CHIPMAN HOUSING AUTHORITY INC.

Environmental Impact Assessment (EIA) Registration

Chipman Residential Subdivision Project, Chipman, New Brunswick

March 2023 – 22-4686

March 10, 2023

New Brunswick Department of Environment and Local Government
Environmental Impact Assessment Branch
P.O. Box 6000
20 McGloin Street, 3rd Floor
Fredericton, NB
E3B 5H1

Attention: Ms. Crystale Harty
Director, Environmental Impact Assessment Branch

RE: Environmental Impact Assessment (EIA) Registration
Chipman Housing Authority Inc., Chipman Residential Subdivision Project,
Chipman, New Brunswick

Dear Ms. Harty:

On behalf of Chipman Housing Authority Inc. (CHA), Dillon Consulting Limited (Dillon) is pleased to submit this environmental impact assessment (EIA) registration document for the proposed residential subdivision development in Chipman, New Brunswick, for your review and consideration.

Dillon looks forward to your timely review of the documentation. Please contact the undersigned if you have any questions or require additional information.

Sincerely,

DILLON CONSULTING LIMITED

Amber Yates

Amber Yates, B.Sc., P.Tech.
Biologist, Project Manager

APY:trw
Attachment: EIA Registration
cc: Renée Morais, P.Eng.

Our file: 22-4686

DILLON CONSULTING

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Dillon Consulting Limited

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DILLON CONSULTING

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Acronyms, Abbreviations, Definitions

Acronym or Unit	Definition
a.m.	morning
AC CDC	Atlantic Canada Conservation Data Centre
AHB	Archaeology and Heritage Branch
AIA	archaeological impact assessment
°C	degrees Celsius
CAC	criteria air contaminant
CCME	Canadian Council of Ministers of the Environment
CEPA	*Canadian Environmental Protection Act*
CHA	Chipman Housing Authority
CH_4	methane
Cm	centimetre
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWQG	Canadian Water Quality Guidelines
CWS	Canadian Wildlife Service
dBA	A-weighted decibels
DFO	Department of Fisheries and Oceans Canada
DO	dissolved oxygen
e.g.	*exempli gratia* (meaning “for example”)
ECCC	Environment and Climate Change Canada
EIA	environmental impact assessment
ESA	Environmentally Sensitive Area
ESC	erosion and sedimentation control
et al.	*et alia* (meaning “and others”)
est.	estimated
etc.	*et cetera* (meaning “and so forth”)
FWAL	freshwater aquatic life
GCDWQ	Guidelines for Canadian Drinking Water Quality
GHG	greenhouse gas
GIS	geographic information system
GPS	global positioning system
H_2S	hydrogen sulphide
ha	hectare

Acronym or Unit	Definition
HADD	harmful alteration, disruption, or destruction (of fish habitat)
i.e.	*id* est (meaning "in other words" or "that is")
IA	impact assessment
IAA	*Impact Assessment Act*
IBA	Important Bird Area
IPCC	Intergovernmental Panel on Climate Change
Km	kilometre
km^2	square kilometre
km/h	kilometres per hour
kPa	kiloPascals
L	litre
L/min	litres per minute
LAA	local assessment area
Leq	equivalent sound pressure level
Lmax	maximum sound pressure level
LOO	License of Occupation
LSD	Local Service District
m	metre
m^2	square metre
m^3	cubic metre
m^3/s	cubic metres per second
m amsl	metres above mean sea level
MBBA	Maritimes Breeding Bird Atlas
MBCA	*Migratory Birds Convention Act*
m bgs	metres below ground surface
mg/L	milligrams per litre
mm	millimetre
Mt	megatonne (metric)
N_2O	nitrous oxide
NAAQO	National Ambient Air Quality Objectives
NB	New Brunswick
NBDELG	New Brunswick Department of Environment and Local Government
NBDNRED	New Brunswick Department of Natural Resources and Energy Development
NBDTHC	New Brunswick Department of Tourism, Heritage and Culture
NBDTI	New Brunswick Department of Transportation and Infrastructure
NB SARA	New Brunswick *Species at Risk Act*
NO_x	nitrogen oxides
NTU	nephelometric turbidity unit

Acronym or Unit	Definition
OWLS	online well log system
PDA	Project Development Area
p.m.	evening
pg.	page
pH	A measure of the acidity or alkalinity of a substance
PID	parcel identifier
PM	total particulate matter
$PM_{2.5}$	particulate matter less than 2.5 microns
PM_{10}	particulate matter less than 10 microns
PNA	Protected Natural Area
pp.	pages
ppm	parts per million
RCNM	Roadway Construction Noise Model
RFA	recreational fishing area
RPC	Research and Productivity Council
RSC	Regional Service Commission
SAR	species at risk
SARA	*Species at Risk Act*
SO_2	sulphur dioxide
SOCC	species of conservation concern
t	tonne (metric)
TLRU	traditional land and resource use
TOC	total organic carbon
TRC	Technical Review Committee
TSP	total suspended particulate
TSS	total suspended sediment
$\mu g/m^3$	microgram per cubic metre
UNFCCC	United Nations Framework Convention on Climate Change
µS/cm	microSiemens per centimetre
VC	valued component
WAWA	watercourse and wetland alteration
WHO	World Health Organization
WMZ	wildlife management zone
MTI	Mi’gmawe’l Tplu’taqnn Incorporated
WNNB	Wolastoqey Nation in New Brunswick

1.0 Introduction

This document is an Environmental Impact Assessment (EIA) Registration document for the Chipman Residential Subdivision Project (the Project) proposed by the Chipman Housing Authority Inc. (CHA) in the Village of Chipman, New Brunswick, Canada.

The Project is an "undertaking" under item (s) of Schedule A of the New Brunswick *Environmental Impact Assessment Regulation – Clean Environment Act* (EIA Regulation) ["(s) all waterworks with a capacity greater than fifty cubic metres of water daily"]. As such, the Project must be registered under Section 5(1) of the EIA Regulation and at minimum a determination review will be conducted. Following the EIA review and approval, other permits and approvals at the federal and provincial levels may be required.

This EIA Registration document is submitted to the New Brunswick Department of Environment and Local Government (NBDELG) under Section 5(2) of the New Brunswick *Environmental Impact Assessment Regulation* 87-83 of the *Clean Environment Act*. It has been prepared by Dillon Consulting Limited (Dillon) on behalf of the Chipman Housing Authority (CHA) to provide information to the NBDELG and its associated Technical Review Committee (TRC) to assist in the EIA review of the Project.

