

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within 5 km of Study Site?
Chrysemys picta picta	Eastern Painted Turtle			No
Chelydra serpentina	Snapping Turtle	Special Concern	Special Concern	No
Glyptemys insculpta	Wood Turtle	Threatened	Threatened	No
Haliaeetus leucocephalus	**Bald Eagle**		**Endangered**	**YES**
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.	Special Concern	Endangered	No
Cicindela marginipennis	Cobblestone Tiger Beetle	Endangered	Endangered	No
Coenonympha nipisiquit	Maritime Ringlet	Endangered	Endangered	No
Bat Hibernaculum		[Endangered][1]	[Endangered][1]	No

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

4.4 SOURCE BIBLIOGRAPHY

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

# recs	CITATION
145	Pardieck, K.L. & Ziolkowski Jr., D.J.; Hudson, M.-A.R. 2014. North American Breeding Bird Survey Dataset 1966 - 2013, version 2013.0. U.S. Geological Survey, Patuxent Wildlife Research Center <www.pwrc.usgs.gov/BBS/RawData/>.
37	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
32	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
6	eBird. 2014. eBird Basic Dataset. Version: EBD_relNov-2014. Ithaca, New York. Nov 2014. Cornell Lab of Ornithology, 25036 recs.
3	Tims, J. & Craig, N. 1995. Environmentally Significant Areas in New Brunswick (NBESA). NB Dept of Environment & Nature Trust of New Brunswick Inc.
2	Benedict, B. Connell Herbarium Specimens (Data) . University New Brunswick, Fredericton. 2003.
2	Cowie, F. 2007. Electrofishing Population Estimates 1979-98. Canadian Rivers Institute, 2698 recs.
2	Hinds, H.R. 1986. Notes on New Brunswick plant collections. Connell Memorial Herbarium, unpubl, 739 recs.
2	Tims, J. & Craig, N. 1995. Environmentally Significant Areas in New Brunswick (NBESA). NB Dept of Environment & Nature Trust of New Brunswick Inc, 6042 recs.
1	Brunelle, P.-M. (compiler). 2009. ADIP/MDDS Odonata Database: data to 2006 inclusive. Atlantic Dragonfly Inventory Program (ADIP), 24200 recs.
1	Downes, C. 1998-2000. Breeding Bird Survey Data. Canadian Wildlife Service, Ottawa, 111 recs.
1	LaFlamme, C. 2008. Disovery of Goodyera pubescens at Springdale, NB. Amec Earth and Environmental. Pers. comm. to D.M. Mazerolle, 1 rec.
1	Scott, Fred W. 1998. Updated Status Report on the Cougar (Puma Concolor couguar) [Eastern population]. Committee on the Status of Endangered Wildlife in Canada, 298 recs.
1	Zelazny, V. 2007. Fine Filter Protected Natural Areas digital ma

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 17953 records of 125 vertebrate and 1002 records of 58 invertebrate fauna; 4747 records of 330 vascular, 684 records of 193 nonvascular flora (attached: *ob100km.xls).

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

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	59	39.0 ± 1.0	NB
A	*Myotis septentrionalis*	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	21	17.8 ± 1.0	NB
A	*Perimyotis subflavus*	Eastern Pipistrelle	Endangered	Endangered	Endangered	S1	1 At Risk	19	10.7 ± 0.0	NB
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	1	75.9 ± 0.0	NS
A	*Dermochelys coriacea (Atlantic pop.)*	Leatherback Sea Turtle - Atlantic pop.	Endangered	Endangered	Endangered	S1S2N	1 At Risk	2	75.2 ± 50.0	NB
A	*Morone saxatilis*	Striped Bass	Endangered			S2	2 May Be At Risk	39	40.3 ± 0.0	NB
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered	Endangered	S2	2 May Be At Risk	48	9.9 ± 0.0	NB
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S2B	1 At Risk	190	44.0 ± 7.0	NB
A	*Calidris canutus rufa*	Red Knot rufa ssp	Endangered		Endangered	S3M	1 At Risk	411	48.0 ± 0.0	NB
A	*Rangifer tarandus pop. 2*	Woodland Caribou (Atlantic-Gasp├⌐sie pop.)	Endangered	Endangered	Extirpated	SX	0.1 Extirpated	4	52.3 ± 1.0	NB
A	*Ixobrychus exilis*	Least Bittern	Threatened	Threatened	Threatened	S1S2B	1 At Risk	25	20.3 ± 7.0	NB
A	*Hylocichla mustelina*	Wood Thrush	Threatened		Threatened	S1S2B	2 May Be At Risk	128	1.0 ± 7.0	NB
A	*Sturnella magna*	Eastern Meadowlark	Threatened		Threatened	S1S2B	2 May Be At Risk	52	1.0 ± 7.0	NB
A	*Caprimulgus vociferus*	Whip-Poor-Will	Threatened	Threatened	Threatened	S2B	1 At Risk	62	16.2 ± 7.0	NB
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2S3	1 At Risk	355	10.7 ± 10.0	NB
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B	1 At Risk	264	2.8 ± 0.0	NB
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Special Concern	Threatened	S2S3B	1 At Risk	9	34.5 ± 0.0	NB
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened		Threatened	S3	4 Secure	4	40.3 ± 1.0	NB
A	*Chordeiles minor*	Common Nighthawk	Threatened	Threatened	Threatened	S3B	1 At Risk	304	11.0 ± 0.0	NB
A	*Hirundo rustica*	Barn Swallow	Threatened		Threatened	S3B	3 Sensitive	1263	1.0 ± 0.0	NB
A	*Riparia riparia*	Bank Swallow	Threatened			S3B	3 Sensitive	477	1.0 ± 0.0	NB
A	*Contopus cooperi*	Olive-sided Flycatcher	Threatened	Threatened	Threatened	S3S4B	1 At Risk	454	3.6 ± 7.0	NB
A	*Wilsonia canadensis*	Canada Warbler	Threatened	Threatened	Threatened	S3S4B	1 At Risk	641	3.6 ± 7.0	NB
A	*Dolichonyx oryzivorus*	Bobolink	Threatened		Threatened	S3S4B	3 Sensitive	1180	1.0 ± 0.0	NB
A	*Anguilla rostrata*	American Eel	Threatened		Threatened	S5	4 Secure	97	16.7 ± 0.0	NB
A	*Coturnicops noveboracensis*	Yellow Rail	Special Concern	Special Concern	Special Concern	S1?B	2 May Be At Risk	8	55.7 ± 7.0	NB
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Endangered	S1B	1 At Risk	484	28.6 ± 7.0	NB
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S1B,S1N	1 At Risk	2	82.0 ± 1.0	NS
A	*Acipenser brevirostrum*	Shortnose Sturgeon	Special Concern	Special Concern	Special Concern	S2	3 Sensitive	6	47.6 ± 10.0	NB
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern	Special Concern	S2N	3 Sensitive	135	41.0 ± 83.0	NB
A	*Balaenoptera physalus*	Fin Whale - Atlantic pop.	Special Concern	Special Concern	Special Concern	S2S3		3	49.0 ± 1.0	NB
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Special Concern	S3	3 Sensitive	9	48.0 ± 1.0	NB
A	*Asio flammeus*	Short-eared Owl	Special Concern	Special Concern	Special Concern	S3B	3 Sensitive	51	51.2 ± 7.0	NB
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Special Concern	S3B	2 May Be At Risk	96	7.4 ± 0.0	NB
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern			S3M	3 Sensitive	13	38.9 ± 0.0	NB
A	*Phocoena phocoena (NW Atlantic pop.)*	Harbour Porpoise - Northwest Atlantic pop.	Special Concern	Threatened		S4		4	75.6 ± 0.0	NB
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern		Special Concern	S4B	4 Secure	655	3.6 ± 7.0	NB

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A	*Podiceps auritus*	Horned Grebe	Special Concern		Special Concern	S4M,S4N	4 Secure	60	22.9 ± 219.0	NB
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S1?	5 Undetermined	11	31.8 ± 0.0	NB
A	*Cistothorus platensis*	Sedge Wren	Not At Risk			S1B	5 Undetermined	7	1.0 ± 7.0	NB
A	*Falco rusticolus*	Gyrfalcon	Not At Risk			S1N	5 Undetermined	4	77.1 ± 0.0	NB
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1S2B	2 May Be At Risk	13	33.6 ± 7.0	NB
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S1S2B	2 May Be At Risk	4	58.0 ± 0.0	NB
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	5	46.7 ± 0.0	NB
A	*Buteo lineatus*	Red-shouldered Hawk	Not At Risk	Special Concern		S2B	2 May Be At Risk	38	20.3 ± 7.0	NB
A	*Fulica americana*	American Coot	Not At Risk			S2B	3 Sensitive	59	38.7 ± 2.0	NB
A	*Chlidonias niger*	Black Tern	Not At Risk			S2B	3 Sensitive	144	35.4 ± 0.0	NB
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3		2	59.4 ± 0.0	NB
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S3	1 At Risk	15	31.3 ± 0.0	NB
A	*Desmognathus fuscus (QC/NB pop.)*	Northern Dusky Salamander - QC/NB pop.	Not At Risk			S3	3 Sensitive	40	37.0 ± 0.0	NB
A	*Haliaeetus leucocephalus*	Bald Eagle	Not At Risk		Endangered	S3B	1 At Risk	1096	2.3 ± 0.0	NB
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B	3 Sensitive	215	30.4 ± 2.0	NB
A	*Podiceps grisegena*	Red-necked Grebe	Not At Risk			S3M,S2N	3 Sensitive	53	49.6 ± 2.0	NB
A	*Lagenorhynchus acutus*	Atlantic White-sided Dolphin	Not At Risk			S3S4		2	65.8 ± 1.0	NB
A	*Canis lupus*	Gray Wolf	Not At Risk		Extirpated	SX	0.1 Extirpated	4	10.5 ± 1.0	NB
A	*Lepomis auritus*	Redbreast Sunfish	Data Deficient	Special Concern		S3?	4 Secure	19	68.5 ± 1.0	NB
A	*Puma concolor pop. 1*	Cougar - Eastern pop.	Data Deficient		Endangered	SU	5 Undetermined	113	3.3 ± 1.0	NB
A	*Salvelinus alpinus*	Arctic Char				S1	3 Sensitive	3	18.1 ± 1.0	NB
A	*Lasionycteris noctivagans*	Silver-haired Bat				S1?	5 Undetermined	3	74.3 ± 1.0	NB
A	*Bartramia longicauda*	Upland Sandpiper				S1B	3 Sensitive	39	18.1 ± 1.0	NB
A	*Phalaropus tricolor*	Wilson's Phalarope				S1B	3 Sensitive	63	40.9 ± 0.0	NB
A	*Leucophaeus atricilla*	Laughing Gull				S1B	3 Sensitive	13	47.3 ± 0.0	NB
A	*Sterna paradisaea*	Arctic Tern				S1B	2 May Be At Risk	8	36.5 ± 11.0	NB
A	*Troglodytes aedon*	House Wren				S1B	5 Undetermined	27	45.5 ± 0.0	NB
A	*Aythya marila*	Greater Scaup				S1B,S2N	4 Secure	31	49.4 ± 1.0	NB
A	*Uria aalge*	Common Murre				S1B,S3N	4 Secure	4	89.4 ± 15.0	NB
A	*Alca torda*	Razorbill				S1B,S3N	4 Secure	2	89.4 ± 15.0	NB
A	*Oxyura jamaicensis*	Ruddy Duck				S1B,S4N	4 Secure	140	41.0 ± 2.0	NB
A	*Rissa tridactyla*	Black-legged Kittiwake				S1B,S4N	4 Secure	3	92.8 ± 0.0	NB
A	*Butorides virescens*	Green Heron				S1S2B	3 Sensitive	18	40.2 ± 4.0	NB
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1S2B	3 Sensitive	10	59.8 ± 0.0	NB
A	*Gallinula chloropus*	Common Moorhen				S1S2B	3 Sensitive	40	7.9 ± 0.0	NB
A	*Fratercula arctica*	Atlantic Puffin				S1S2B	3 Sensitive	4	36.5 ± 11.0	NB
A	*Empidonax traillii*	Willow Flycatcher				S1S2B	3 Sensitive	97	1.0 ± 7.0	NB
A	*Progne subis*	Purple Martin				S1S2B	2 May Be At Risk	243	1.0 ± 7.0	NB
A	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow				S1S2B	2 May Be At Risk	7	55.7 ± 7.0	NB
A	*Prosopium cylindraceum*	Round Whitefish				S2	4 Secure	1	71.9 ± 0.0	NB
A	*Salmo salar*	Atlantic Salmon				S2	2 May Be At Risk	64	22.5 ± 0.0	NB
A	*Lasiurus borealis*	Eastern Red Bat				S2?	5 Undetermined	7	76.2 ± 1.0	NB
A	*Lasiurus cinereus*	Hoary Bat				S2?	5 Undetermined	3	67.0 ± 1.0	NB
A	*Oceanodroma leucorhoa*	Leach's Storm-Petrel				S2B	3 Sensitive	3	91.8 ± 0.0	NB
A	*Anas clypeata*	Northern Shoveler				S2B	4 Secure	310	20.3 ± 7.0	NB
A	*Anas strepera*	Gadwall				S2B	4 Secure	218	38.6 ± 0.0	NB
A	*Eremophila alpestris*	Horned Lark				S2B	2 May Be At Risk	54	1.0 ± 7.0	NB
A	*Cistothorus palustris*	Marsh Wren				S2B	3 Sensitive	99	48.3 ± 0.0	NB
A	*Toxostoma rufum*	Brown Thrasher				S2B	3 Sensitive	38	1.0 ± 7.0	NB