1.1 Proponent Information

The Project may be referred to as the "Chipman Residential Subdivision Project". The Proponent of the Project is the Chipman Housing Authority (CHA). The Proponent's contact information is provided in **Table 1-1** below.

Table 1-1: Proponent Information

Name of Project:	Chipman Residential Subdivision Project
Name of Proponent:	Chipman Housing Authority Inc. (CHA)
Mailing Address of Proponent:	P.O. Box 5777, 300 Union Street Saint John, New Brunswick, E2L 4M3
Proponent's Contact Person for the purposes of this EIA Registration:	Renée Morais, Director of Environmental Affairs Tel: 506.647.0418 Email: Morais.Renee@jdirving.com
Environmental Consultant that led the preparation of this EIA Registration:	Amber Yates, B.Sc., P.Tech. Biologist, Project Manager Dillon Consulting Limited 1149 Smythe Street, Suite 200 Fredericton, NB E3B 3H4 Tel.: 506.444.8820 ext. 5118 Cell: 506.470.0341 Email: ayates@dillon.ca

1.2 About the Chipman Housing Authority Inc.

The CHA, a not for profit organization, was created in 2018 to facilitate the settlement of skilled workers to support local forestry operations in the Chipman area. J.D. Irving (JDI) plans on filling positions to support their forestry operations. However, a lack of housing in the Chipman area has created a barrier to the settlement of workers. CHA, a non-profit housing authority, was established to create temporary rental housing with the long-term goal of constructing permanent residences and selling homes to workers. The Project described herein is a reflection of the goal of the CHA to provide permanent housing for the influx of skilled workers and their families to the Chipman area.

1.3 The Undertaking

A high-level description of the undertaking is presented in this section.

1.3.1 Project Overview (Nature of the Undertaking)

The Project includes the development of two properties (estimated at a total combined area of 14 hectares [ha]) for the purpose of constructing a residential development consisting of up to 75 dwellings. The conceptual plan comprises of a mini-homes. Refer to **Section 2.2** for further details on the proposed dwellings.

Each home will either be serviced by communal or individual wells. A preliminary groundwater assessment was undertaken by Dillon to determine the aquifer's capacity to support the proposed development (refer to **Section 5.4** and **Appendix A**). A WSSA will be completed in conjunction with EIA review (refer to **Appendix A** for application forms). All lots will be serviced by a gravity sanitary sewer system that will tie into the existing sanitary sewer system in the Village of Chipman.

The subject properties, identified by parcel identifier (PID) numbers 45080470 and 45211679, are located south of the Chipman Forest Avenue School and are shown in **Figure 1-1** below.

Portions of the Project that are located in unmapped wetlands may require a watercourse and wetland alteration (WAWA) permit. Refer to **Sections 5.5**, **5.7**, and **5.10** for information on the surface water, wetland, and heritage resources on site. The main environmental effects will involve removal of vegetation to develop the lots and related site preparation activities.

CHIPMAN HOUSING AUTHORITY INC.

Environmental Impact Assessment (EIA)

SITE LOCATION PLAN

FIGURE 1-1

Road

Property Boundary

Subject Property Boundary

0 20 40 80 Meters

SCALE 1:3,000

N
W E
S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: RP
MAP CHECKED BY: AY
MAP PROJECTION: NAD_1983_CSRS_NEW_BRUNSWICK_STEREOGRAPHIC

DILLON CONSULTING

PROJECT: 22-4686

STATUS: DRAFT

DATE: 2022-10-10

FILE LOCATION: K:\2022\224686\Product\Client\2022EIA\Figure 1.1 Site Map.mxd

Following the completion of the EIA review and obtaining all applicable permits, it is projected that the construction work of the Project would begin in the spring of 2023, assuming the EIA review process is completed by then. It is anticipated that construction would be completed by 2025.

1.3.2 Rationale and Need for the Project

Currently, the supply of residential housing in Chipman and surrounding areas is low. As such, additional residential developments are needed in Chipman to house workers to fill the need for skilled workers in JDI's forestry operations (e.g., trucking, logging, milling). CHA proposes to develop a residential subdivision on two properties to house skilled workers immigrating to the area. Currently, 55 new employees are required to fully operate the woodlands/sawmill operations in Chipman for 2023. Workers and their families live in apartments in Fredericton and nearby camps while they wait for houses to be built. Ideally, homes would be built before the new school year to allow an easier transition for families.

1.3.2.1 Project Purpose

In consideration of the above, the purpose of the Project is to provide housing for workers to support JDI's forestry and sawmill operations.

1.4 Regulatory Context

The potential permitting requirements that may apply to the Project at the federal, provincial and local levels are summarized in **Table 1-2**.

Table 1-2: Potential Provincial, Federal, and Local Environmental Permitting Requirements

Legislation	Permit/Approval/ License/Authorization	Required for the Project?	Applicability/Relevance to the Project
Provincial			
Clean Environment Act	*Environmental Impact Assessment Regulation:* EIA Registration	Yes	EIA Registration (likely limited to the determination review level) is required, since the Project involves the development of waterworks with a capacity greater than 50 cubic metres (m^3) of water daily (item (*s*) of Schedule A of the Regulation). EIA registration is also required for projects affecting 2 or more hectares of wetland, which may present a secondary trigger. While at the Minister's sole discretion, a comprehensive review is unlikely to be required.

Legislation	Permit/Approval/ License/Authorization	Required for the Project?	Applicability/Relevance to the Project
Clean Environment Act	*Water Quality Regulation*: • Water Quality Approval to Construct; and • Water Quality Approval to Operate.	No	An Approval under the *Water Quality Regulation* is not believed to be required currently or in the future because the Project is not considered a "source" of contaminants to watercourses.
Clean Water Act	*Watercourse and Wetland Alteration Regulation*: Watercourse and Wetland Alteration (WAWA) Permit Application	Possibly	A WAWA permit is required for work within 30 m of a watercourse or wetland before commencement of the Project. Any construction activities within 30 m of a watercourse or wetland will require a WAWA permit. However, given that there are no watercourses on site and wetlands on site are less than a hectare and not contiguous with a watercourse, a WAWA permit is not anticipated to be needed.
Clean Air Act	*Air Quality Regulation*: • Air Quality Approval to Construct; and • Air Quality Approval to Operate.	No	An Approval under the *Air Quality Regulation* is not believed to be required currently or in the future because the Project is not considered a "source" of contaminants to the atmosphere.
New Brunswick *Species at Risk Act*	Permit for killing, taking, or possessing a species listed as Extirpated, Endangered, or Threatened under NB SARA	Possibly	For Project works that would cause the unavoidable destruction or harm to species at risk and/or their critical habitat, should such an event occur (not currently planned, but field work may identify unanticipated species at risk).
Crown Lands and Forests Act	Land use, ownership, commercial and industrials activities permit application(s) (License of Occupation)	No	A License of Occupation (LOO) is not required because all features of the Project are located on privately-owned land, and no aspect of the proposed activities as part of the Project will be conducted on Crown land.