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A	*Pooecetes gramineus*	Vesper Sparrow				S2B	2 May Be At Risk	98	1.0 ± 7.0	NB
A	*Tringa solitaria*	Solitary Sandpiper				S2B,S5M	4 Secure	180	23.1 ± 0.0	NB
A	*Chroicocephalus ridibundus*	Black-headed Gull				S2M,S1N	3 Sensitive	12	36.8 ± 0.0	NB
A	*Somateria spectabilis*	King Eider				S2N	4 Secure	3	51.0 ± 0.0	NB
A	*Asio otus*	Long-eared Owl				S2S3	5 Undetermined	19	12.6 ± 7.0	NB
A	*Tringa semipalmata*	Willet				S2S3B	3 Sensitive	260	38.0 ± 0.0	NB
A	*Pinicola enucleator*	Pine Grosbeak				S2S3B,S4S5N	3 Sensitive	22	36.5 ± 11.0	NB
A	*Branta bernicla*	Brant				S2S3M,S2S3N	4 Secure	32	47.8 ± 2.0	NB
A	*Uria lomvia*	Thick-billed Murre				S2S3N	5 Undetermined	3	89.4 ± 15.0	NB
A	*Cepphus grylle*	Black Guillemot				S3	4 Secure	51	36.5 ± 11.0	NB
A	*Loxia curvirostra*	Red Crossbill				S3	4 Secure	125	6.8 ± 0.0	NB
A	*Coregonus clupeaformis*	Lake Whitefish				S3	4 Secure	8	38.8 ± 0.0	NB
A	*Salvelinus namaycush*	Lake Trout				S3	3 Sensitive	1	90.0 ± 0.0	NB
A	*Sorex maritimensis*	Maritime Shrew				S3	4 Secure	105	86.1 ± 1.0	NB
A	*Eptesicus fuscus*	Big Brown Bat				S3	3 Sensitive	32	11.6 ± 1.0	NB
A	*Picoides dorsalis*	American Three-toed Woodpecker				S3?	3 Sensitive	15	21.9 ± 7.0	NB
A	*Anas acuta*	Northern Pintail				S3B	3 Sensitive	125	31.8 ± 7.0	NB
A	*Anas americana*	American Wigeon				S3B	4 Secure	705	10.8 ± 0.0	NB
A	*Cathartes aura*	Turkey Vulture				S3B	4 Secure	262	5.4 ± 0.0	NB
A	*Rallus limicola*	Virginia Rail				S3B	3 Sensitive	151	32.2 ± 7.0	NB
A	*Charadrius vociferus*	Killdeer				S3B	3 Sensitive	920	1.2 ± 0.0	NB
A	*Larus delawarensis*	Ring-billed Gull				S3B	4 Secure	293	12.8 ± 0.0	NB
A	*Myiarchus crinitus*	Great Crested Flycatcher				S3B	3 Sensitive	198	1.7 ± 0.0	NB
A	*Mimus polyglottos*	Northern Mockingbird				S3B	3 Sensitive	155	2.0 ± 0.0	NB
A	*Passerina cyanea*	Indigo Bunting				S3B	4 Secure	65	29.9 ± 7.0	NB
A	*Molothrus ater*	Brown-headed Cowbird				S3B	2 May Be At Risk	332	1.4 ± 0.0	NB
A	*Mergus serrator*	Red-breasted Merganser				S3B,S4S5N	4 Secure	103	31.0 ± 7.0	NB
A	*Pluvialis dominica*	American Golden-Plover				S3M	3 Sensitive	178	48.0 ± 0.0	NB
A	*Phalaropus fulicarius*	Red Phalarope				S3M	3 Sensitive	3	36.5 ± 11.0	NB
A	*Melanitta nigra*	Black Scoter				S3M,S2S3N	3 Sensitive	215	36.5 ± 11.0	NB
A	*Calidris maritima*	Purple Sandpiper				S3M,S3N	4 Secure	77	36.5 ± 11.0	NB
A	*Bucephala albeola*	Bufflehead				S3N	3 Sensitive	527	36.5 ± 11.0	NB
A	*Synaptomys cooperi*	Southern Bog Lemming				S3S4	4 Secure	94	12.9 ± 1.0	NB
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B	3 Sensitive	535	1.0 ± 0.0	NB
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S3S4B	3 Sensitive	574	1.0 ± 0.0	NB
A	*Piranga olivacea*	Scarlet Tanager				S3S4B	4 Secure	90	3.6 ± 7.0	NB
A	*Coccothraustes vespertinus*	Evening Grosbeak				S3S4B,S4S5N	3 Sensitive	284	1.2 ± 0.0	NB
A	*Morus bassanus*	Northern Gannet				SHB,S5M,S5N	4 Secure	69	36.5 ± 11.0	NB
A	*Lanius ludovicianus*	Loggerhead Shrike				SXB,SNAN	1 At Risk	1	59.8 ± 0.0	NB
C	*Quercus macrocarpa - Acer rubrum / Onoclea sensibilis - Carex arcta Forest*	Bur Oak - Red Maple / Sensitive Fern - Northern Clustered Sedge Forest				S2		1	62.6 ± 0.0	NB
C	*Acer saccharinum / Onoclea sensibilis - Lysimachia terrestris Forest*	Silver Maple / Sensitive Fern - Swamp Yellow Loosestrife Forest				S3		1	93.4 ± 0.0	NB
C	*Acer saccharum - Fraxinus americana / Polystichum acrostichoides Forest*	Sugar Maple - White Ash / Christmas Fern Forest				S3S4		1	51.8 ± 0.0	NB
I	*Cicindela marginipennis*	Cobblestone Tiger Beetle	Endangered	Endangered	Endangered	S1?	1 At Risk	16	56.4 ± 0.0	NB

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I	*Gomphus ventricosus*	Skillet Clubtail	Endangered		Endangered	S1S2	2 May Be At Risk	47	33.2 ± 0.0	NB
I	*Alasmidonta varicosa*	Brook Floater	Special Concern		Special Concern	S1S2	3 Sensitive	16	26.5 ± 1.0	NB
I	*Ophiogomphus howei*	Pygmy Snaketail	Special Concern	Special Concern	Special Concern	S2	2 May Be At Risk	3	62.4 ± 0.0	NB
I	*Lampsilis cariosa*	Yellow Lampmussel	Special Concern	Special Concern	Special Concern	S2	3 Sensitive	94	32.2 ± 0.0	NB
I	*Danaus plexippus*	Monarch	Special Concern	Special Concern	Special Concern	S3B	3 Sensitive	99	38.8 ± 10.0	NB
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern			SU	3 Sensitive	13	34.2 ± 0.0	NB
I	*Lyogyrus granum*	Squat Duskysnail	Data Deficient			S2		33	43.4 ± 0.0	NB
I	*Erora laeta*	Early Hairstreak				S1	2 May Be At Risk	1	60.8 ± 1.0	NB
I	*Celithemis martha*	Martha's Pennant				S1	5 Undetermined	1	86.2 ± 0.0	NB
I	*Arigomphus furcifer*	Lilypad Clubtail				S1	5 Undetermined	6	56.5 ± 0.0	NB
I	*Polites origenes*	Crossline Skipper				S1?	5 Undetermined	4	56.5 ± 0.0	NB
I	*Coccinella transversoguttata richardsoni*	Transverse Lady Beetle				S1S2	2 May Be At Risk	25	56.0 ± 1.0	NB
I	*Plebejus saepiolus*	Greenish Blue				S1S2	4 Secure	2	25.0 ± 1.0	NB
I	*Ophiogomphus colubrinus*	Boreal Snaketail				S1S2	2 May Be At Risk	30	66.7 ± 0.0	NB
I	*Satyrium calanus*	Banded Hairstreak				S2	3 Sensitive	2	95.7 ± 0.0	NB
I	*Satyrium calanus falacer*	Banded Hairstreak				S2	4 Secure	2	96.8 ± 1.0	NB
I	*Strymon melinus*	Grey Hairstreak				S2	4 Secure	4	59.5 ± 1.0	NB
I	*Aeshna clepsydra*	Mottled Darner				S2	3 Sensitive	8	56.3 ± 0.0	NB
I	*Somatochlora brevicincta*	Quebec Emerald				S2	5 Undetermined	2	59.3 ± 0.0	NB
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S2	5 Undetermined	5	82.9 ± 1.0	NB
I	*Ischnura posita*	Fragile Forktail				S2	2 May Be At Risk	1	96.8 ± 1.0	NS
I	*Alasmidonta undulata*	Triangle Floater				S2	3 Sensitive	62	18.0 ± 0.0	NB
I	*Anatis labiculata*	Fifteen-spotted Lady Beetle				S2S3	3 Sensitive	1	80.1 ± 0.0	NB
I	*Cicindela hirticollis*	Hairy-necked Tiger Beetle				S2S3	4 Secure	3	55.7 ± 0.0	NB
I	*Callophrys henrici*	Henry's Elfin				S2S3	4 Secure	9	58.0 ± 0.0	NB
I	*Euphyes bimacula*	Two-spotted Skipper				S3	4 Secure	7	58.4 ± 1.0	NB
I	*Papilio brevicauda*	Short-tailed Swallowtail				S3	4 Secure	2	99.8 ± 0.0	NB
I	*Papilio brevicauda bretonensis*	Short-tailed Swallowtail				S3	4 Secure	5	88.8 ± 0.0	NB
I	*Lycaena hyllus*	Bronze Copper				S3	3 Sensitive	61	49.2 ± 0.0	NB
I	*Lycaena dospassosi*	Salt Marsh Copper				S3	4 Secure	15	85.8 ± 0.0	NB
I	*Satyrium acadica*	Acadian Hairstreak				S3	4 Secure	22	11.6 ± 1.0	NB
I	*Callophrys polios*	Hoary Elfin				S3	4 Secure	9	43.6 ± 0.0	NB
I	*Plebejus idas*	Northern Blue				S3	4 Secure	15	33.7 ± 1.0	NB
I	*Plebejus idas empetri*	Crowberry Blue				S3	4 Secure	4	86.6 ± 1.0	NB
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	4 Secure	15	58.7 ± 0.0	NS
I	*Boloria bellona*	Meadow Fritillary				S3	4 Secure	20	58.4 ± 0.0	NB
I	*Boloria chariclea*	Arctic Fritillary				S3	4 Secure	10	69.3 ± 1.0	NB
I	*Polygonia satyrus*	Satyr Comma				S3	4 Secure	4	82.1 ± 1.0	NB
I	*Polygonia gracilis*	Hoary Comma				S3	4 Secure	1	78.8 ± 1.0	NB
I	*Nymphalis l-album*	Compton Tortoiseshell				S3	4 Secure	10	38.9 ± 0.0	NB
I	*Gomphus vastus*	Cobra Clubtail				S3	3 Sensitive	54	44.3 ± 0.0	NB
I	*Gomphus abbreviatus*	Spine-crowned Clubtail				S3	4 Secure	26	17.9 ± 0.0	NB
I	*Gomphaeschna furcillata*	Harlequin Darner				S3	5 Undetermined	1	99.5 ± 1.0	NB
I	*Dorocordulia lepida*	Petite Emerald				S3	4 Secure	19	34.4 ± 1.0	NB
I	*Somatochlora cingulata*	Lake Emerald				S3	4 Secure	6	30.4 ± 1.0	NB
I	*Somatochlora forcipata*	Forcipate Emerald				S3	4 Secure	5	29.0 ± 1.0	NB
I	*Williamsonia fletcheri*	Ebony Boghaunter				S3	4 Secure	13	59.5 ± 1.0	NB
I	*Lestes eurinus*	Amber-Winged Spreadwing				S3	4 Secure	6	34.4 ± 1.0	NB

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I	*Lestes vigilax*	Swamp Spreadwing				S3	3 Sensitive	16	71.1 ± 0.0	NB
I	*Enallagma geminatum*	Skimming Bluet				S3	5 Undetermined	11	59.0 ± 0.0	NB
I	*Enallagma signatum*	Orange Bluet				S3	4 Secure	6	56.8 ± 0.0	NB
I	*Stylurus scudderi*	Zebra Clubtail				S3	4 Secure	45	3.7 ± 1.0	NB
I	*Leptodea ochracea*	Tidewater Mucket				S3	4 Secure	79	33.5 ± 0.0	NB
I	*Pantala hymenaea*	Spot-Winged Glider				S3B	4 Secure	5	84.0 ± 1.0	NS
I	*Satyrium liparops*	Striped Hairstreak				S3S4	4 Secure	7	57.4 ± 5.0	NB
I	*Satyrium liparops strigosum*	Striped Hairstreak				S3S4	4 Secure	10	53.2 ± 0.0	NB
I	*Cupido comyntas*	Eastern Tailed Blue				S3S4	4 Secure	4	46.9 ± 0.0	NB
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered		Endangered	S1	2 May Be At Risk	1	37.5 ± 1.0	NB
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	SH	1 At Risk	2	56.8 ± 0.0	NS
N	*Peltigera hydrothyria*	Eastern Waterfan	Threatened			S1	5 Undetermined	5	28.3 ± 1.0	NB
N	*Anzia colpodes*	Black-foam Lichen	Threatened			S3	5 Undetermined	2	31.2 ± 1.0	NB
N	*Degelia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Special Concern	S1	2 May Be At Risk	2	56.8 ± 0.0	NS
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S3	5 Undetermined	14	34.9 ± 0.0	NB
N	*Aloina rigida*	Aloe-Like Rigid Screw Moss				S1	2 May Be At Risk	1	68.0 ± 0.0	NB
N	*Anomodon minor*	Blunt-leaved Anomodon Moss				S1	2 May Be At Risk	1	27.8 ± 1.0	NB
N	*Anomodon viticulosus*	a Moss				S1	2 May Be At Risk	6	9.2 ± 0.0	NB
N	*Bartramia ithyphylla*	Straight-leaved Apple Moss				S1	2 May Be At Risk	2	29.9 ± 0.0	NB
N	*Bryum muehlenbeckii*	Muehlenbeck's Bryum Moss				S1	2 May Be At Risk	1	77.8 ± 1.0	NB
N	*Bryum salinum*	a Moss				S1	2 May Be At Risk	1	37.7 ± 1.0	NB
N	*Calliergon trifarium*	Three-ranked Moss				S1	2 May Be At Risk	1	85.6 ± 0.0	NB
N	*Tortula obtusifolia*	a Moss				S1	2 May Be At Risk	1	47.1 ± 0.0	NB
N	*Dichelyma falcatum*	a Moss				S1	2 May Be At Risk	1	80.6 ± 1.0	NB
N	*Dicranoweisia crispula*	Mountain Thatch Moss				S1	2 May Be At Risk	1	36.7 ± 0.0	NB
N	*Dicranum bonjeanii*	Bonjean's Broom Moss				S1	2 May Be At Risk	2	91.9 ± 0.0	NS
N	*Dicranum condensatum*	Condensed Broom Moss				S1	2 May Be At Risk	2	36.5 ± 0.0	NB
N	*Didymodon rigidulus var. gracilis*	a moss				S1	2 May Be At Risk	1	38.4 ± 1.0	NB
N	*Distichium inclinatum*	Inclined Iris Moss				S1	2 May Be At Risk	5	38.4 ± 1.0	NB
N	*Ditrichum pallidum*	Pale Cow-hair Moss				S1	2 May Be At Risk	2	11.9 ± 1.0	NB
N	*Entodon brevisetus*	a Moss				S1	2 May Be At Risk	1	33.3 ± 10.0	NB
N	*Eurhynchium hians*	Light Beaked Moss				S1	2 May Be At Risk	2	12.6 ± 0.0	NB
N	*Homomallium adnatum*	Adnate Hairy-gray Moss				S1	2 May Be At Risk	3	33.3 ± 10.0	NB
N	*Meesia triquetra*	Three-ranked Cold Moss				S1	2 May Be At Risk	1	44.3 ± 100.0	NB
N	*Plagiothecium latebricola*	Alder Silk Moss				S1	2 May Be At Risk	2	37.7 ± 1.0	NB
N	*Rhytidiadelphus loreus*	Lanky Moss				S1	2 May Be At Risk	1	38.4 ± 1.0	NB
N	*Rhytidium rugosum*	Wrinkle-leaved Moss				S1	2 May Be At Risk	2	13.9 ± 0.0	NB
N	*Seligeria recurvata*	a Moss				S1	2 May Be At Risk	3	34.6 ± 1.0	NB
N	*Sphagnum macrophyllum*	Sphagnum				S1	2 May Be At Risk	2	91.3 ± 0.0	NB
N	*Sphagnum strictum*	Atlantic Peat Moss				S1	2 May Be At Risk	3	32.9 ± 0.0	NB
N	*Splachnum pennsylvanicum*	Southern Dung Moss				S1	2 May Be At Risk	1	78.8 ± 1.0	NB
N	*Timmia norvegica*	a moss				S1	2 May Be At Risk	3	23.2 ± 0.0	NB
N	*Tortella humilis*	Small Crisp Moss				S1	2 May Be At Risk	7	23.5 ± 1.0	NB
N	*Syntrichia ruralis*	a Moss				S1	2 May Be At Risk	1	8.3 ± 0.0	NB
N	*Pseudotaxiphyllum distichaceum*	a Moss				S1	2 May Be At Risk	1	72.5 ± 1.0	NB
N	*Hamatocaulis vernicosus*	a Moss				S1	2 May Be At Risk	1	56.9 ± 100.0	NB
N	*Coscinodon cribrosus*	Sieve-Toothed Moss				S1	2 May Be At Risk	1	78.9 ± 0.0	NB

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N	*Bryohaplocladium microphyllum*	Tiny-leaved Haplocladium Moss				S1	2 May Be At Risk	1	99.3 ± 3.0	NS
N	*Cladonia metacorallifera*	Reptilian Pixie-cup Lichen				S1	5 Undetermined	5	29.8 ± 1.0	NB
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S1	2 May Be At Risk	1	56.8 ± 0.0	NS
N	*Coccocarpia palmicola*	Salted Shell Lichen				S1	2 May Be At Risk	1	34.9 ± 1.0	NB
N	*Peltigera malacea*	Veinless Pelt Lichen				S1	5 Undetermined	1	31.8 ± 1.0	NB
N	*Bryoria bicolor*	Electrified Horsehair Lichen				S1	2 May Be At Risk	1	31.8 ± 1.0	NB
N	*Pohlia filum*	a Moss				S1?	5 Undetermined	1	43.9 ± 15.0	NB
N	*Anomobryum filiforme*	a moss				S1?	5 Undetermined	4	38.4 ± 1.0	NB
N	*Andreaea rothii*	a Moss				S1S2	3 Sensitive	5	29.9 ± 0.0	NB
N	*Brachythecium digastrum*	a Moss				S1S2	3 Sensitive	1	57.8 ± 0.0	NB
N	*Bryum pallescens*	Pale Bryum Moss				S1S2	5 Undetermined	3	78.0 ± 1.0	NB
N	*Campylium radicale*	Long-stalked Fine Wet Moss				S1S2	5 Undetermined	1	98.6 ± 3.0	NS
N	*Dichelyma capillaceum*	Hairlike Dichelyma Moss				S1S2	3 Sensitive	1	33.7 ± 3.0	NB
N	*Didymodon ferrugineus*	a moss				S1S2	3 Sensitive	1	53.8 ± 1.0	NB
N	*Anomodon tristis*	a Moss				S1S2	2 May Be At Risk	9	32.0 ± 10.0	NB
N	*Hygrohypnum bestii*	Best's Brook Moss				S1S2	3 Sensitive	5	5.8 ± 0.0	NB
N	*Hygrohypnum montanum*	a Moss				S1S2	3 Sensitive	2	30.9 ± 1.0	NB
N	*Schistostega pennata*	Luminous Moss				S1S2	3 Sensitive	2	33.4 ± 100.0	NB
N	*Seligeria campylopoda*	a Moss				S1S2	3 Sensitive	1	56.9 ± 100.0	NB
N	*Seligeria diversifolia*	a Moss				S1S2	3 Sensitive	2	41.6 ± 0.0	NB
N	*Sphagnum angermanicum*	a Peatmoss				S1S2	3 Sensitive	1	36.8 ± 10.0	NB
N	*Tetrodontium brownianum*	Little Georgia				S1S2	3 Sensitive	7	32.0 ± 10.0	NB
N	*Tortula mucronifolia*	Mucronate Screw Moss				S1S2	3 Sensitive	2	78.7 ± 0.0	NB
N	*Trichodon cylindricus*	Cylindric Hairy-teeth Moss				S1S2	3 Sensitive	3	34.6 ± 10.0	NB
N	*Plagiomnium rostratum*	Long-beaked Leafy Moss				S1S2	3 Sensitive	6	11.4 ± 0.0	NB
N	*Peltigera scabrosa*	Greater Toad Pelt Lichen				S1S2	2 May Be At Risk	4	30.6 ± 1.0	NB
N	*Calypogeia neesiana*	Nees' Pouchwort				S1S3	6 Not Assessed	1	52.5 ± 1.0	NB
N	*Cephaloziella elachista*	Spurred Threadwort				S1S3	6 Not Assessed	1	85.8 ± 5.0	NB
N	*Cephaloziella spinigera*	Spiny Threadwort				S1S3	6 Not Assessed	2	52.2 ± 0.0	NB
N	*Cladopodiella francisci*	Holt's Notchwort				S1S3	6 Not Assessed	4	32.5 ± 1.0	NB
N	*Harpanthus flotovianus*	Great Mountain Flapwort				S1S3	6 Not Assessed	2	23.5 ± 1.0	NB
N	*Hygrobiella laxifolia*	Lax Notchwort				S1S3	6 Not Assessed	1	29.9 ± 1.0	NB
N	*Jungermannia obovata*	Egg Flapwort				S1S3	6 Not Assessed	2	39.1 ± 0.0	NB
N	*Lophozia ascendens*	Small Notchwort				S1S3	6 Not Assessed	2	34.4 ± 1.0	NB
N	*Porella pinnata*	Pinnate Scalewort				S1S3	6 Not Assessed	1	46.7 ± 1.0	NB
N	*Radula tenax*	Tenacious Scalewort				S1S3	6 Not Assessed	1	39.1 ± 0.0	NB
N	*Scapania gymnostomophila*	Narrow-lobed Earwort				S1S3	6 Not Assessed	1	38.3 ± 1.0	NB
N	*Tritomaria scitula*	Mountain Notchwort				S1S3	6 Not Assessed	1	38.4 ± 1.0	NB
N	*Amphidium mougeotii*	a Moss				S2	3 Sensitive	13	29.3 ± 0.0	NB
N	*Bryum uliginosum*	a Moss				S2	3 Sensitive	2	38.1 ± 0.0	NB
N	*Buxbaumia aphylla*	Brown Shield Moss				S2	3 Sensitive	4	98.6 ± 3.0	NS
N	*Campylium polygamum*	a Moss				S2	3 Sensitive	1	27.2 ± 0.0	NB
N	*Cirriphyllum piliferum*	Hair-pointed Moss				S2	3 Sensitive	4	18.7 ± 5.0	NB
N	*Palustriella falcata*	a Moss				S2	3 Sensitive	2	29.1 ± 0.0	NB
N	*Dicranella palustris*	Drooping-Leaved Fork Moss				S2	3 Sensitive	10	24.6 ± 5.0	NB
N	*Hypnum pratense*	Meadow Plait Moss				S2	3 Sensitive	2	82.7 ± 0.0	NB
N	*Isopterygiopsis pulchella*	Neat Silk Moss				S2	3 Sensitive	8	33.2 ± 1.0	NB
N	*Orthotrichum speciosum*	Showy Bristle Moss				S2	4 Secure	1	95.4 ± 1.0	NS

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N	*Physcomitrium immersum*	a Moss				S2	3 Sensitive	1	46.7 ± 1.0	NB
N	*Physcomitrium pyriforme*	Pear-shaped Urn Moss				S2	3 Sensitive	3	11.6 ± 0.0	NB
N	*Platydictya jungermannioides*	False Willow Moss				S2	3 Sensitive	4	25.6 ± 0.0	NB
N	*Pohlia elongata*	Long-necked Nodding Moss				S2	3 Sensitive	10	25.5 ± 0.0	NB
N	*Pohlia proligera*	Cottony Nodding Moss				S2	3 Sensitive	5	38.4 ± 1.0	NB
N	*Racomitrium fasciculare*	a Moss				S2	3 Sensitive	3	29.3 ± 0.0	NB
N	*Racomitrium affine*	a Moss				S2	3 Sensitive	1	31.4 ± 1.0	NB
N	*Saelania glaucescens*	Blue Dew Moss				S2	3 Sensitive	2	36.7 ± 0.0	NB
N	*Scorpidium scorpioides*	Hooked Scorpion Moss				S2	3 Sensitive	4	66.8 ± 0.0	NB
N	*Seligeria calcarea*	Chalk Brittle Moss				S2	3 Sensitive	2	31.2 ± 0.0	NB
N	*Sphagnum centrale*	Central Peat Moss				S2	3 Sensitive	7	25.5 ± 0.0	NB
N	*Sphagnum lindbergii*	Lindberg's Peat Moss				S2	3 Sensitive	5	54.8 ± 5.0	NB
N	*Sphagnum flexuosum*	Flexuous Peatmoss				S2	3 Sensitive	4	30.3 ± 0.0	NB
N	*Taxiphyllum deplanatum*	Imbricate Yew-leaved Moss				S2	3 Sensitive	2	38.6 ± 1.0	NB
N	*Tayloria serrata*	Serrate Trumpet Moss				S2	3 Sensitive	8	28.1 ± 2.0	NB
N	*Thamnobryum alleghaniense*	a Moss				S2	3 Sensitive	7	11.4 ± 0.0	NB
N	*Ulota phyllantha*	a Moss				S2	3 Sensitive	4	38.1 ± 0.0	NB
N	*Zygodon viridissimus*	a Moss				S2	2 May Be At Risk	2	38.6 ± 1.0	NB
N	*Schistidium agassizii*	Elf Bloom Moss				S2	3 Sensitive	3	25.5 ± 1.0	NB
N	*Loeskeobryum brevirostre*	a Moss				S2	3 Sensitive	16	10.8 ± 2.0	NB
N	*Ramalina pollinaria*	Chalky Ramalina Lichen				S2	5 Undetermined	1	39.0 ± 1.0	NB
N	*Umbilicaria vellea*	Grizzled Rocktripe Lichen				S2	5 Undetermined	1	38.1 ± 1.0	NB
N	*Cladonia macrophylla*	Fig-leaved Lichen				S2	5 Undetermined	3	34.9 ± 1.0	NB
N	*Nephroma arcticum*	Arctic Kidney Lichen				S2	3 Sensitive	1	30.6 ± 1.0	NB
N	*Calliergonella cuspidata*	Common Large Wetland Moss				S2S3	3 Sensitive	7	32.9 ± 5.0	NB
N	*Didymodon rigidulus*	Rigid Screw Moss				S2S3	3 Sensitive	8	36.3 ± 2.0	NB
N	*Didymodon fallax*	False Beard Moss				S2S3	3 Sensitive	3	38.4 ± 0.0	NB
N	*Ephemerum serratum*	a Moss				S2S3	3 Sensitive	4	7.2 ± 0.0	NB
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2S3	3 Sensitive	6	29.3 ± 0.0	NB
N	*Nephroma bellum*	Naked Kidney Lichen				S2S3	4 Secure	3	26.2 ± 1.0	NB
N	*Sphaerophorus globosus*	Northern Coral Lichen				S2S3	3 Sensitive	5	31.8 ± 1.0	NB
N	*Cladonia sulphurina*	Greater Sulphur-cup Lichen				S2S3?	5 Undetermined	1	35.6 ± 1.0	NB
N	*Bazzania tricrenata*	Three-toothed Whipwort				S2S4		1	24.4 ± 1.0	NB
N	*Cephaloziella divaricata*	Common Threadwort				S2S4	6 Not Assessed	2	30.3 ± 0.0	NB
N	*Riccia fluitans*	Floating Crystalwort				S2S4	6 Not Assessed	4	46.7 ± 1.0	NB
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3	3 Sensitive	3	88.0 ± 3.0	NS
N	*Aulacomnium androgynum*	Little Groove Moss				S3	4 Secure	7	38.4 ± 1.0	NB
N	*Calliergon giganteum*	Giant Spear Moss				S3	3 Sensitive	1	98.6 ± 3.0	NS
N	*Dicranella cerviculata*	a Moss				S3	3 Sensitive	3	28.1 ± 2.0	NB
N	*Dicranum majus*	Greater Broom Moss				S3	4 Secure	17	30.5 ± 0.0	NB
N	*Encalypta ciliata*	Fringed Extinquisher Moss				S3	3 Sensitive	3	38.3 ± 0.0	NB
N	*Heterocladium dimorphum*	Dimorphous Tangle Moss				S3	4 Secure	4	34.1 ± 0.0	NB
N	*Hypnum curvifolium*	Curved-leaved Plait Moss				S3	3 Sensitive	14	29.3 ± 0.0	NB
N	*Pleuridium subulatum*	a Moss				S3	3 Sensitive	6	7.9 ± 0.0	NB

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N	*Pogonatum dentatum*	Mountain Hair Moss				S3	4 Secure	3	38.1 ± 0.0	NB
N	*Sphagnum torreyanum*	a Peatmoss				S3	4 Secure	4	31.9 ± 0.0	NB
N	*Sphagnum austinii*	Austin's Peat Moss				S3	4 Secure	2	91.5 ± 1.0	NB
N	*Splachnum rubrum*	Red Collar Moss				S3	4 Secure	1	63.2 ± 1.0	NB
N	*Tetraphis geniculata*	Geniculate Four-tooth Moss				S3	4 Secure	13	31.4 ± 1.0	NB
N	*Tortella fragilis*	Fragile Twisted Moss				S3	3 Sensitive	1	38.4 ± 0.0	NB
N	*Weissia controversa*	Green-Cushioned Weissia				S3	4 Secure	1	38.4 ± 1.0	NB
N	*Trichostomum tenuirostre*	Acid-Soil Moss				S3	4 Secure	5	29.3 ± 0.0	NB
N	*Schistidium maritimum*	a Moss				S3	4 Secure	5	38.1 ± 0.0	NB
N	*Hymenostylium recurvirostre*	Hymenostylium Moss				S3	3 Sensitive	4	38.4 ± 1.0	NB
N	*Solorina saccata*	Woodland Owl Lichen				S3	5 Undetermined	6	35.7 ± 1.0	NB
N	*Leptogium lichenoides*	Tattered Jellyskin Lichen				S3	5 Undetermined	6	38.1 ± 1.0	NB
N	*Protopannaria pezizoides*	Brown-gray Moss-shingle Lichen				S3	4 Secure	10	35.7 ± 1.0	NB
N	*Usnea strigosa*	Bushy Beard Lichen				S3	5 Undetermined	1	40.1 ± 1.0	NB
N	*Leptogium laceroides*	Short-bearded Jellyskin Lichen				S3	3 Sensitive	2	31.2 ± 1.0	NB
N	*Peltigera membranacea*	Membranous Pelt Lichen				S3	5 Undetermined	6	35.7 ± 1.0	NB
N	*Dicranella rufescens*	Red Forklet Moss				S3?	5 Undetermined	2	38.4 ± 0.0	NB
N	*Sphagnum contortum*	Twisted Peat Moss				S3?	4 Secure	1	66.7 ± 0.0	NB
N	*Sphagnum lescurii*	a Peatmoss				S3?	5 Undetermined	4	25.2 ± 0.0	NB
N	*Cladonia farinacea*	Farinose Pixie Lichen				S3?	5 Undetermined	5	35.8 ± 1.0	NB
N	*Cladonia carneola*	Crowned Pixie-cup Lichen				S3?	5 Undetermined	1	35.8 ± 1.0	NB
N	*Dermatocarpon luridum*	Brookside Stippleback Lichen				S3?S4?	4 Secure	5	28.3 ± 1.0	NB
N	*Atrichum tenellum*	Slender Smoothcap Moss				S3S4	4 Secure	2	46.9 ± 2.0	NB
N	*Barbula convoluta*	Lesser Bird's-claw Beard Moss				S3S4	4 Secure	1	63.3 ± 15.0	NB
N	*Blindia acuta*	a Moss				S3S4	4 Secure	17	29.3 ± 0.0	NB
N	*Brachythecium campestre*	Field Ragged Moss				S3S4	4 Secure	1	38.6 ± 1.0	NB
N	*Brachythecium velutinum*	Velvet Ragged Moss				S3S4	4 Secure	7	25.5 ± 1.0	NB
N	*Dicranella subulata*	Awl-leaved Forklet Moss				S3S4	4 Secure	5	34.0 ± 3.0	NB
N	*Dicranella varia*	a Moss				S3S4	4 Secure	1	82.9 ± 3.0	NS
N	*Dicranum leioneuron*	a Dicranum Moss				S3S4	4 Secure	2	30.6 ± 0.0	NB
N	*Distichium capillaceum*	Erect-fruited Iris Moss				S3S4	4 Secure	13	29.3 ± 0.0	NB
N	*Fissidens bryoides*	Lesser Pocket Moss				S3S4	4 Secure	5	39.7 ± 0.0	NB
N	*Hypnum fauriei*	a Moss				S3S4	4 Secure	6	28.1 ± 2.0	NB
N	*Isopterygiopsis muelleriana*	a Moss				S3S4	4 Secure	18	31.3 ± 0.0	NB
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	4 Secure	2	38.1 ± 0.0	NB
N	*Pohlia annotina*	a Moss				S3S4	4 Secure	8	31.9 ± 2.0	NB
N	*Pohlia andalusica*	a Moss				S3S4	4 Secure	1	38.3 ± 0.0	NB
N	*Tortula truncata*	a Moss				S3S4	4 Secure	4	7.9 ± 0.0	NB
N	*Racomitrium canescens*	Grey Rock Moss				S3S4	4 Secure	2	30.4 ± 0.0	NB
N	*Sphagnum majus*	Olive Peat Moss				S3S4	4 Secure	1	72.5 ± 5.0	NB
N	*Sphagnum quinquefarium*	Five-ranked Peat Moss				S3S4	4 Secure	1	30.7 ± 0.0	NB
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S3S4	4 Secure	1	57.2 ± 0.0	NS
N	*Abietinella abietina*	Wiry Fern Moss				S3S4	4 Secure	1	38.4 ± 0.0	NB
N	*Hylocomiastrum pyrenaicum*	a Feather Moss				S3S4	4 Secure	1	96.0 ± 3.0	NS
N	*Pannaria rubiginosa*	Brown-eyed Shingle Lichen				S3S4	3 Sensitive	2	37.1 ± 1.0	NB