Legislation	Permit/Approval/ License/Authorization	Required for the Project?	Applicability/Relevance to the Project
Heritage Conservation Act	Archaeological Field Research Permit	Possibly	An archaeological impact assessment may be required for the Project if there is anticipated disturbance within an area of high archaeological potential.
	Site Alteration Permit	Possibly	A Site Alteration Permit is required for any alterations within 100 m of registered archaeological sites, should any be present. However, there are currently no known registered archaeological sites in proximity to the Project.
Federal			
Impact Assessment Act (IAA)	Impact Assessment	No	A federal impact assessment is not required since the Project is not a designated physical activity under the *Physical Activities Regulations* and there are no aspects of the proposed development activities of the Project that will be conducted on federal land.
Fisheries Act	*Fisheries Act* Authorization and Offsetting Plan	No	Temporary or permanent in-water works only that are determined by DFO result in harmful alteration, disruption or destruction of fish and fish habitat (DFO 2019) would require an authorization under the *Fisheries Act*. However, since it is anticipated that no in-water works will be associated with the proposed development activities as part of the Project, such an authorization is not required.
Species at Risk Act (SARA)	Environment and Climate Change Canada (ECCC)/Canadian Wildlife Service (CWS) Approval	Possibly	For Project works that would cause the unavoidable destruction or harm to species at risk and/or their critical habitat, should such an event occur (not currently planned, but field work may identify unanticipated species at risk).

Legislation	Permit/Approval/ License/Authorization	Required for the Project?	Applicability/Relevance to the Project
Migratory Birds Convention Act (MBCA)	ECCC/CWS Approval	Possibly	For Project works that would cause the unavoidable destruction or harm to migratory birds and/or their nests, or for work conducted between April 8 and August 28 (nesting zone C3 for southern New Brunswick) that may disturb or harass migratory birds, their eggs, their chicks, or their nests. CWS will be consulted.
Canadian Navigable Waters Act	Permit Application	No	This Project does not involve any activities that will disrupt water navigation and related activities.
Local			
Community Planning Act	Building permits, demolition approval, heritage approval, possible other permits required by the Village of Chipman, New Brunswick	Yes	Residential developments are likely to be subject to approvals under the *Community Planning Act*.

1.5 Purpose and Organization of this Document

The purpose of this EIA Registration document is to provide information to the NBDELG and its TRC as part of its review of the environmental effects of the Project in accordance with the EIA Regulation. The EIA Registration document provides a description of the Project, describes existing environmental conditions, identifies mitigation to be employed to minimize the environmental effects of the Project, and characterizes residual environmental effects of the Project after mitigation and best management practices have been applied.

This EIA Registration document is organized in 11 chapters, as follows:

- **Chapter 1** provides an introduction to the Project, including proponent information, a Project overview, the purpose, rationale, need for the Project, and an overview of the applicable regulatory framework;
- **Chapter 2** provides a high-level description of the Project as currently conceived, and describes how the Project may be carried out. Emissions and wastes from the Project are also described;
- **Chapter 3** provides an overview of the environmental setting of the Project;
- **Chapter 4** provides information on the scope of the EIA, and the methods that were used to evaluate the potential interactions between the Project and the environment;

- **Chapter 5** provides the assessment of potential interactions between the Project and the environment, on various valued components (VCs) of the environment that are of relevance and importance to this EIA Registration, for each applicable Project phase;
- **Chapter 6** provides an assessment of potential effects of the environment on the Project;
- **Chapter 7** provides an assessment of accidents, malfunctions, and unplanned events;
- **Chapter 8** describes planned Indigenous, public, and stakeholder engagement activities in respect of the Project;
- **Chapter 9** provides other information relevant to the EIA Registration to meet the requirements of the NBDELG's EIA Guide (NBDELG 2018a);
- **Chapter 10** provides closing remarks; and
- **Chapter 11** provides the references and personal communications cited in this EIA Registration document.

Additional supporting information is provided in the appendices to this EIA Registration document.

2.0 Project Description

This section provides a high level description of the activities that will be required to complete the Project, as currently conceived and based on the information available at the time of preparing the EIA Registration. Final engineering design for the Project is underway, anticipated to be complete mid-winter (early 2023) and is likely to evolve as Project planning and engineering design is completed. So as to not understate the potential environmental consequences of the Project at this conceptual planning stage, the Project description presents a conservative estimate of the scope, footprint and anticipated environment effects of the Project.

The key aspects of the Project are described below, including:

- The Project location and property ownership;
- A brief description of the existing properties to be developed as part of the Project (the conceptual subdivision layout);
- The activities that may be carried out during construction;
- The planned Project schedule; and
- Project-related emissions and wastes.

2.1 Project Location

The Project is located south of Forest Avenue School, in the Village of Chipman, Queens County, New Brunswick (**Figure 1-1**). The current condition of the subject properties (PID #45211679 and PID #45080470) are heavily wooded, greenfield areas, meaning that they have not previously been developed or built upon. These properties are surrounded by undeveloped and forested land, a school ground, a railroad corridor and a current construction site for a roadway extension, and six residential lots. The Forest Avenue School partially bounds the properties to the north; a cemetery and railroad right-of-way make up a small part of the property boundaries to the southwest and southeast respectively; and an active construction site that was expected to be completed by November 2022, (paving and landscaping are the remaining tasks to be completed on this property in the spring of 2023) makes up the west boundary of the lot. The geographic centre of the properties is at approximately latitude 46.180915 and longitude -65.865441. The subject properties (**Figure 1-1**) have a total combined area of approximately 14 ha, and are accessible via Forest Avenue to the north of the Project.

2.1.1 Project Development Area

The Project development area (PDA) is defined as the area of physical disturbance (or physical footprint) associated with construction and operation of the Project (**Figure 2-1**). Specifically, the PDA consists of an area of approximately 14 ha (i.e., conservatively assumed to be the entirety of PIDs #45211679 and 45080470) that may include mini-homes, roadways, roadside ditches, potable water wells, electricity distribution infrastructure, property grading, a stormwater retention basin, greenspace, and all related surface and subsurface utilities to be located on the properties.

The nearest major watercourse to the property is the Salmon River, which travels north-south to the west of the PDA. The distance between the centre of the PDA to the Salmon River is approximately 850 m to the northwest. There is a minor ephemeral watercourse that runs from the west side of the PDA to the Salmon River. This watercourse begins at the outlet of the culvert and carries stormwater runoff from the surface to the river.