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N	*Ramalina thrausta*	Angelhair Ramalina Lichen				S3S4	5 Undetermined	11	29.8 ± 1.0	NB
N	*Melanelia panniformis*	Shingled Camouflage Lichen				S3S4	5 Undetermined	4	31.8 ± 1.0	NB
N	*Nephroma parile*	Powdery Kidney Lichen				S3S4	4 Secure	6	33.7 ± 1.0	NB
N	*Peltigera degenii*	Lustrous Pelt Lichen				S3S4	5 Undetermined	3	28.3 ± 1.0	NB
N	*Pseudocyphellaria perpetua*	Gilded Specklebelly Lichen				S3S4	3 Sensitive	2	34.7 ± 1.0	NB
N	*Stereocaulon paschale*	Easter Foam Lichen				S3S4	5 Undetermined	1	84.4 ± 1.0	NB
N	*Stereocaulon subcoralloides*	Coralloid Foam Lichen				S3S4	5 Undetermined	1	39.0 ± 1.0	NB
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	3 Sensitive	3	31.2 ± 1.0	NB
N	*Peltigera neopolydactyla*	Undulating Pelt Lichen				S3S4	5 Undetermined	8	28.3 ± 1.0	NB
N	*Cladonia cariosa*	Lesser Ribbed Pixie Lichen				S3S4	4 Secure	3	39.0 ± 1.0	NB
N	*Cladonia floerkeana*	Gritty British Soldiers Lichen				S3S4?	4 Secure	3	25.2 ± 1.0	NB
N	*Phaeophyscia sciastra*	Dark Shadow Lichen				S3S4?	5 Undetermined	2	38.1 ± 1.0	NB
N	*Cladonia deformis*	Lesser Sulphur-cup Lichen				S3S4?	4 Secure	5	29.8 ± 1.0	NB
N	*Grimmia anodon*	Toothless Grimmia Moss				SH	5 Undetermined	2	76.3 ± 10.0	NB
N	*Leucodon brachypus*	a Moss				SH	2 May Be At Risk	8	30.5 ± 0.0	NB
N	*Splachnum luteum*	Yellow Collar Moss				SH	5 Undetermined	1	99.8 ± 100.0	NB
N	*Thelia hirtella*	a Moss				SH	2 May Be At Risk	1	44.3 ± 100.0	NB
N	*Cyrto-hypnum minutulum*	Tiny Cedar Moss				SH	2 May Be At Risk	3	34.0 ± 10.0	NB
P	*Juglans cinerea*	Butternut	Endangered	Endangered	Endangered	S1	1 At Risk	32	9.2 ± 1.0	NB
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Endangered	S2	1 At Risk	5	76.7 ± 0.0	NB
P	*Lechea maritima var. subcylindrica*	Beach Pinweed	Special Concern			S2	3 Sensitive	4	97.6 ± 0.0	NB
P	*Cryptotaenia canadensis*	Canada Honewort				S1	2 May Be At Risk	1	11.0 ± 1.0	NB
P	*Sanicula trifoliata*	Large-Fruited Sanicle				S1	2 May Be At Risk	1	43.3 ± 5.0	NB
P	*Antennaria parlinii*	a Pussytoes				S1	2 May Be At Risk	5	48.6 ± 1.0	NB
P	*Antennaria howellii ssp. petaloidea*	Pussy-Toes				S1	2 May Be At Risk	2	78.5 ± 5.0	NB
P	*Bidens discoidea*	Swamp Beggarticks				S1	2 May Be At Risk	3	69.8 ± 0.0	NB
P	*Pseudognaphalium obtusifolium*	Eastern Cudweed				S1	2 May Be At Risk	8	51.5 ± 1.0	NB
P	*Hieracium kalmii var. kalmii*	Kalm's Hawkweed				S1	2 May Be At Risk	1	99.9 ± 1.0	NB
P	*Hieracium paniculatum*	Panicled Hawkweed				S1	2 May Be At Risk	2	40.0 ± 0.0	NB
P	*Hieracium robinsonii*	Robinson's Hawkweed				S1	3 Sensitive	5	29.1 ± 0.0	NB
P	*Solidago multiradiata*	Multi-rayed Goldenrod				S1	2 May Be At Risk	10	54.1 ± 0.0	NB
P	*Cardamine parviflora var. arenicola*	Small-flowered Bittercress				S1	2 May Be At Risk	10	54.4 ± 0.0	NB
P	*Draba arabisans*	Rock Whitlow-Grass				S1	2 May Be At Risk	25	34.8 ± 0.0	NB
P	*Draba glabella*	Rock Whitlow-Grass				S1	2 May Be At Risk	14	38.4 ± 0.0	NB
P	*Minuartia groenlandica*	Greenland Stitchwort				S1	2 May Be At Risk	1	89.3 ± 0.0	NB
P	*Stellaria crassifolia*	Fleshy Stitchwort				S1	2 May Be At Risk	2	83.6 ± 5.0	NB
P	*Chenopodium capitatum*	Strawberry-blite				S1	2 May Be At Risk	3	36.0 ± 1.0	NB
P	*Chenopodium simplex*	Maple-leaved Goosefoot				S1	2 May Be At Risk	6	10.1 ± 1.0	NB
P	*Suaeda rolandii*	Roland's Sea-Blite				S1	3 Sensitive	3	60.5 ± 0.0	NB
P	*Triadenum virginicum*	Virginia St John's-wort				S1	2 May Be At Risk	2	72.7 ± 0.0	NB
P	*Cuscuta pentagona*	Five-angled Dodder				S1	2 May Be At Risk	3	51.0 ± 5.0	NB
P	*Corema conradii*	Broom Crowberry				S1	2 May Be At Risk	2	78.6 ± 10.0	NB
P	*Vaccinium boreale*	Northern Blueberry				S1	2 May Be At Risk	4	54.1 ± 0.0	NS
P	*Desmodium glutinosum*	Large Tick-Trefoil				S1	2 May Be At Risk	1	91.8 ± 7.0	NS
P	*Lespedeza capitata*	Round-headed Bush-clover				S1	2 May Be At Risk	5	50.7 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Proserpinaca pectinata*	Comb-leaved Mermaidweed				S1	2 May Be At Risk	2	86.9 ± 5.0	NS
P	*Pycnanthemum virginianum*	Virginia Mountain Mint				S1	2 May Be At Risk	4	48.6 ± 0.0	NB
P	*Lysimachia quadrifolia*	Whorled Yellow Loosestrife				S1	2 May Be At Risk	14	38.5 ± 0.0	NB
P	*Primula laurentiana*	Laurentian Primrose				S1	2 May Be At Risk	35	38.1 ± 0.0	NB
P	*Ranunculus sceleratus*	Cursed Buttercup				S1	2 May Be At Risk	4	83.3 ± 0.0	NB
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S1	2 May Be At Risk	1	47.2 ± 1.0	NB
P	*Crataegus jonesiae*	Jones' Hawthorn				S1	2 May Be At Risk	3	64.4 ± 1.0	NB
P	*Dryas integrifolia*	Entire-leaved Mountain Avens				S1	2 May Be At Risk	11	57.1 ± 1.0	NB
P	*Potentilla canadensis*	Canada Cinquefoil				S1	5 Undetermined	1	58.5 ± 0.0	NB
P	*Waldsteinia fragarioides*	Barren Strawberry				S1	2 May Be At Risk	1	79.8 ± 1.0	NB
P	*Salix myrtillifolia*	Blueberry Willow				S1	2 May Be At Risk	24	56.3 ± 0.0	NB
P	*Saxifraga paniculata ssp. neogaea*	White Mountain Saxifrage				S1	2 May Be At Risk	27	13.7 ± 1.0	NB
P	*Agalinis paupercula var. borealis*	Small-flowered Agalinis				S1	2 May Be At Risk	4	54.7 ± 1.0	NB
P	*Agalinis tenuifolia*	Slender Agalinis				S1	2 May Be At Risk	6	93.7 ± 0.0	NB
P	*Gratiola aurea*	Golden Hedge-Hyssop				S1	3 Sensitive	2	89.4 ± 0.0	NB
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S1	2 May Be At Risk	13	92.5 ± 0.0	NS
P	*Alisma subcordatum*	Southern Water Plantain				S1	5 Undetermined	2	47.9 ± 0.0	NB
P	*Carex annectens*	Yellow-Fruited Sedge				S1	2 May Be At Risk	2	89.8 ± 0.0	NB
P	*Carex atlantica ssp. atlantica*	Atlantic Sedge				S1	2 May Be At Risk	6	31.5 ± 0.0	NB
P	*Carex backii*	Rocky Mountain Sedge				S1	2 May Be At Risk	3	9.1 ± 0.0	NB
P	*Carex comosa*	Bearded Sedge				S1	2 May Be At Risk	9	66.6 ± 1.0	NS
P	*Carex merritt-fernaldii*	Merritt Fernald's Sedge				S1	2 May Be At Risk	1	29.9 ± 0.0	NB
P	*Carex saxatilis*	Russet Sedge				S1	2 May Be At Risk	13	56.1 ± 10.0	NB
P	*Carex sterilis*	Sterile Sedge				S1	2 May Be At Risk	1	29.5 ± 2.0	NB
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	2 May Be At Risk	9	12.2 ± 5.0	NB
P	*Cyperus diandrus*	Low Flatsedge				S1	2 May Be At Risk	4	95.0 ± 1.0	NB
P	*Cyperus lupulinus*	Hop Flatsedge				S1	2 May Be At Risk	5	57.7 ± 0.0	NB
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S1	2 May Be At Risk	16	55.2 ± 0.0	NB
P	*Scirpus pendulus*	Hanging Bulrush				S1	2 May Be At Risk	5	23.3 ± 0.0	NB
P	*Sisyrinchium angustifolium*	Narrow-leaved Blue-eyed-grass				S1	2 May Be At Risk	6	79.0 ± 1.0	NB
P	*Juncus greenei*	Greene's Rush				S1	2 May Be At Risk	2	86.0 ± 0.0	NB
P	*Juncus stygius ssp. americanus*	Moor Rush				S1	2 May Be At Risk	14	89.0 ± 10.0	NB
P	*Juncus subtilis*	Creeping Rush				S1	2 May Be At Risk	1	56.8 ± 5.0	NB
P	*Allium canadense*	Canada Garlic				S1	2 May Be At Risk	1	48.7 ± 0.0	NB
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S1	2 May Be At Risk	5	4.9 ± 0.0	NB
P	*Malaxis brachypoda*	White Adder's-Mouth				S1	2 May Be At Risk	2	65.5 ± 0.0	NS
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S1	2 May Be At Risk	10	88.1 ± 10.0	NB
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S1	2 May Be At Risk	2	14.3 ± 1.0	NB
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S1	2 May Be At Risk	6	54.0 ± 0.0	NS
P	*Bromus pubescens*	Hairy Wood Brome Grass				S1	5 Undetermined	6	62.6 ± 0.0	NB
P	*Calamagrostis stricta ssp. inexpansa*	Slim-stemmed Reed Grass				S1	2 May Be At Risk	1	91.0 ± 1.0	NB
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1	2 May Be At Risk	5	39.5 ± 1.0	NB
P	*Danthonia compressa*	Flattened Oat Grass				S1	2 May Be At Risk	7	8.9 ± 1.0	NB
P	*Dichanthelium dichotomum*	Forked Panic Grass				S1	2 May Be At Risk	1	54.5 ± 1.0	NB

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P	*Festuca subverticillata*	Nodding Fescue				S1	2 May Be At Risk	7	61.1 ± 1.0	NS
P	*Potamogeton friesii*	Fries' Pondweed				S1	2 May Be At Risk	5	79.9 ± 5.0	NB
P	*Potamogeton nodosus*	Long-leaved Pondweed				S1	2 May Be At Risk	4	80.8 ± 5.0	NB
P	*Potamogeton strictifolius*	Straight-leaved Pondweed				S1	2 May Be At Risk	2	42.5 ± 2.0	NB
P	*Xyris difformis*	Bog Yellow-eyed-grass				S1	5 Undetermined	3	72.8 ± 0.0	NB
P	*Asplenium ruta-muraria var. cryptolepis*	Wallrue Spleenwort				S1	2 May Be At Risk	3	64.4 ± 0.0	NB
P	*Cystopteris laurentiana*	Laurentian Bladder Fern				S1	2 May Be At Risk	1	14.4 ± 1.0	NB
P	*Dryopteris filix-mas*	Male Fern				S1	2 May Be At Risk	2	41.7 ± 1.0	NB
P	*Botrychium oneidense*	Blunt-lobed Moonwort				S1	2 May Be At Risk	4	76.8 ± 5.0	NB
P	*Schizaea pusilla*	Little Curlygrass Fern				S1	2 May Be At Risk	18	30.9 ± 0.0	NB
P	*Hieracium kalmii var. fasciculatum*	Kalm's Hawkweed				S1?	5 Undetermined	1	97.9 ± 1.0	NB
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S1?	2 May Be At Risk	5	65.4 ± 0.0	NB
P	*Carex laxiflora*	Loose-Flowered Sedge				S1?	5 Undetermined	2	65.3 ± 7.0	NS
P	*Wolffia columbiana*	Columbian Watermeal				S1?	2 May Be At Risk	5	74.4 ± 0.0	NB
P	*Humulus lupulus var. lupuloides*	Common Hop				S1S2	3 Sensitive	2	92.3 ± 1.0	NB
P	*Carex rostrata*	Narrow-leaved Beaked Sedge				S1S2	3 Sensitive	1	23.4 ± 0.0	NB
P	*Potamogeton bicupulatus*	Snailseed Pondweed				S1S2	2 May Be At Risk	2	90.9 ± 0.0	NB
P	*Selaginella rupestris*	Rock Spikemoss				S1S2	2 May Be At Risk	7	8.9 ± 1.0	NB
P	*Thelypteris simulata*	Bog Fern				S1S2	2 May Be At Risk	7	56.1 ± 0.0	NB
P	*Listera australis*	Southern Twayblade			Endangered	S2	1 At Risk	14	69.3 ± 0.0	NB
P	*Sanicula odorata*	Clustered Sanicle				S2	2 May Be At Risk	4	98.2 ± 2.0	NS
P	*Pseudognaphalium macounii*	Macoun's Cudweed				S2	3 Sensitive	4	25.0 ± 5.0	NB
P	*Solidago altissima*	Tall Goldenrod				S2	4 Secure	3	54.3 ± 1.0	NB
P	*Symphyotrichum racemosum*	Small White Aster				S2	3 Sensitive	7	42.5 ± 5.0	NB
P	*Impatiens pallida*	Pale Jewelweed				S2	2 May Be At Risk	5	56.5 ± 0.0	NS
P	*Alnus serrulata*	Smooth Alder				S2	3 Sensitive	8	57.5 ± 0.0	NB
P	*Arabis drummondii*	Drummond's Rockcress				S2	3 Sensitive	18	10.1 ± 0.0	NB
P	*Barbarea orthoceras*	American Yellow Rocket				S2	3 Sensitive	4	13.7 ± 1.0	NB
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S2	3 Sensitive	1	96.9 ± 0.0	NB
P	*Stellaria longifolia*	Long-leaved Starwort				S2	3 Sensitive	7	28.3 ± 1.0	NB
P	*Atriplex franktonii*	Frankton's Saltbush				S2	4 Secure	4	48.3 ± 1.0	NB
P	*Chenopodium rubrum*	Red Pigweed				S2	3 Sensitive	5	76.1 ± 1.0	NB
P	*Callitriche hermaphroditica*	Northern Water-starwort				S2	4 Secure	9	27.8 ± 0.0	NB
P	*Hypericum dissimulatum*	Disguised St John's-wort				S2	3 Sensitive	2	64.7 ± 1.0	NB
P	*Lonicera oblongifolia*	Swamp Fly Honeysuckle				S2	3 Sensitive	1	93.2 ± 6.0	NB
P	*Shepherdia canadensis*	Soapberry				S2	3 Sensitive	5	57.2 ± 0.0	NB
P	*Astragalus eucosmus*	Elegant Milk-vetch				S2	2 May Be At Risk	3	53.7 ± 0.0	NB
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S2	3 Sensitive	14	54.2 ± 0.0	NB
P	*Quercus macrocarpa*	Bur Oak				S2	2 May Be At Risk	39	34.9 ± 1.0	NB
P	*Gentiana linearis*	Narrow-Leaved Gentian				S2	3 Sensitive	4	84.3 ± 50.0	NB
P	*Myriophyllum humile*	Low Water Milfoil				S2	3 Sensitive	5	24.5 ± 1.0	NB
P	*Hedeoma pulegioides*	American False Pennyroyal				S2	4 Secure	12	9.1 ± 0.0	NB
P	*Nuphar lutea ssp. rubrodisca*	Red-disked Yellow Pond-lily				S2	3 Sensitive	13	55.7 ± 0.0	NB
P	*Orobanche uniflora*	One-Flowered Broomrape				S2	3 Sensitive	8	53.1 ± 1.0	NB

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P	*Polygala paucifolia*	Fringed Milkwort				S2	3 Sensitive	9	29.4 ± 0.0	NB
P	*Polygala sanguinea*	Blood Milkwort				S2	3 Sensitive	20	36.8 ± 5.0	NB
P	*Polygonum amphibium var. emersum*	Water Smartweed				S2	3 Sensitive	20	44.7 ± 0.0	NB
P	*Polygonum careyi*	Carey's Smartweed				S2	3 Sensitive	13	50.3 ± 1.0	NB
P	*Podostemum ceratophyllum*	Horn-leaved Riverweed				S2	3 Sensitive	7	95.5 ± 0.0	NB
P	*Anemone parviflora*	Small-flowered Anemone				S2	3 Sensitive	8	57.1 ± 5.0	NB
P	*Hepatica nobilis var. obtusa*	Round-lobed Hepatica				S2	3 Sensitive	5	28.7 ± 1.0	NB
P	*Ranunculus flabellaris*	Yellow Water Buttercup				S2	4 Secure	14	54.4 ± 0.0	NB
P	*Crataegus scabrida*	Rough Hawthorn				S2	3 Sensitive	9	5.9 ± 1.0	NB
P	*Sanguisorba canadensis*	Canada Burnet				S2	4 Secure	15	34.9 ± 0.0	NB
P	*Cephalanthus occidentalis*	Common Buttonbush				S2	3 Sensitive	19	57.4 ± 0.0	NB
P	*Agalinis neoscotica*	Nova Scotia Agalinis				S2	3 Sensitive	2	95.3 ± 3.0	NS
P	*Euphrasia randii*	Rand's Eyebright				S2	2 May Be At Risk	4	35.1 ± 0.0	NB
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S2	3 Sensitive	6	8.9 ± 1.0	NB
P	*Dirca palustris*	Eastern Leatherwood				S2	2 May Be At Risk	1	58.4 ± 1.0	NB
P	*Viola novae-angliae*	New England Violet				S2	3 Sensitive	3	54.8 ± 0.0	NB
P	*Sagittaria calycina var. spongiosa*	Long-lobed Arrowhead				S2	4 Secure	27	84.1 ± 0.0	NB
P	*Symplocarpus foetidus*	Eastern Skunk Cabbage				S2	3 Sensitive	110	50.1 ± 5.0	NB
P	*Carex granularis*	Limestone Meadow Sedge				S2	3 Sensitive	4	11.2 ± 5.0	NB
P	*Carex gynocrates*	Northern Bog Sedge				S2	3 Sensitive	1	8.9 ± 1.0	NB
P	*Carex hirtifolia*	Pubescent Sedge				S2	3 Sensitive	4	24.4 ± 5.0	NB
P	*Carex livida var. radicaulis*	Livid Sedge				S2	3 Sensitive	5	78.9 ± 2.0	NB
P	*Carex prairea*	Prairie Sedge				S2	3 Sensitive	2	97.5 ± 1.0	NS
P	*Carex salina*	Saltmarsh Sedge				S2	3 Sensitive	2	80.2 ± 1.0	NB
P	*Carex sprengelii*	Longbeak Sedge				S2	3 Sensitive	2	15.6 ± 0.0	NB
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S2	2 May Be At Risk	1	21.8 ± 10.0	NB
P	*Carex albicans var. emmonsii*	White-tinged Sedge				S2	3 Sensitive	10	39.0 ± 0.0	NB
P	*Carex vacillans*	Estuarine Sedge				S2	3 Sensitive	1	86.4 ± 0.0	NB
P	*Cyperus squarrosus*	Awned Flatsedge				S2	3 Sensitive	29	41.2 ± 1.0	NB
P	*Eriophorum gracile*	Slender Cottongrass				S2	2 May Be At Risk	26	66.8 ± 0.0	NB
P	*Elodea nuttallii*	Nuttall's Waterweed				S2	3 Sensitive	6	55.6 ± 0.0	NB
P	*Juncus vaseyi*	Vasey Rush				S2	3 Sensitive	7	23.0 ± 0.0	NB
P	*Lemna trisulca*	Star Duckweed				S2	4 Secure	26	21.2 ± 1.0	NB
P	*Allium tricoccum*	Wild Leek				S2	2 May Be At Risk	21	7.0 ± 1.0	NB
P	*Najas gracillima*	Thread-Like Naiad				S2	3 Sensitive	3	68.5 ± 0.0	NB
P	*Calypso bulbosa var. americana*	Calypso				S2	2 May Be At Risk	7	24.2 ± 5.0	NB
P	*Coeloglossum viride var. virescens*	Long-bracted Frog Orchid				S2	2 May Be At Risk	6	24.3 ± 0.0	NB
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	2 May Be At Risk	5	54.7 ± 1.0	NB
P	*Spiranthes cernua*	Nodding Ladies'-Tresses				S2	3 Sensitive	13	55.6 ± 1.0	NB
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	3 Sensitive	10	24.3 ± 1.0	NB
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S2	3 Sensitive	5	20.0 ± 0.0	NB
P	*Elymus canadensis*	Canada Wild Rye				S2	2 May Be At Risk	3	52.0 ± 1.0	NB
P	*Leersia virginica*	White Cut Grass				S2	2 May Be At Risk	35	54.3 ± 0.0	NB