2.1.2 Property Ownership

Both properties PIDs #45080470 and #45211679 were recently acquired by and are currently under the ownership of Chipman Housing Authority Inc., who will develop the properties. The two PIDs will be amalgamated into one larger property for development.

2.1.3 Siting Considerations

The Project location was selected due to its proximity to centre of the Village of Chipman. The target market for this housing development are workers of J.D. Irving's forestry operations; these are generally expected to be families with children. The close proximity of the school makes it the ideal location for this type of development. Other favorable conditions are the existing road infrastructure and ease of access to the site from the end of Forest Avenue, along with this location being appropriately sized for the required number of dwellings.

The selection of the subject properties for residential development was also guided by a groundwater assessment (**Appendix A**) and pre-development planning carried out by Dillon on behalf of CHA. Understanding that the Village of Chipman has faced water supply and water quality issues recently, it was important to complete a preliminary groundwater assessment. The assessment found adequate quantities of clean water to support the preliminary development plan. These early investigations, conceptual layout, and review of constraints resulted in several design-related decisions that will need to be made to meet the overall desired needs for the development, but no major constraints have been realized that would indicate significant impediments to development. One constraint is the presence of wetlands within PIDs #45211679 and #45080470.

As part of the pre-development planning, it was determined that the optimal location for site access would be through the South end of Forest Avenue, which is a low spot on the development site (**Figure 2-2**).

CHIPMAN HOUSING AUTHORITY INC.
Environmental Impact Assessment (EIA)

PROJECT DEVELOPMENT AREA
FIGURE 2-1

Road
Project Development Area
Property Boundary

0 20 40 80 Meters
SCALE 1:3,000

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: RP
MAP CHECKED BY: AY
MAP PROJECTION: NAD_1983_CSRS_NEW_BRUNSWICK_STEREOGRAPHIC

DILLON CONSULTING

PROJECT: 22-4686
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DATE: 2022-10-10

FILE LOCATION: K:\2022\224686\Product\Client\2022EIA\Figure 2.1 Project Development Area.mxd

2.2 Description of Project Components

The proposed process to develop the residential subdivision is discussed in this section. As stated previously, the subdivision layout is currently conceptual only, detailed design is projected to be complete mid-winter (early 2023).

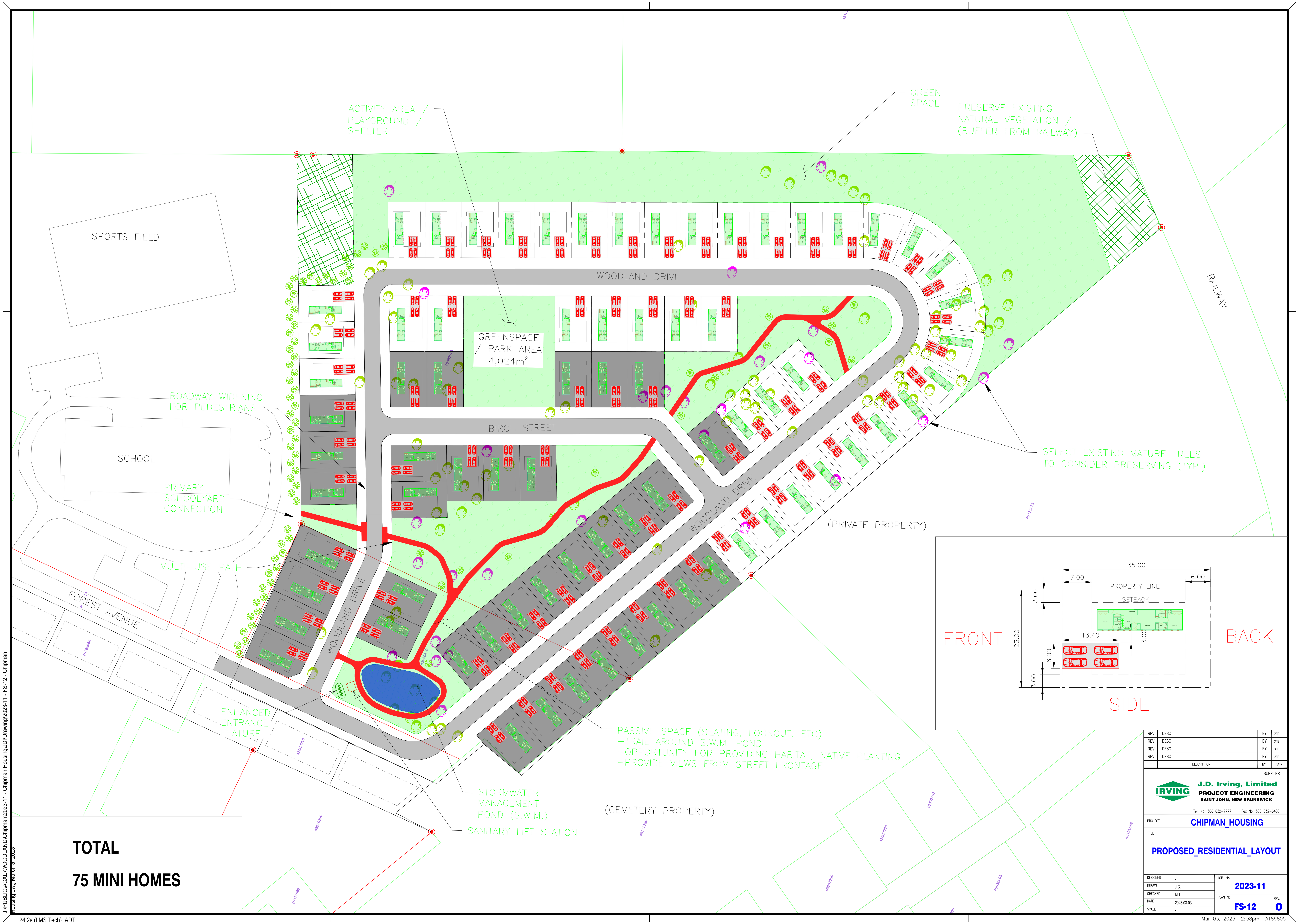
2.2.1 Conceptual Subdivision Layout

A full-sized copy of the tentative subdivision plan is presented in **Appendix B** and the proposed conceptual layout is shown in **Figure 2-3**. Key components of the proposed conceptual layout across the 14 ha developable area include:

- housing;
- site access and roadways;
- stormwater and surface water management; and
- pedestrian and greenspace areas.

As stated previously, the PDA comprises an approximate area of 14 ha which may be subdivided to support up to 75 dwellings. The development is proposed to include mini-homes without a basement. In addition to the dwellings, the development may include: stormwater collection, a stormwater management basin, and green space to create a welcoming and pleasant community environment.

The proposed conceptual layout (**Figure 2-3**) includes up to 75 dwellings, community green space, connection to the existing sports field at Forest Avenue School, and a multi-use pathway connecting the green spaces and sports field.



ACTIVITY AREA / PLAYGROUND / SHELTER
GREEN SPACE
PRESERVE EXISTING NATURAL VEGETATION / (BUFFER FROM RAILWAY)
SPORTS FIELD
RAILWAY
WOODLAND DRIVE
GREENSPACE / PARK AREA 4,024m²
ROADWAY WIDENING FOR PEDESTRIANS
SCHOOL
BIRCH STREET
PRIMARY SCHOOLYARD CONNECTION
SELECT EXISTING MATURE TREES TO CONSIDER PRESERVING (TYP.)
(PRIVATE PROPERTY)
MULTI-USE PATH
FOREST AVENUE
WOODLAND DRIVE
35.00
7.00
6.00
PROPERTY LINE
SETBACK
3.00
23.00
13.40
3.00
6.00
3.00
FRONT
BACK
SIDE
ENHANCED ENTRANCE FEATURE
PASSIVE SPACE (SEATING, LOOKOUT, ETC)
-TRAIL AROUND S.W.M. POND
-OPPORTUNITY FOR PROVIDING HABITAT, NATIVE PLANTING
-PROVIDE VIEWS FROM STREET FRONTAGE
STORMWATER MANAGEMENT POND (S.W.M.)
SANITARY LIFT STATION
(CEMETERY PROPERTY)
TOTAL
75 MINI HOMES
REV DESC BY DATE
REV DESC BY DATE
REV DESC BY DATE
REV DESC BY DATE
DESCRIPTION BY DATE
SUPPLIER
IRVING
J.D. Irving, Limited
PROJECT ENGINEERING
SAINT JOHN, NEW BRUNSWICK
Tel. No. 506 632-7777 Fax No. 506 632-6408
PROJECT CHIPMAN_HOUSING
TITLE PROPOSED_RESIDENTIAL_LAYOUT
DESIGNED -
DRAWN J.C.
CHECKED M.T.
DATE 2023-03-03
SCALE -
JOB. No. 2023-11
PLAN No. FS-12
REV. 0
Mar 03, 2023 2:58pm A189805
24.2s (LMS Tech) ADT

2.2.1.1 Housing

As previously stated, the development is proposed to include mini-homes. The total estimated hard surface area to be created by the housing developments is 2.5 ha. Electricity will be provided to the dwellings through a typical overhead network of utility poles installed, operated and maintained by the New Brunswick Power Corporation. Pending the results of the WSSA, it is anticipated that the lots will be serviced by individual domestic wells to provide water to the dwellings. All lots will be serviced by a gravity sanitary sewer system that will tie into the existing sanitary sewer system in the Village of Chipman.

2.2.1.2 Site Access and Roadways

The proposed streets within the proposed development will be constructed based on the New Brunswick Department Transportation and Infrastructure (NBDTI) requirements and standards. As stated previously, site access will extend from the South end of Forest Avenue. Proposed roads to extend beyond Forest Avenue include Woodland Drive, with Birch Street connecting and running roughly North-South between the Woodland Drive loop (see conceptual plan layout in **Figure 2-3**). The road names may be subject to change. The conceptual road designs include a 24 m wide right-of-way concept with open ditches on each side of the road. The approximate length of new roads to be constructed is 1,900 m, and may encompass an approximate hard surface area of 38,000 m^2 (3.8 ha).

2.2.1.3 Stormwater and Surface Water Management

Stormwater and surface runoff may be managed through the installation of a network of roadside ditches and an appropriately sized stormwater management basin to maintain the net surface water runoff the same after development as it was prior to it. Based on the preliminary design, the surface area of the basin will be approximately 0.24 ha. Aligned with standard best practice, and in accordance with the New Brunswick Department of Transportation and Infrastructure (NBDTI) Minimum Standards for the Construction of Subdivision Roads and Streets (NBDTI 2017), stormwater drainage should have no negative impact on existing infrastructure or property. Additionally, drainage should be designed to ensure no net increase from pre-development to post-development stormwater discharge to receiving watercourses at peak conditions during a 1:100 year storm event. The basin is proposed to discharge into the existing road ditch. It should be noted that the basin will not contain standing water.

Based on a review of available Light Detection and Ranging (LiDAR) data, the PDA was found to consist of relatively uniform grading falling from the southeast to the northwest, which indicated no major constraints to detailed design or earthworks. The general direction of flow of surface water from the PDA heads west toward the Salmon River and does not indicate significant low areas where pooling water could form as a result of typical surface water runoff. The highest point of the PDA is in the southeast corner at approximately 29 m above mean sea level (m amsl), and the lowest point of the site is toward the northwest corner at approximately 13 m amsl, having a total elevation difference across the PDA of approximately 16 m. The topographic gradient of the proposed development area will allow water to flow to the proposed stormwater management basin near the end of Forest Avenue, without a drastic change in the direction of flow, before leaving the PDA.

The proposed stormwater management basin to be created as part of the Project development is designed to be a feature in the landscape. The stormwater management basin is proposed to provide an open greenspace and passive recreational opportunities (refer to **Figure 2-3**). The design layout of the stormwater management basin may be natural in appearance and surrounded with native plantings and landscape features to reduce the engineered appearance.

2.2.1.4 Wastewater Management

Preliminary findings show that the PDA topography is amenable to a gravity sanitary sewer following the road network to the entrance of the subdivision at the south end of Forest Avenue; however, the connection to the existing sanitary manhole at this location would require a substandard depth of cover and bare minimum slope, which could require regular flushing to keep the lines clear. The alternative and preferred approach is to install a small wastewater pumping station and forcemain to send the wastewater from the entrance of the subdivision to the existing sanitary sewer manhole on Forest Avenue. Additional details of the approach to liquid and solid human waste management during the construction phase are presented in **Sections 2.6.3** and **2.6.4**, respectively.

2.2.1.5 Pedestrian and Greenspace Areas

An eastern greenspace may be created to provide a central common greenspace and focal point within the community. A greenspace corridor within the residential development may be created to facilitate continuous, uninterrupted movement through the community. This 'backyard' green corridor could provide an opportunity to incorporate new green connectors/trails, providing for both passive and active recreation opportunities for residents such as walking and cycling. A primary multi-use path along the greenspace corridors could be included to facilitate safe and accessible pedestrian circulation between green spaces, and include linkages to the adjacent school and other key areas.