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P	*Piptatherum canadense*	Canada Rice Grass				S2	3 Sensitive	4	24.5 ± 10.0	NB
P	*Puccinellia phryganodes*	Creeping Alkali Grass				S2	3 Sensitive	2	49.7 ± 0.0	NB
P	*Schizachyrium scoparium*	Little Bluestem				S2	3 Sensitive	27	48.8 ± 0.0	NB
P	*Zizania aquatica var. aquatica*	Indian Wild Rice				S2	5 Undetermined	5	36.1 ± 1.0	NB
P	*Piptatherum pungens*	Slender Rice Grass				S2	2 May Be At Risk	4	30.5 ± 0.0	NB
P	*Stuckenia filiformis ssp. alpina*	Thread-leaved Pondweed				S2	3 Sensitive	8	64.1 ± 0.0	NB
P	*Potamogeton richardsonii*	Richardson's Pondweed				S2	3 Sensitive	19	42.0 ± 0.0	NB
P	*Potamogeton vaseyi*	Vasey's Pondweed				S2	3 Sensitive	2	79.9 ± 1.0	NB
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S2	3 Sensitive	17	30.2 ± 1.0	NB
P	*Woodwardia virginica*	Virginia Chain Fern				S2	3 Sensitive	3	97.4 ± 0.0	NS
P	*Woodsia alpina*	Alpine Cliff Fern				S2	3 Sensitive	7	31.9 ± 0.0	NB
P	*Lycopodium sitchense*	Sitka Clubmoss				S2	3 Sensitive	4	53.0 ± 5.0	NB
P	*Selaginella selaginoides*	Low Spikemoss				S2	3 Sensitive	9	28.1 ± 5.0	NB
P	*Toxicodendron radicans*	Poison Ivy				S2?	3 Sensitive	12	38.2 ± 0.0	NB
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2?	3 Sensitive	9	82.8 ± 1.0	NS
P	*Symphyotrichum novi-belgii var. crenifolium*	New York Aster				S2?	5 Undetermined	4	39.5 ± 0.0	NB
P	*Proserpinaca palustris var. crebra*	Marsh Mermaidweed				S2?	3 Sensitive	3	51.3 ± 0.0	NB
P	*Epilobium coloratum*	Purple-veined Willowherb				S2?	3 Sensitive	3	76.2 ± 1.0	NB
P	*Rubus pensilvanicus*	Pennsylvania Blackberry				S2?	4 Secure	18	5.2 ± 1.0	NB
P	*Rubus recurvicaulis*	Arching Dewberry				S2?	4 Secure	7	28.6 ± 1.0	NB
P	*Galium obtusum*	Blunt-leaved Bedstraw				S2?	4 Secure	6	39.4 ± 1.0	NB
P	*Salix myricoides*	Bayberry Willow				S2?	3 Sensitive	2	57.2 ± 1.0	NB
P	*Platanthera huronensis*	Fragrant Green Orchid				S2?	5 Undetermined	1	61.8 ± 10.0	NS
P	*Eragrostis pectinacea*	Tufted Love Grass				S2?	4 Secure	13	25.9 ± 0.0	NB
P	*Ceratophyllum echinatum*	Prickly Hornwort				S2S3	3 Sensitive	29	42.5 ± 2.0	NB
P	*Elatine americana*	American Waterwort				S2S3	3 Sensitive	12	42.5 ± 2.0	NB
P	*Bartonia paniculata*	Branched Bartonia				S2S3	3 Sensitive	2	81.0 ± 0.0	NS
P	*Bartonia paniculata ssp. iodandra*	Branched Bartonia				S2S3	3 Sensitive	29	28.1 ± 0.0	NB
P	*Geranium robertianum*	Herb Robert				S2S3	4 Secure	32	28.6 ± 1.0	NB
P	*Myriophyllum quitense*	Andean Water Milfoil				S2S3	4 Secure	71	42.5 ± 0.0	NB
P	*Rumex pallidus*	Seabeach Dock				S2S3	3 Sensitive	4	56.9 ± 1.0	NB
P	*Galium labradoricum*	Labrador Bedstraw				S2S3	3 Sensitive	2	34.8 ± 0.0	NB
P	*Carex adusta*	Lesser Brown Sedge				S2S3	4 Secure	10	37.7 ± 0.0	NB
P	*Corallorhiza maculata var. occidentalis*	Spotted Coralroot				S2S3	3 Sensitive	6	12.4 ± 1.0	NB
P	*Corallorhiza maculata var. maculata*	Spotted Coralroot				S2S3	3 Sensitive	1	98.8 ± 1.0	NB
P	*Listera auriculata*	Auricled Twayblade				S2S3	3 Sensitive	2	29.4 ± 0.0	NB
P	*Potamogeton praelongus*	White-stemmed Pondweed				S2S3	4 Secure	13	45.8 ± 0.0	NB
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3 Sensitive	8	9.3 ± 5.0	NB
P	*Panax trifolius*	Dwarf Ginseng				S3	3 Sensitive	18	25.3 ± 0.0	NB
P	*Artemisia campestris*	Field Wormwood				S3	4 Secure	4	35.1 ± 0.0	NB
P	*Artemisia campestris ssp. caudata*	Field Wormwood				S3	4 Secure	74	35.0 ± 10.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Bidens hyperborea*	Estuary Beggarticks				S3	4 Secure	9	78.1 ± 0.0	NB
P	*Bidens hyperborea var. hyperborea*	Estuary Beggarticks				S3	4 Secure	2	77.6 ± 1.0	NB
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	4 Secure	41	23.0 ± 0.0	NB
P	*Prenanthes racemosa*	Glaucous Rattlesnakeroot				S3	4 Secure	49	39.1 ± 0.0	NB
P	*Tanacetum bipinnatum ssp. huronense*	Lake Huron Tansy				S3	4 Secure	10	46.8 ± 10.0	NB
P	*Symphyotrichum boreale*	Boreal Aster				S3	3 Sensitive	4	35.0 ± 0.0	NB
P	*Betula pumila*	Bog Birch				S3	4 Secure	18	52.2 ± 0.0	NB
P	*Arabis glabra*	Tower Mustard				S3	5 Undetermined	1	35.1 ± 0.0	NB
P	*Arabis hirsuta var. pycnocarpa*	Western Hairy Rockcress				S3	4 Secure	18	10.2 ± 0.0	NB
P	*Cardamine maxima*	Large Toothwort				S3	4 Secure	24	35.1 ± 0.0	NB
P	*Subularia aquatica var. americana*	Water Awlwort				S3	4 Secure	5	23.0 ± 0.0	NB
P	*Lobelia cardinalis*	Cardinal Flower				S3	4 Secure	4	95.8 ± 0.0	NB
P	*Stellaria humifusa*	Saltmarsh Starwort				S3	4 Secure	16	33.9 ± 0.0	NB
P	*Hudsonia tomentosa*	Woolly Beach-heath				S3	4 Secure	21	89.1 ± 50.0	NB
P	*Cornus amomum ssp. obliqua*	Pale Dogwood				S3	3 Sensitive	57	45.6 ± 0.0	NB
P	*Crassula aquatica*	Water Pygmyweed				S3	4 Secure	5	54.5 ± 0.0	NB
P	*Rhodiola rosea*	Roseroot				S3	4 Secure	34	29.1 ± 0.0	NB
P	*Penthorum sedoides*	Ditch Stonecrop				S3	4 Secure	39	28.2 ± 1.0	NB
P	*Elatine minima*	Small Waterwort				S3	4 Secure	8	23.4 ± 0.0	NB
P	*Hedysarum alpinum*	Alpine Sweet-vetch				S3	4 Secure	2	53.6 ± 0.0	NB
P	*Gentianella amarella ssp. acuta*	Northern Gentian				S3	4 Secure	3	78.4 ± 0.0	NB
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	4 Secure	16	11.6 ± 5.0	NB
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S3	4 Secure	12	24.1 ± 0.0	NB
P	*Myriophyllum heterophyllum*	Variable-leaved Water Milfoil				S3	4 Secure	49	39.4 ± 0.0	NB
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S3	4 Secure	28	28.4 ± 0.0	NB
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3	4 Secure	27	35.5 ± 0.0	NB
P	*Stachys tenuifolia*	Smooth Hedge-Nettle				S3	3 Sensitive	4	52.5 ± 0.0	NB
P	*Teucrium canadense*	Canada Germander				S3	3 Sensitive	18	83.1 ± 0.0	NB
P	*Utricularia radiata*	Little Floating Bladderwort				S3	4 Secure	16	84.9 ± 0.0	NB
P	*Nuphar lutea ssp. pumila*	Small Yellow Pond-lily				S3	4 Secure	18	55.3 ± 0.0	NB
P	*Epilobium hornemannii*	Hornemann's Willowherb				S3	4 Secure	3	32.5 ± 1.0	NB
P	*Epilobium hornemannii ssp. hornemannii*	Hornemann's Willowherb				S3	4 Secure	1	31.5 ± 0.0	NB
P	*Epilobium strictum*	Downy Willowherb				S3	4 Secure	18	39.1 ± 5.0	NB
P	*Polygonum arifolium*	Halberd-leaved Tearthumb				S3	4 Secure	34	14.4 ± 1.0	NB
P	*Polygonum punctatum*	Dotted Smartweed				S3	4 Secure	4	69.0 ± 0.0	NB
P	*Polygonum punctatum var. confertiflorum*	Dotted Smartweed				S3	4 Secure	7	70.5 ± 1.0	NB
P	*Polygonum scandens*	Climbing False Buckwheat				S3	4 Secure	25	28.6 ± 5.0	NB
P	*Littorella uniflora*	American Shoreweed				S3	4 Secure	7	41.6 ± 1.0	NB
P	*Primula mistassinica*	Mistassini Primrose				S3	4 Secure	10	53.2 ± 0.0	NB
P	*Samolus valerandi ssp. parviflorus*	Seaside Brookweed				S3	4 Secure	30	79.4 ± 0.0	NB
P	*Pyrola minor*	Lesser Pyrola				S3	4 Secure	5	32.5 ± 1.0	NB
P	*Clematis occidentalis*	Purple Clematis				S3	4 Secure	11	13.5 ± 0.0	NB
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	4 Secure	26	22.1 ± 10.0	NB
P	*Thalictrum venulosum*	Northern Meadow-rue				S3	4 Secure	68	42.7 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	*Agrimonia gryposepala*	Hooked Agrimony				S3	4 Secure	10	44.3 ± 0.0	NB
P	*Amelanchier canadensis*	Canada Serviceberry				S3	4 Secure	17	9.3 ± 1.0	NB
P	*Rosa palustris*	Swamp Rose				S3	4 Secure	13	19.1 ± 5.0	NB
P	*Rubus chamaemorus*	Cloudberry				S3	4 Secure	38	30.7 ± 0.0	NB
P	*Rubus occidentalis*	Black Raspberry				S3	4 Secure	3	39.6 ± 0.0	NB
P	*Salix interior*	Sandbar Willow				S3	4 Secure	13	50.5 ± 1.0	NB
P	*Salix nigra*	Black Willow				S3	3 Sensitive	121	35.5 ± 50.0	NB
P	*Salix pedicellaris*	Bog Willow				S3	4 Secure	44	25.0 ± 5.0	NB
P	*Comandra umbellata*	Bastard's Toadflax				S3	4 Secure	13	56.1 ± 10.0	NB
P	*Geocaulon lividum*	Northern Comandra				S3	4 Secure	12	54.2 ± 1.0	NS
P	*Limosella australis*	Southern Mudwort				S3	4 Secure	25	78.0 ± 0.0	NB
P	*Veronica serpyllifolia ssp. humifusa*	Thyme-Leaved Speedwell				S3	4 Secure	11	36.9 ± 0.0	NB
P	*Boehmeria cylindrica*	Small-spike False-nettle				S3	3 Sensitive	5	68.7 ± 0.0	NB
P	*Pilea pumila*	Dwarf Clearweed				S3	4 Secure	19	17.0 ± 0.0	NB
P	*Viola adunca*	Hooked Violet				S3	4 Secure	7	10.2 ± 0.0	NB
P	*Viola nephrophylla*	Northern Bog Violet				S3	4 Secure	4	32.3 ± 1.0	NB
P	*Carex arcta*	Northern Clustered Sedge				S3	4 Secure	42	24.4 ± 5.0	NB
P	*Carex atratiformis*	Scabrous Black Sedge				S3	4 Secure	4	78.9 ± 0.0	NB
P	*Carex capillaris*	Hairlike Sedge				S3	4 Secure	16	29.1 ± 0.0	NB
P	*Carex chordorrhiza*	Creeping Sedge				S3	4 Secure	60	35.8 ± 0.0	NB
P	*Carex conoidea*	Field Sedge				S3	4 Secure	20	1.4 ± 1.0	NB
P	*Carex eburnea*	Bristle-leaved Sedge				S3	4 Secure	2	31.2 ± 0.0	NB
P	*Carex exilis*	Coastal Sedge				S3	4 Secure	71	31.6 ± 0.0	NB
P	*Carex garberi*	Garber's Sedge				S3	3 Sensitive	3	54.2 ± 0.0	NB
P	*Carex haydenii*	Hayden's Sedge				S3	4 Secure	29	46.5 ± 0.0	NB
P	*Carex lupulina*	Hop Sedge				S3	4 Secure	75	28.1 ± 5.0	NB
P	*Carex michauxiana*	Michaux's Sedge				S3	4 Secure	46	28.3 ± 0.0	NB
P	*Carex ormostachya*	Necklace Spike Sedge				S3	4 Secure	5	34.5 ± 0.0	NB
P	*Carex rosea*	Rosy Sedge				S3	4 Secure	27	8.7 ± 0.0	NB
P	*Carex tenera*	Tender Sedge				S3	4 Secure	40	5.0 ± 0.0	NB
P	*Carex tuckermanii*	Tuckerman's Sedge				S3	4 Secure	69	23.5 ± 5.0	NB
P	*Carex wiegandii*	Wiegand's Sedge				S3	4 Secure	118	15.0 ± 1.0	NB
P	*Carex recta*	Estuary Sedge				S3	4 Secure	9	38.1 ± 0.0	NB
P	*Cyperus dentatus*	Toothed Flatsedge				S3	4 Secure	110	40.4 ± 0.0	NB
P	*Cyperus esculentus*	Perennial Yellow Nutsedge				S3	4 Secure	35	16.9 ± 0.0	NB
P	*Eleocharis intermedia*	Matted Spikerush				S3	4 Secure	1	4.4 ± 0.0	NB
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S3	4 Secure	2	66.6 ± 0.0	NB
P	*Eriophorum russeolum*	Russet Cottongrass				S3	4 Secure	95	30.5 ± 0.0	NB
P	*Rhynchospora capitellata*	Small-headed Beakrush				S3	4 Secure	9	32.1 ± 0.0	NB
P	*Rhynchospora fusca*	Brown Beakrush				S3	4 Secure	25	28.1 ± 0.0	NB
P	*Trichophorum clintonii*	Clinton's Clubrush				S3	4 Secure	16	29.1 ± 0.0	NB
P	*Schoenoplectus fluviatilis*	River Bulrush				S3	3 Sensitive	50	38.8 ± 0.0	NB
P	*Schoenoplectus torreyi*	Torrey's Bulrush				S3	4 Secure	24	38.3 ± 0.0	NB
P	*Triglochin gaspensis*	Gasp ├╴ Arrowgrass				S3	4 Secure	14	34.6 ± 0.0	NB
P	*Triantha glutinosa*	Sticky False-Asphodel				S3	4 Secure	3	54.1 ± 0.0	NB
P	*Cypripedium reginae*	Showy Lady's-Slipper				S3	3 Sensitive	6	35.1 ± 0.0	NB
P	*Liparis loeselii*	Loesel's Twayblade				S3	4 Secure	11	27.8 ± 1.0	NB
P	*Platanthera blephariglottis*	White Fringed Orchid				S3	4 Secure	28	54.6 ± 10.0	NB
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	3 Sensitive	17	29.8 ± 1.0	NB
P	*Bromus latiglumis*	Broad-Glumed Brome				S3	3 Sensitive	2	26.8 ± 0.0	NB
P	*Calamagrostis*	Pickering's Reed Grass				S3	4 Secure	88	35.0 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
	pickeringii									
P	*Dichanthelium depauperatum*	Starved Panic Grass				S3	4 Secure	14	51.2 ± 0.0	NB
P	*Poa glauca*	Glaucous Blue Grass				S3	4 Secure	18	29.8 ± 0.0	NB
P	*Heteranthera dubia*	Water Stargrass				S3	4 Secure	49	39.7 ± 0.0	NB
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S3	4 Secure	29	23.4 ± 0.0	NB
P	*Xyris montana*	Northern Yellow-Eyed-Grass				S3	4 Secure	39	32.0 ± 0.0	NB
P	*Zannichellia palustris*	Horned Pondweed				S3	4 Secure	17	48.4 ± 1.0	NB
P	*Adiantum pedatum*	Northern Maidenhair Fern				S3	4 Secure	2	28.7 ± 1.0	NB
P	*Cryptogramma stelleri*	Steller's Rockbrake				S3	4 Secure	2	41.7 ± 0.0	NB
P	*Asplenium trichomanes-ramosum*	Green Spleenwort				S3	4 Secure	19	29.4 ± 0.0	NB
P	*Dryopteris fragrans var. remotiuscula*	Fragrant Wood Fern				S3	4 Secure	39	15.0 ± 1.0	NB
P	*Woodsia glabella*	Smooth Cliff Fern				S3	4 Secure	24	28.0 ± 1.0	NB
P	*Equisetum palustre*	Marsh Horsetail				S3	4 Secure	5	89.9 ± 10.0	NB
P	*Isoetes tuckermanii*	Tuckerman's Quillwort				S3	4 Secure	12	28.1 ± 0.0	NB
P	*Lycopodium sabinifolium*	Ground-Fir				S3	4 Secure	21	32.1 ± 0.0	NB
P	*Huperzia appalachiana*	Appalachian Fir-Clubmoss				S3	3 Sensitive	23	29.1 ± 0.0	NB
P	*Botrychium dissectum*	Cut-leaved Moonwort				S3	4 Secure	24	55.8 ± 1.0	NB
P	*Botrychium lanceolatum var. angustisegmentum*	Lance-Leaf Grape-Fern				S3	3 Sensitive	8	15.4 ± 1.0	NB
P	*Botrychium simplex*	Least Moonwort				S3	4 Secure	1	81.9 ± 0.0	NB
P	*Polypodium appalachianum*	Appalachian Polypody				S3	4 Secure	15	14.0 ± 1.0	NB
P	*Utricularia resupinata*	Inverted Bladderwort				S3?	4 Secure	12	63.3 ± 1.0	NB
P	*Crataegus submollis*	Quebec Hawthorn				S3?	3 Sensitive	8	37.6 ± 1.0	NB
P	*Lobelia kalmii*	Brook Lobelia				S3S4	4 Secure	9	43.6 ± 10.0	NB
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	4 Secure	14	49.8 ± 0.0	NB
P	*Utricularia gibba*	Humped Bladderwort				S3S4	4 Secure	16	61.2 ± 0.0	NB
P	*Rumex maritimus*	Sea-Side Dock				S3S4	4 Secure	22	54.6 ± 0.0	NB
P	*Rumex maritimus var. fueginus*	Tierra del Fuego Dock				S3S4	4 Secure	1	58.1 ± 0.0	NB
P	*Potentilla arguta*	Tall Cinquefoil				S3S4	4 Secure	2	54.3 ± 0.0	NB
P	*Cladium mariscoides*	Smooth Twigrush				S3S4	4 Secure	13	66.8 ± 0.0	NB
P	*Spirodela polyrrhiza*	Great Duckweed				S3S4	4 Secure	38	43.4 ± 0.0	NB
P	*Corallorhiza maculata*	Spotted Coralroot				S3S4	3 Sensitive	15	18.7 ± 0.0	NB
P	*Distichlis spicata*	Salt Grass				S3S4	4 Secure	22	4.9 ± 1.0	NB
P	*Potamogeton oakesianus*	Oakes' Pondweed				S3S4	4 Secure	37	30.4 ± 0.0	NB
P	*Stuckenia pectinata*	Sago Pondweed				S3S4	4 Secure	66	24.4 ± 5.0	NB
P	*Montia fontana*	Water Blinks				SH	2 May Be At Risk	3	68.3 ± 0.0	NS
P	*Solidago caesia*	Blue-stemmed Goldenrod				SX	0.1 Extirpated	2	76.2 ± 1.0	NB
P	*Carex swanii*	Swan's Sedge				SX	0.1 Extirpated	3	83.8 ± 2.0	NS