2.3 Description of Project Activities

A description of the various activities associated with the Project is provided in this section. As noted in **Sections 2.0** and **2.2**, the engineering design of the Project is currently underway. As such, the Project Description provided in this Section presents a high-level "outer envelope" or conservative estimate of the scope, footprint, and anticipated environmental effects of the Project. The Project will ultimately be completed such that the resulting environmental effects remain within the outer envelope as presented in this EIA Registration.

Construction of the Project is anticipated to start in 2023 and is expected to be completed in 2025. The development may proceed from west to east and start with clearing and grubbing which is planned for the early spring. Road construction may also proceed in a west to east direction. Lots may be developed to support mini homes. A stormwater management basin may also be constructed, greenspace park areas may also be incorporated. Construction of overhead electrical lines and utility poles, community domestic water wells and sanitary sewer connection to the Village will also occur.

Key components of the proposed Project activities include:

- Construction – Includes site preparation activities such as clearing, grubbing, site grading, and lot construction; and
- Operation – Includes lot, greenspace, and road maintenance prior to transferring of maintenance duties to the Village of Chipman and individual property owners.

2.3.1 Construction

Construction will be initiated following the completion of the EIA review and the receipt of all required permits, approvals, licenses, authorizations, or leases required for the Project (assumed to be spring 2023). Construction will begin with site preparation activities including vegetation clearing, grubbing, site grading, and lot construction. It is estimated construction each year may take approximately 3 to 4 months to complete (see **Section 2.4** for additional information). A third-party heavy equipment contractor will implement construction activities for the Project. A high-level description of each of the activities associated with the construction of the Project is provided below.

2.3.1.1 Clearing

The areas selected for development each year will be cleared of trees, shrubs, and other ground vegetation to make way for the Project components described in **Section 2.2**. Clearing is estimated to be completed over a period of 1 to 3 months (depending on the total area to be selected for development). Clearing may be completed using a mechanical harvester supplemented by a bulldozer and manual removal methods (e.g., chain saws, brush saws), if required. Mature trees should be maintained to the extent possible. A conservative estimate of 13.7 ha of vegetation (i.e., the entire area of the PDA minus the existing vegetation to be maintained as a buffer near the railway [refer to **Figure 2-3**]), may be cleared within the PDA. Merchantable timber should be directed to the local sawmill, otherwise other timber, brush, and slash should be taken off-site to an appropriate waste site.

2.3.1.2 Grubbing

Grubbing includes the removal and disposal of stumps and roots that remain after the Project site has been cleared. Grubbing will follow clearing and be conducted using a skidder or bulldozer to remove the roots and stumps. It is estimated that grubbing may take 1-2 months. It is estimated the entire cleared portion of the PDA may be grubbed, approximately 13.7 ha. Grubbing wastes should be taken off-site to an appropriate waste site.

2.3.1.3 Site Grading

Site grading will be completed to achieve the grade/elevation for the construction of Project infrastructure (e.g., roads, ditching, and housing). Grading should occur such that there should be a balance of cut and fill volumes using on-site materials if possible. It is estimated that 10,000-20,000 m^3 of earth may be moved around on the PDA to achieve finals grades. Excavation to be associated with this Project may include excavations for: the residence foundation; connection of the groundwater wells; connection to the municipal sanitary wastewater system; ditching; roadway construction; and stormwater management basin. Fill may be obtained from approved off-site borrow sources if material is unable to be reused from excavations. Fill should be clean material that is ensured to be non-acid generating in order to protect the adjacent environment.

2.3.1.4 Road Construction and Ditching

The roads to be developed include: Woodland Drive and Birch Street. Woodland Drive is planned to extend from the South end of Forest Avenue run roughly West/East, then loop back running North/South before connecting back to Forest Avenue. Birch Street is anticipated to run roughly North/South and connect Woodland Drive (**Figure 2-3**). The streets should be constructed at an average grade of 3.5% up to 5% maximum grade. A granular base will be used under the 24 m right-of-way roads prior to final finishing through paving. It is estimated that 3,780 tonnes of asphalt concrete paving may be required to complete the roads.

2.3.1.5 Lot Construction, Footings and Foundation Construction, Modular Home Installation, and Landscaping

Lot construction may involve infilling the areas required on each lot for building wells, driveways, and residences. Lots should be prepared by levelling of the areas using mobile equipment such as excavators, front end loader, bulldozer, and dump trucks.

Dwellings on the lots will be built using materials that meet applicable standards and codes to maintain structural integrity; these may be constructed in a modular fashion at manufacturing facilities elsewhere, and may be transported to the individual lots using flatbed trucks and assembled on-site. Footings for the dwellings will be constructed to building code standards using concrete from local approved ready-mix concrete plants. Energy efficient materials for dwelling construction may also be used to reduce the long-term carbon footprint of the dwellings.

Once the lots are developed, the remaining exposed lands should be landscaped. It is expected that those lands may be landscaped with a typical residential-style lawn, trees, and gardens.

2.3.1.6 Utilities Construction

CHA will appoint private developers to carry out the installation of the services infrastructure (i.e., potable well, stormwater basin and collection, sanitary sewer piping+ and infrastructure [lift station] construction, and electrical distribution).

Energy supply to the units will be provided through connection to the New Brunswick Power grid via overhead lines and utility. Water supply will be maintained through the local aquifer and provided via individual and/or communal domestic wells. Drilling and installation of the groundwater wells will be done by a qualified and licensed water well driller. Sanitary wastewater will be collected through plumbing, transported through underground piping and/or a sanitary lift station, and then connected to the existing municipal sanitary sewer system.

2.3.2 Operation

Operation of the Project will begin following completion of construction and will include occupation of the residential subdivision by skilled workers to support local forestry operations. The Chipman Residential Subdivision Project may serve up to 75 dwellings upon its completion. Operation should continue after construction is complete until the Village of Chipman takes over the long term maintenance of the municipal infrastructure and individual lots are sold to families.

Operation may include routine maintenance of the subdivision and include general landscaping during the summer months (e.g., lawn mowing, gardening, mulching, fertilizing, etc.), snow and ice removal during the winter months (e.g., snowplowing, application of salt and sand, etc.), and garbage removal throughout the year. The properties within the Project will be originally owned by CHA but are intended to be sold to private owners, at which time the routine maintenance will become the responsibility of the owner.

2.3.3 Decommissioning

Decommissioning of the Project is not envisioned at this time. The ultimate fate of the dwellings at the end of their useful life or once they are no longer needed will be determined by the individual homeowners.

2.4 Project Schedule

Following the completion of the EIA review and after obtaining all applicable permits, it is projected that the development work would begin in the spring of 2023. The development may begin with the West side of the development and move East with the streets running North/South. The anticipated Project schedule (subject to change) is provided in **Table 2-1**.

Table 2-1: Conceptual Project Schedule

Season/Year	Planned Activity
Fall 2022	Subdivision Conceptual Design
Winter 2023	EIA Registration Submission and Review Period
Winter 2022 - 2023	Detailed Design and Tendering
Spring 2023	Approval to Construct
Spring 2023 - Spring 2025	Clearing and Grubbing (spring); Site Grading, Road Construction and Ditching, Lot Construction and Operations (spring, summer and fall); Operations upon completion of housing development

The Project schedule has not been fully defined at this planning stage, but the entire site clearing, grading and construction is expected to take an estimated 4-6 months.

For the purpose of this EIA Registration, it has been assumed that the requisite regulatory approvals would be received by spring/early summer of 2023. It is estimated site clearing continue for a period of 2-3 months. An additional 2-3 months is estimated to complete the site grading, lot construction and construction of all the dwellings, greenspace areas, stormwater management basin, and related infrastructure (i.e., electricity hookup, sanitary sewer collection lines, sanitary lift station, and domestic water well installation).

It is anticipated that construction activities would mostly occur during the daytime (7:00 a.m. to 7:00 p.m.), Monday to Friday excluding holidays. Activities may occur during the nighttime (7:00 p.m. to 7:00 a.m.) or on weekends or holidays, but these should consist of non-intrusive activities that generate little noise.

2.5 Workforce

The workforce required for constructing and operating the Project is relatively modest, given the simple nature of the Project and its intended purpose. While specific labour projections have not been completed at this time, it is estimated that a crew size of 5 to 10 people would be required for the construction activities.

During construction, activities will be carried out largely by a third-party heavy equipment contractor who will implement site clearing, grading, road construction, and related construction activities for the Project. The contractor should work under the supervision of a CHA representative (or designate).

During operation, CHA should maintain the properties and be responsible lawn and greenspace maintenance. This may be completed with a modest crew size of 1-2 people.

2.6 Emissions and Wastes

The anticipated emissions and wastes associated with the Project are discussed in this section. CHA, through the conditions of the various permits and approvals they may receive to enable the commissioning of the Project, will meet or exceed the compliance standards outlined in applicable regulations and guidelines with respect to waste, emissions, and discharges from the Project. Where no such standards exist, industry best practices may be adopted, where applicable. Emissions and wastes should be reduced through best management practices, following applicable legislation, and mitigation planning.

2.6.1 Air Contaminant Emissions

Air contaminant emissions from the Project will occur primarily from dust generated from construction activities as well as from fossil fuel combustion in trucks and mobile equipment used to accomplish those activities. Emissions of concern are generally classified as criteria air contaminants (CACs) and include carbon monoxide (CO), nitrogen oxides (NO_X), sulphur dioxide (SO_2), and total particulate matter (PM, including its size fractions PM_{10} and $PM_{2.5}$). Given the relatively straightforward nature of the Project, measurable emissions of other air contaminants (other than greenhouse gases) are not expected.

Emissions over the course of Project will be generally related to the generation of dust and routine emissions from construction equipment or other construction activities. Equipment used during construction may include: dozers, backhoes, chain saws, excavators, flatbed trucks, concrete mixers, dump trucks, grader trucks, and domestic well installation equipment (drill rig). Control measures such as use of dust suppression techniques may be used, if required, to reduce the fugitive dust. As well, routine inspection and maintenance of construction equipment may be undertaken to reduce exhaust fumes. Timing of activities to avoid undue nuisance to off-site receptors such as nearby residents (e.g., limiting intrusive activities to between 7:00 a.m. and 7:00 p.m. Monday to Friday [i.e., average daylight hours]) may be undertaken to limit nuisance noise and dust as necessary. The burning of waste brush/slash material on-site will not be permitted.

Greenhouse gas (GHG) emissions from the Project, consisting of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), as carbon dioxide equivalents (CO_2e), will be generated from fossil fuel combustion in trucks and mobile equipment used to accomplish the construction activities. In addition, the loss of some carbon sinks will occur from clearing and grubbing activities as trees and carbon absorbing soils are removed. Given the relatively straightforward nature and short duration of the Project activities, these emissions are not expected to be substantive.

Emissions during the operation phase of the Project will be indirectly related to the home energy needs connected to the provincial power grid; however, the use of energy efficient home designs and building materials, which are proposed to be used for the project, should limit energy needs. It is anticipated that the homes would be heated by electric baseboard and/or split system heat pumps. Furthermore, given the relatively small size of the Project, it is not anticipated that the increase in emissions due to the long term use of the homes within the subdivision to be substantive.

An assessment of environmental interactions due to Project-related air contaminant emissions and GHG emissions is provided in **Section 5.2**.

2.6.2 Noise

Noise emissions from the Project will occur primarily from the operation of mobile equipment for use during the construction activities. Noise will be intermittent as equipment will be operated on an as-needed basis as construction is taking place, and mostly during daytime hours. Noise sources may be mitigated through the use of mufflers on all equipment, carrying out routine maintenance of equipment to maintain it in good working order, and limiting intrusive noise-producing operations to daytime (7:00 a.m. and 7:00 p.m., Monday to Friday) as necessary.

An assessment of the interactions between the Project and the acoustic environment is provided in **Section 5.3**.

2.6.3 Liquid Wastes

Liquid wastes generated during construction activities may consist of oils and lubricants from mobile equipment. These wastes are considered dangerous goods and will be collected and disposed of in accordance with applicable local and provincial regulations. Contractors and their equipment will be prepared with spill kits on site to contain any liquid waste spills and all applicable environmental requirements will be followed with respect to refueling and dangerous goods.

There will be no permanent fuel storage, or equipment maintenance on-site; as such, the generation of liquid wastes (including liquid hazardous wastes) from the Project is not expected. Portable toilets may be used on-site, which will be collected and disposed of in accordance with local and provincial standards. Runoff may be managed using erosion and sediment control measures (i.e., silt fencing), and by directing flow into ditches and the stormwater management basin.

2.6.4 Solid Wastes

Given the relatively simple nature of the Project, few solid wastes are expected to be generated from the Project. Soils from earth moving activities during grading and levelling may be reused in shaping and contouring the site. Grubbing waste and non-merchantable timber from clearing will be disposed of off-site.