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

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21	Blaney, C.S.; Mazerolle, D.M. 2011. Fieldwork 2011. Atlantic Canada Conservation Data Centre. Sackville NB.
21	Doucet, D.A. 2007. Lepidopteran Records, 1988-2006. Doucet, 700 recs.
19	Roland, A.E. & Smith, E.C. 1969. The Flora of Nova Scotia, 1st Ed. Nova Scotia Museum, Halifax, 743pp.
19	Scott, F.W. 2002. Nova Scotia Herpetofauna Atlas Database. Acadia University, Wolfville NS, 8856 recs.
18	Benedict, B. Connell Herbarium Specimens, Digital photos. University New Brunswick, Fredericton. 2005.
18	McAlpine, D.F. 1983. Status & Conservation of Solution Caves in New Brunswick. New Brunswick Museum, Publications in Natural Science, no. 1, 28pp.
18	Pike, E., Tingley, S. & Christie, D.S. 2000. Nature NB Listserve. University of New Brunswick, listserv.unb.ca/archives/naturenb. 68 recs.
17	Edsall, J. 2001. Lepidopteran records in New Brunswick, 1997-99. , Pers. comm. to K.A. Bredin. 91 recs.
16	Bateman, M.C. 2000. Waterfowl Brood Surveys Database, 1990-2000 . Canadian Wildlife Service, Sackville, unpublished data. 149 recs.
16	Blaney, C.S & Spicer, C.D.; Popma, T.M.; Basquill, S.P. 2003. Vascular Plant Surveys of Northumberland Strait Rivers & Amherst Area Peatlands. Nova Scotia Museum Research Grant, 501 recs.
16	Caissie, A. Herbarium Records. Fundy National Park, Alma NB. 1961-1993.
15	Robinson, S.L. 2010. Fieldwork 2009 (dune ecology). Atlantic Canada Conservation Data Centre. Sackville NB, 408 recs.
14	Speers, L. 2001. Butterflies of Canada database. Agriculture & Agri-Food Canada, Biological Resources Program, Ottawa, 190 recs.
13	Bateman, M.C. 2001. Coastal Waterfowl Surveys Database, 1965-2001. Canadian Wildlife Service, Sackville, 667 recs.
13	Blaney, C.S.; Spicer, C.D. 2001. Fieldwork 2001. Atlantic Canada Conservation Data Centre. Sackville NB, 981 recs.
13	Cronin, P. & Ayer, C.; Dubee, B.; Hooper, W.C.; LeBlanc, E.; Madden, A.; Pettigrew, T.; Seymour, P. 1998. Fish Species Management Plans (draft). NB DNRE Internal Report. Fredericton, 164pp.
13	Donell, R. 2008. Rare plant records from rare coastal plant project. Bouctouche Dune Irving Eco-centre. Pers. comm. to D.M. Mazerolle, 50 recs.
13	Downes, C. 1998-2000. Breeding Bird Survey Data. Canadian Wildlife Service, Ottawa, 111 recs.
13	Wissink, R. 2000. Rare Plants of Fundy: maps. Parks Canada, 20 recs.
13	Zinck, M. & Roland, A.E. 1998. Roland's Flora of Nova Scotia. Nova Scotia Museum, 3rd ed., rev. M. Zinck; 2 Vol., 1297 pp.
12	Amirault, D.L. & McKnight, J. 2003. Piping Plover Database 1991-2003. Canadian Wildlife Service, Sackville, unpublished data. 7 recs.
12	Wood Turtle (Glyptemys insculpta) Miramichi Watershed Synopsis 2013 Compiled by: Vladimir King Trajkovic, EPt Miramichi River Environmental Assessment Committee
11	Bredin, K.A. 2001. WTF Project: Freshwater Mussel Fieldwork in Freshwater Species data. Atlantic Canada Conservation Data Centere, 101 recs.
10	Blaney, C.S.; Spicer, C.D.; Rothfels, C. 2004. Fieldwork 2004. Atlantic Canada Conservation Data Centre. Sackville NB, 1343 recs.
10	Clayden, S.R. 2005. Confidential supplement to Status Report on Ghost Antler Lichen (Pseudevernia cladonia). Committee on the Status of Endangered Wildlife in Canada, 27 recs.
10	Hall, R.A. 2003. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 189 recs.
10	Houston, J.J. 1990. Status of the Redbreast Sunfish (Lepomis auritus) in Canada. Can. Field-Nat., 104:64-68. 15 recs.
10	Kennedy, Joseph. 2010. New Brunswick Peregrine records, 2010. New Brunswick Dept Natural Resources, 16 recs (11 active).
10	Layberry, R.A. & Hall, P.W., LaFontaine, J.D. 1998. The Butterflies of Canada. University of Toronto Press. 280 pp+plates.
9	Hall, R.A. 2001. S.. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 178 recs.
8	Basquill, S.P. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre, Sackville NB, 69 recs.
8	Benedict, B. Connell Herbarium Specimens. University New Brunswick, Fredericton. 2000.
8	Blaney, C.S. Miscellaneous specimens received by ACCDC (botany). Various persons. 2001-08.
8	Hinds, H.R. 1992. Rare Vascular Plants of Fundy National Park. , 10 recs.
8	Hinds, H.R. 1997. Vascular Plants of Cocagne Island. , 14 recs.
8	Webster, R.P. 2006. Survey for Suitable Salt Marshes for the Maritime Ringlet, New Populations of the Cobblestone Tiger Beetle, & New Localities of Three Rare Butterfly Species. New Brunswick WTF Report, 28 recs.
7	Popma, T.M. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre. Sackville NB, 113 recs.
6	Canadian Wildlife Service, Dartmouth. 2010. Piping Plover censuses 2007-09, 304 recs.
6	Godbout, V. 2002. SAR Inventory: Birds in Fort Beauséjour NHS. Parks Canada, Atlantic, SARINV02-01. 202 recs.
6	Newell, R.E. 2008. Vascular Plants of Muzroll Lake. Pers. comm. to C.S. Blaney, 1 pg. 43 recs.
6	Oldham, M.J. 2000. Oldham database records from Maritime provinces. Oldham, M.J; ONHIC, 487 recs.
6	Tremblay, E. 2006. Kouchibouguac National Park Digital Database. Parks Canada, 105 recs.

# recs	CITATION
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5	Edsall, J. 2007. Personal Butterfly Collection: specimens collected in the Canadian Maritimes, 1961-2007. J. Edsall, unpubl. report, 137 recs.
5	Klymko, J.J.D.; Robinson, S.L. 2012. 2012 field data. Atlantic Canada Conservation Data Centre, 447 recs.
5	Litvak, M.K. 2001. Shortnose Sturgeon records in four NB rivers. UNB Saint John NB. Pers. comm. to K. Bredin, 6 recs.
5	Parker, M.S.R. 2011. Hampton Wind Farm 2010: significant floral/faunal observations. , 13 recs.
4	Chaput, G. 2002. Atlantic Salmon: Maritime Provinces Overview for 2001. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-14. 39 recs.
4	Goltz, J.P. & Bishop, G. 2005. Confidential supplement to Status Report on Prototype Quillwort (Isoetes prototypus). Committee on the Status of Endangered Wildlife in Canada, 111 recs.
4	Goltz, J.P. 2002. Botany Ramblings: 1 July to 30 September, 2002. N.B. Naturalist, 29 (3):84-92. 7 recs.
4	Gravel, Mireille. 2010. Coordonnées des tortues des bois Salmon River Road, 2005. Kouchibouguac National Park, 4 recs.
4	Klymko, J.J.D. 2012. Insect fieldwork & submissions, 2011. Atlantic Canada Conservation Data Centre. Sackville NB, 760 recs.
4	Olsen, R. Herbarium Specimens. Nova Scotia Agricultural College, Truro. 2003.
4	Tremblay, E. 2001. Kouchibouguacis River Freshwater Mussel Data. Parks Canada, Kouchibouguac NP, 45 recs.
3	Bagnell, B.A. 2003. Update to New Brunswick Rare Bryophyte Occurrences. B&B Botanical, Sussex, 5 recs.
3	Benjamin, L.K. 2009. NSDNR Fieldwork & Consultants Reports. Nova Scotia Dept Natural Resources, 143 recs.
3	Bishop, G. 2012. Field data from September 2012 Anticosti Aster collection trip. , 135 rec.
3	Bishop, G., Bagnell, B.A. 2004. Site Assessment of Musquash Harbour, Nature Conservancy of Canada Property - Preliminary Botanical Survey. B&B Botanical, 12pp.
3	Clayden, S.R. 2006. Pseudevernia cladonia records. NB Museum. Pers. comm. to S. Blaney, Dec, 4 recs.
3	Doucet, D.A. & Edsall, J. 2007. Ophiogomphus howei records. Atlantic Canada Conservation Data Centre, Sackville NB, 21 recs.
3	Forbes, G. 2001. Bog Lemming, Phalarope records, NB. , Pers. comm. to K.A. Bredin. 6 recs.
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3	Lautenschlager, R.A. 2005. Survey for Species at Risk on the Canadian Forest Service's Acadia Research Forest near Fredericton, New Brunswick. Atlantic Canada Conservation Data Centre, 6. 3 recs.
3	Marshall, L. 1998. Atlantic Salmon: Southwest New Brunswick outer-Fundy SFA 23. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-13. 6 recs.
3	Mazerolle, D. 2003. Assessment of Seaside Pinweed (Lechea maritima var. subcylindrica) in Southeastern New Brunswick. Irving Eco-centre, la Dune du Bouctouche, 18 recs.
3	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2014.
3	Nye, T. 2002. Wood Turtle observations in Westmorland, Queens Cos. , Pers. com. to S.H. Gerriets, Dec. 3. 3 recs.
3	Powell, B.C. 1967. Female sexual cycles of Chrysemy spicta & Clemmys insculpta in Nova Scotia. Can. Field-Nat., 81:134-139. 26 recs.
3	Sabine, D.L. 2012. Bronze Copper records, 2003-06. New Brunswick Dept of Natural Resources, 5 recs.
3	Sollows, M.C,. 2009. NBM Science Collections databases: Coccinellid & Cerambycid Beetles. New Brunswick Museum, Saint John NB, download Feb. 2009, 569 recs.
3	Toner, M. 2001. Lynx Records 1973-2000. NB Dept of Natural Resources, 29 recs.
3	Webster, R.P. 2004. Lepidopteran Records for National Wildlife Areas in New Brunswick. Webster, 1101 recs.
3	Webster, R.P. 2005. Coleoptera Data 2004-05. Pers. comm. to D. Doucet. 16 recs, 16 recs.
2	Adams, J. & Herman, T.B. 1998. Thesis, Unpublished map of C. insculpta sightings. Acadia University, Wolfville NS, 88 recs.
2	Amirault, D.L. 2000. Piping Plover Surveys, 1983-2000. Canadian Wildlife Service, Sackville, unpublished data. 70 recs.
2	Christie, D.S. 2000. Christmas Bird Count Data, 1997-2000. Nature NB, 54 recs.
2	Daury, R.W. & Bateman, M.C. 1996. The Barrow's Goldeneye (Bucephala islandica) in the Atlantic Provinces and Maine. Canadian Wildlife Service, Sackville, 47pp.
2	Dept of Fisheries & Oceans. 1999. Status of Wild Striped Bass, & Interaction between Wild & Cultured Striped Bass in the Maritime Provinces. , Science Stock Status Report D3-22. 13 recs.
2	Doucet, D.A. 2008. Wood Turtle Records 2002-07. Pers. comm. to S. Gerriets, 7 recs, 7 recs.
2	Edsall, J. 1992. Summer 1992 Report. New Brunswick Bird Info Line, 2 recs.
2	Edsall, J. 1993. Spring 1993 Report. New Brunswick Bird Info Line, 3 recs.
2	Hicklin, P.W. 1995. The Maritime Shorebird Survey Newsletter. Calidris, No. 3. 6 recs.
2	Hinds, H.R. 1999. A Vascular Plant Survey of the Musquash Estuary in New Brunswick. , 12pp.
2	Layberry, R.A. 2012. Lepidopteran records for the Maritimes, 1974-2008. Layberry Collection, 1060 recs.
2	Madden, A. 1998. Wood Turtle records in northern NB. New Brunswick Dept of Natural Resources & Energy, Campbellton, Pers. comm. to S.H. Gerriets. 16 recs.
2	McAlpine, D.F. 2001. Lepomis auritus, 2 sites in Saint John County. New Brunswick Museum, Pers. comm. to K.A. Bredin. 2 recs.
2	Popma, K. 2001. Phalarope & other bird observations in Westmorland Co. , Pers. comm. to K.A. Bredin. 5 recs.
1	Amiro, Peter G. 1998. Atlantic Salmon: Inner Bay of Fundy SFA 22 & part of SFA 23. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-12. 4 recs.
1	Basquill, S.P. 2011 vascular plant field data. Nova Scotia Department of Natural Resources, 37 recs.
1	Belliveau, A. 2013. Rare species records from Nova Scotia. Mersey Tobeatic Research Institute, 296 records. 296 recs.
1	Belliveau, A.G. 2014. Plant Records from Southern and Central Nova Scotia. Atlantic Canada Conservation Data Centre, 919 recs.
1	Benjamin, L.K. (compiler). 2002. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 32 spp, 683 recs.
1	Blaney, C.S. 1999. Fieldwork 1999. Atlantic Canada Conservation Data Centre. Sackville NB, 292 recs.
1	Blaney, C.S. 2014. 2014 Bank Swallow colony observation, Westcock, NB. Atlantic Canada Conservation Data Centre.
1	Boyne, A.W. 2000. Tern Surveys. Canadian Wildlife Service, Sackville, unpublished data. 168 recs.
1	Bredin, K.A. 2000. NB & NS Bog Project, fieldwork. Atlantic Canada Conservation Data Centre, Sackville, 1 rec.
1	Bredin, K.A. 2001. NB Freshwater Mussel Fieldwork. Atlantic Canada Conservation Data Centere, 16 recs.
1	Bredin, K.A. 2002. NB Freshwater Mussel Fieldwork. Atlantic Canada Conservation Data Centere, 30 recs.
1	Cameron, R.P. 2009. Erioderma pedicellatum database, 1979-2008. Dept Environment & Labour, 103 recs.

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1	Clavette, A., and others. 2013. Peregrine Falcon nesting information from NatureNB listserv. NatureNB.
1	Crowell, M.J. Plant specimens from Nictaux, NS sent to Sean Blaney for identification. Jacques Whitford Limited. 2005.
1	Dadswell, M.J. 1979. Status Report on Shortnose Sturgeon (Acipenser brevirostrum) in Canada. Committee on the Status of Endangered Wildlife in Canada, 15 pp.
1	Doucet, D.A. 2007. Fieldwork 2007: Insects (minus Odonata). ACCDC Staff, 1 rec.
1	Edsall, J. 1993. Summer 1993 Report. New Brunswick Bird Info Line, 2 recs.
1	Edsall, J. 2007. Lepidopteran Records from Halls Creek, 1994-2000. Edsall, 43 recs.
1	Gerriets, S.H. 1997-2001. Element Occurrence Database. Atlantic Canada Conservation Data Centre, Sackville NB, 1 rec.
1	Godbout, V. 2000. Recherche de l'Aster du St-Laurent (Aster laurentianus) et du Satyre des Maritimes (Coenonympha nepisiquit) au Parc national Kouchibouguac et a Dune du Bouctouche, N-B. Irving Eco-centre, 23 pp.
1	Goltz, J.P. 2001. Botany Ramblings April 29-June 30, 2001. N.B. Naturalist, 28 (2): 51-2. 8 recs.
1	Hinds, H.R. 2000. Rare plants of Fundy in Rare Plants of Fundy: maps. Wissink, R. (ed.) Parks Canada, 2 recs.
1	Jessop, B. 2004. Acipenser oxyrinchus locations. Dept of Fisheries & Oceans, Atlantic Region, Pers. comm. to K. Bredin. 1 rec.
1	Kirkland, G.L. Jr. & Schmidt, D.F. 1982. Abundance, habitat, reproduction & morphology of forest-dwelling small mammals of NS & south-eastern NB. Can. Field-Nat., 96(2): 156-162. 1 rec.
1	Kirkland, G.L. Jr., Schmidt, D.F. & Kirkland, C.J. 1979. First record of the long-tailed shrew (Sorex dispar) in New Brunswick. Can. Field-Nat., 93: 195-198. 1 rec.
1	Klymko, J.J.D. 2010. Miscellaneous observations reported to ACCDC (zoology). Pers. comm. from various persons, 3 recs.
1	LaFlamme, C. 2008. Disovery of Goodyera pubescens at Springdale, NB. Amec Earth and Environmental. Pers. comm. to D.M. Mazerolle, 1 rec.
1	Loo, J. & MacDougall, A. 1994. GAP analysis: Summary Report. Fundy Model Forest, 2 recs.
1	MacKinnon, D.S. 2013. Email report of Peregrine Falcon nest E of St. Martins NB. NS Department of Environment and Labour, 1 record.
1	McAlpine, D.F. & Collingwood, L. 1989. Rare Salamander Survey in Fundy National Park. Fundy National Park, Internal Documents, 1 rec.
1	McAlpine, D.F. & Cox, S.L., McCabe, D.A., Schnare, J.-L. 2004. Occurrence of the Long-tailed Shrew (Sorex dispar) in the Nerepis Hills NB. Northeastern Naturalist, vol 11 (4) 383-386. 1 rec.
1	McAlpine, D.F. 1983. Species Record Cards. Fundy National Park, Library, 1 rec.
1	Miller, D.G. 2013. Peregrine Falcon nesting information from birdingnewbrunswick.ca. birdingnewbrunswick.ca.
1	Morrison, Annie. 2010. NCC Properties Fieldwork: June-August 2010. Nature Conservancy Canada, 508 recs.
1	Neily, T.H. & Pepper, C.; Toms, B. 2013. Nova Scotia lichen location database. Mersey Tobeatic Research Institute, 1301 records.
1	Plissner, J.H. & Haig, S.M. 1997. 1996 International piping plover census. US Geological Survey, Corvallis OR, 231 pp.
1	Poirier, Nelson. 2012. Geranium robertianum record for NB. Pers. comm. to S. Blaney, Sep. 6, 1 rec.
1	Porter, C.J.M. 2014. Field work data 2007-2014. Nova Scotia Nature Trust, 96 recs.
1	Sabine, D.L. & Goltz, J.P. 2006. Discovery of Utricularia resupinata at Little Otter Lake, CFB Gagetown. Pers. comm. to D.M. Mazerolle, 1 rec.
1	Sabine, D.L. 2004. Specimen data: Whittaker Lake & Marysville NB. Pers. comm. to C.S. Blaney, 2pp, 4 recs.
1	Sabine, D.L. 2013. Dwaine Sabine butterfly records, 2009 and earlier.
1	Smith, M. 2013. Email to Sean Blaney regarding Schizaea pusilla at Caribou Plain Bog, Fundy NP. pers. comm., 1 rec.
1	Spicer, C.D. 2004. Specimens from CWS Herbarium, Mount Allison Herbarium Database. Mount Allison University, 5939 recs.
1	Steeves, R. 2004. Goodyera pubescens occurrence from Colpitts Brook, Albert Co. , Pers. comm. to C.S. Blaney. 1 rec.
1	Toner, M. 2005. Listera australis population at Bull Pasture Plains. NB Dept of Natural Resources. Pers. comm. to S. Blaney, 8 recs.
1	Toner, M. 2011. Wood Turtle sighting. NB Dept of Natural Resources. Pers. com. to S. Gerriets, Sep 2, photo, 1 rec.
1	Torenvliet, Ed. 2010. Wood Turtle roadkill. NB Dept of Transport. Pers. com. to R. Lautenschlager, Aug. 20, photos, 1 rec.
1	Wissink, R. 2000. Four-toed Salamander Survey results, 2000. Fundy National Park, Internal Documents, 1 rec.

DATA DICTIONARY: revised May 4, 2012

I. Observation Records

The following fields of data may be included (and may or may not be populated) in occurrence records.
Text field lengths given as TXT+ are 255 char max. (and may truncate text).

TAXONOMY	*type*	*definition*
MCODE	TXT 8	8 character 'Museum Code' (1 to 4 = genus, 5 to 8 = sp+ssp)
ELCODE	TXT 10-12	Unique IIdentifier of taxon[1]
SCINAME	TXT+	Global Scientific Name of taxon[1]
COMNAME	TXT+	English Common Name of taxon[1]
NOMCOMMUN	TXT+	French Common Name

LOCATION

SURVEYSITE	TXT+	General locality of occurrence (not necessarily protected)
DIRECTIONS	TXT+	Specific locality: e.g. bearings and distance from enduring landmark
SUBNAT	TXT 2	Province/State: 2 character ISO code
COCODE	TXT 6	County Code (2 chars for province + 4 chars for county name)
MAPCODE	TXT 7	Map number: NTS identifier in Canada
UTME20	NUM 6	UTM[3] Easting reprojected as Zone 20
UTMN20	NUM 7	UTM[3] Northing reprojected as Zone 20
LONDEC	DEC 12,6	Decimal Longitude (6 decimal places, negative for west of Greenwich)
LATDEC	DEC 12,6	Decimal Latitude (6 decimal places)
LOCUNCM	NUM 5	Precision in meters, i.e. geospatial resolution or lack thereof
PREC	DEC 3,1	Precision in meters by power of 10 (e.g. 3 = 10 to the 3rd = 1000m = 1km)

prec	*common speech*	*example*	*unit size*	*literal range (m)*
6.0	within province	province	1000.0km	562.3 - 1778.3
5.7	in part of province	'NW NB'	500.0km	281.2 - 889.1
5.0	within in county	county	100.0km	56.2 - 177.8
4.7	within 50s of kilometers		50.0km	28.1 - 88.9
4.0	within 10s of kilometers	BBA grid	10.0km	5.6 - 17.8
3.7	within 5s of kilometers		5.0km	2.8 - 8.9
3.0	within kilometers	topo grid	1.0km	0.6 - 1.8
2.7	within 500s of meters		500.0m	281.2 - 889.1
2.0	within 100s of meters	ball field	100.0m	56.2 - 177.8
1.7	within 50s of meters		50.0m	28.1 - 88.9
1.0	within 10s of meters	boxcar	10.0m	5.6 - 17.8
0.7	within 5s of meters		5.0m	2.8 - 8.9
0.0	within meters ***NOT USED***	pace	1.0m	0.6 - 1.8
-1.0	within 10s of centimeters	fingernail	0.1m	0.1 - 0.2

RARITY STATUS

NRANK	TXT 5	National Rarity Rank of taxon (in Canada)[1]
NPROT	TXT+	National Protection Status of taxon (= COSEWIC in Canada)

code	*rank and short definition*
X	Extinct in Canada and elsewhere
XT	Extirpated in Canada but surviving elsewhere
E	Endangered in Canada
T	Threatened in Canada
V	Vulnerable in Canada
SC	Special Concern in Canada
DD	Data Deficient: data inadequate for assessment
NAR	Not At Risk in Canada

SRANK** TXT 5 Subnational (Provincial) Rarity Rank of taxon[1]

code	*rank and short definition*
SX	Extinct or extirpated in province
SH	Historically occuring but currently undetected in province
S1	Extremely rare in province
S2	Rare in province
S3	Uncommon in province
S4	Widespread, common and apparently secure in province
S5	Widespread, abundant and demonstrably secure in province
SE	Exotic in province
SA	Accidental, infrequent and outside of range within province
SNA	Ranking not applicable in province
SNR	Not yet assessed in province

SPROT** TXT+ Provincial rank/status of taxon; cf provincial websites

DATASENS	TXT 5	Data sensitivity index; indicates blurred[2] export coordinates
IUCN	TXT+	International Union of Conservation Naturalists rarity rank; cf IUCN website

code	*rank and short definition*
EX	Extinct: no individuals remaining
EW	Extinct in the Wild: only captive or naturalised survivors
CR	Critically Endangered: extreme risk of extinction in wild
EN	Endangered: high risk of extinction in wild
VU	Vulnerable: high risk of endangerment in wild
NT	Near Threatened: likely to become endangered soon
LC	Least Concern: lowest risk, widespread and abundant
DD	Data Deficient: data inadequate for assessment
NE	Not Evaluated, not yet assessed against criteria

OBSERVATION

OBSERVER	TXT+	Person or persons collecting specimen, in bibliographic form
OBDATE	TXT 10	Date of specimen collection as YYYY MM DD
OBDATA	TXT+	Concatenation of fields below, relating to specimen (EODATAEVID, EODATACNT etc)
OBEVID	TXT+	Type of evidence (specimen, photo etc)
OBCOUNT	TXT+	Number of individuals at location
OBABUN	TXT+	Relative rarity of taxon at location, e.g. 'common', 'scattered'
OBSIZE	TXT+	Size of specimen
SIZE	TXT+	Size of occurrence 'patch' (in m2, ha or acres)
OBDESC	TXT+	Details of specimen appearance
OBPHEN	TXT+	Lifestage of specimen (bud, flowering etc)
OBSEX	TXT+	Male/female if relevant
OBACTIV	TXT+	Activity of taxon when observed (nesting, crossing road etc)
OBASSP	TXT+	Other taxa associated with specimen
NOTETAX	TXT+	Identifier's note on taxonomic issues
GENDESC	TXT+	Concatenation of fields below, relating to site (HABITAT, ECOL etc)
HABITAT	TXT+	Habitat characterisation of location
ECODIST	NUM 4	National Ecological Framework EcoDistrict identifier
WSCODE	TXT 10	Quaternary Watershed identifier
GCOM	TXT+	General Comments: concatenation of Notes (NOTE1, NOTE2, NOTE3)

COLLECTION

OWNER	TXT+	Landowner or owner type (Federal, Provincial, Private, etc)
ACCNUM	TXT+	Museum/Herbarium Accession number
COLLNUM	TXT+	Collectors' number
COLLECTION	TXT+	Herbarium acronym(s) with specimen
CITATION	TXT+	Primary source of data

DATA MANAGEMENT

IDNUM	TXT+	Field Office Number: Internal ACCDC record reference (not the EONUM)
EDITION	TXT 14	Last editor's initials and date as YYYY MM DD
OB	TXT 2	Mapping shape: PN=polygon, BF=buffer, LN=line, PT=point
DB	TXT 2	Database, e.g. Ob=observations, Ff=freshwater fish, Bp=birds, pelagic
IN	TXT 2	GIS search flag for observation within buffer
IX	TXT 2	GIS search flag for observation intersects buffer
EONUMLAST	NUM 3	Map labeling flag for most recent taxon observation in area
RARENS	NUM 1	Inclusion flag for extraprovincial records in NS 100km GIS scans

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Notes:

[1] Methodology of NatureServe, Arlington, VA

[2] Easting and Northing rounded to 5, 10 or 50km grid location.

[3] Universal Transverse Mercator.

** Field name followed by 2-character ISO provincial abbreviation.

II. Managed or Special Areas

The following fields of data may be included (and may or may not be populated) for Protected Areas and Ecologically Significant Areas.

IDENTITY

MACODE	TXT 14	Unique identifier for Managed Area[1] with some level of protection
SACODE	TXT 14	Unique identifier for Ecologically Special Area[1] with or without protection
MANAME	TXT+	Name of Protected Area containing occurrence
SANAME	TXT+	Name of Ecologically Special Area containing occurrence
SITECODE	TXT+	External agency site identity code

JURISDICTION / OWNERSHIP

LOCALJURIS	TXT+	Abbreviation for mandated agency
OWNER	TXT+	Short name or category of title holder
OWNERCOM	TXT+	Short detail of multiparty arrangements
OWNERCODE	TXT+	Canadian Conservation Area DB ownercodes (modified)

group	*code*	*designation*
Owner	GN	government, national (federal)
	GS	government, subnational (prov., state)
	GM	government, municipal
	IN	international
	NG	non-governmental organisation
	OR	organisational
	CO	corporate
	PR	private

CLASSIFICATION

PROTSTAT	TXT+	Activities permitted or restricted (when known)
LEGALACT	TXT+	Short title of enabling legislation
LEGALDATE	TXT+	Year of enabling legislation
ESTABDATE	TXT+	Year of site designation
IBP	TXT+	International Biological Program identity number (Y=unknown)
IBPSTATUS	TXT+	International Biological Program status: proposed or declared
IUCN	TXT+	IUCN protection level, e.g. I very restricted, VI few restrictions
LEVEL1	TXT 3	Canadian Conservation Area DB type
LEVEL2	TXT+	Canadian Conservation Area DB subtype(s)

group	*code*	*designation*
Conservation	CEP	Conservation Easement Property
	ESA	Environmentally Sensitive Area
	NAC	Nature Conservancy
	NAT	Natural Area
	NCA	NCC Conservation Land
	PCA	Private Conservation Area
	PRA	Protected Area
	PRB	Protected Beach
	RER	Representative Area Ecological Reserve
	TRA	Nature Trail
Heritage	ARS	Archaeological Site
	HEA	Heritage Area or Park
	HEC	Heritage Canal
	HEP	Heritage Park
	HER	Heritage River
	HIA	Historic Area or Park
	NHP	National Historic Park
	NHS	National Historic Site
	PEP	Provincial Heritage Property
	PHP	Provincial Historic/Heritage Park
	PHS	Provincial Heritage Site
	WHS	World Heritage Site
Parks	CMG	Campground
	CMP	Community Park
	DUP	Day Use Park
	MUP	Municipal Park
	NAP	National Park
	NEP	Natural Environment Park
	NTP	Nature Park
	PKW	Parkway
	PNS	Picnic Site
	PVP	Provincial Park
	WAP	Wayside Park

group	*code*	*designation*
Wilderness	ECR	Ecological Reserve
	NTA	Nature Trust Area
	NTR	Nature Reserve
	SES	Significant Ecological Area
	WDA	Wilderness Area
	WDR	Wilderness Reserve
Wildlife	BSR	Bird Sanctuary
	EHJ	Eastern Habitat Joint Venture
	GAS	Game Sanctuary
	MBS	Migratory Bird Sanctuary
	NWA	National Wildlife Area
	PWA	Provincial Wildlife Area
	SBS	Sea Bird Sanctuary
	WHR	Western Hemispheric Shorebird Reserve
	WLP	Wildlife Park
	WLR	Wildlife Reserve
	WLS	Wildlife Sanctuary
	WMA	Wildlife Management Area
	WPA	Wildlife Protection Area
	WRF	Wildlife Refuge
Other	AGF	Agreement Forest
	ASI	Area of Scientific Interest
	DUN	Ducks Unlimited Canada
	EDA	Education Area
	FCP	Federal Community Pasture
	IBP	International Biological Program
	NCC	National Capital Commission
	NSA	Natural Scenic Area
	PLS	Palaeontological Site
	PSL	Public Safety Lands: watershed protection
	RAM	Ramsar Wetland Site
	RTA	Research and Teaching Area
NS SigHab	380	wetland habitat
	381	saltmarsh habitat
	382	deer/moose wintering
	383	other significant habitats