Any garbage and other refuse within the PDA during construction may be managed by storage in an on-site dumpster and periodically removed by a waste disposal contractor for disposal at an approved and licensed Solid Waste Commission landfill. There should be no permanent storage of dangerous goods, or equipment maintenance on-site; as such, the generation of solid wastes (including solid hazardous wastes) from the Project is not expected.

3.0 Overview of Environmental Setting

A high-level overview of the environmental setting for the Project is provided in this section. Additional detail regarding the existing conditions of each Valued Component considered in the EIA registration is provided in **Section 5.0**.

3.1 Physical Setting

3.1.1 Physiography and Geography

The Project is located in Queens County, in the Village of Chipman, in south-central New Brunswick, approximately 60 kilometres (km) northeast (straight-line distance) of the capital city of Fredericton. The Project is located within the Salmon River watershed, the river flows north-south approximately 800 m west of the PDA. Additional information on the physiography and geography of the PDA is provided in **Section 5.0**.

3.1.2 Topography and Drainage

To a large degree, the landscape of the PDA reflects the shape of the underlying carboniferous aged sedimentary bedrock; generally, the softer sedimentary rocks are characterized by low relief (Zelazny 2007). As stated in **Section 2.2.2**, elevations through the PDA are approximately 29 m above mean sea level (m amsl) at the highest elevation in the southeast corner to 13 m amsl at the lowest elevation in the northwest corner, gradually sloping downward and west towards the Salmon River.

3.1.3 Surficial Geology

The native surficial soils in the PDA consist of a blanket of marine sediments over bedrock, generally 0.5 to 3 m thick, of sand, silt, gravel, and clay deposited in shallow marine water which submerged coastal areas and many valleys during and following Late Wisconsinan deglaciation (Rampton 1984). According to the driller's reports from the preliminary groundwater assessment (**Appendix A**), surficial materials in the PDA consists of brown sandy clays and clays ranging in thickness of 4 to 6 meters.

3.1.4 Bedrock Geology

The bedrock geology of the Chipman area, underlying the PDA, is made up of the Minto Formation. These formations are late Carboniferous aged, sedimentary deposits that form part of the Pictou Group. Minto Formation is grey to red, fine to medium-grained sandstone; grey, green and red mudstone; minor grey and red, granule to cobble conglomerate and contains traces of coal (Smith 2007).

3.2 Biophysical Setting

3.2.1 Climate

New Brunswick has a humid continental climate, with slightly milder winters on the Gulf of St. Lawrence coastline. Southern New Brunswick experiences a more moderate maritime climate than the northern or central parts of the province as the Bay of Fundy never fully freezes, thus moderating the winter temperatures and providing generally cooler summer temperatures compared to other inland locations.

The nearest representative weather station to the Station to the PDA is located at Coles Island (approximately 29 km south). According to the Government of Canada (GOC) Canadian Climate Normals from 1981 to 2010, on average, temperatures are lowest in the winter and early spring, and highest during the summer months. Daily averages range from a low of -8.7°C in January to a high of 19.1°C in July. Precipitation, on average, is highest during the spring from March to May (GOC 2022a). From 1981 to 2010, the region has received an average of 1,079.0 mm of precipitation per year, of which 847.7 mm was rain and 231.3 cm was snowfall (as water equivalent) (GOC 2022a).

More information on anticipated climate conditions within the PDA is available in **Section 5.2**.

3.2.2 Atmospheric Environment

The Project is located in a rural, mostly forested area with limited residential dwellings nearby in the Village of Chipman. Some industrial sources, which tend to release air contaminants, are located nearby in the cities of Fredericton and Moncton (approximately 85 km east of Chipman). Sources of air contaminants in the immediate vicinity are mainly limited to vehicle and home heating emissions as well as the local sawmill. The low population density and rural character of the Chipman area, and the lack of substantive emission sources in the area, likely contribute to favourable ambient air quality.

Based on data from the National Air Pollution Surveillance (NAPS) (2022), in general, air quality in Fredericton, which is the closest representative station to the PDA (approximately 60 km southwest of the Village of Chipman) can be characterized as good to very good, most of the time, with occasional short-term periods of poor air quality (particularly in summer). By extension, ambient air quality in more rural areas of South-central New Brunswick (such as the Chipman area) can be inferred to be equivalent to, or better than, that in Fredericton.

3.2.3 Freshwater Environment

The main waterbody/watercourse in the vicinity of the Project is the Salmon River, which flows within Queens, Sudbury, Northumberland, and Kent counties. The main branch of the Salmon River, upstream of the Village of Chipman, is approximately 55 kilometres long (straight-line distance) and flows southwesterly from its headwaters near Harcourt into Grand Lake, which in turns flows into the Saint John River. There are at least 28 fish species in the Saint John River watershed, including American eel (*Anguilla rostrata*), Atlantic salmon (*Salmo salar*), banded killifish (*Fundulus diaphanous*), yellow perch (*Perca flavescens*), four spined stickleback (*Apeltes quadracus*), gaspereau (*Alosa pseudoharengus*), smallmouth bass (*Micropterus dolomieu*), brown bullhead catfish (*Ameiurus nebulosus*), common shiner (*Luxilus cornutus*), and white sucker (*Catostomus commersonii*) (NBDELG 2007), among others. Due to its connection with the Saint John River, the Salmon River and its associated tributaries have the potential to support these and possibly other fish species as well.

3.2.4 Terrestrial Environment

The Project is located within the Grand Lake Lowlands ecoregion and, more specifically, within the Maquapit ecodistrict. The landscape presents a gently sloping basin filled with Grand Lake, Washademoak Lake, and their feeder streams. Elevations are less than 120 m amsl at the ecodistrict perimeter and drop gradually inwards toward Grand Lake in the centre of the ecodistrict (Zelazny 2007).

Mixed stands of red spruce (*Picea rubens*) and hemlock (*Tsuga sp.*), with red maple (*Acer rubrum*), white birch (*Betula papyrifera*), and trembling aspen (*Populus tremuloides*), form the most common forest cover in the Grand Lake Lowlands and are associated with the better drained upland soils. White pine grows throughout the lowlands but is particularly dominant on lower slopes and flatlands of the ecoregion. Black spruce (*Picea mariana*) prevails on the acidic, poorly drained upland soils and in the numerous bogs of this ecodistrict (Zelazny 2007).

3.3 Socioeconomic Setting

3.3.1 Demographic and Economic Overview

The Project will be located within the Village of Chipman Census Subdivision. The population of this Census Subdivision in 2021 was 1,201, which represents an 8.8% increase from the 2016 population numbers (Statistics Canada 2022). The population density of the Village is 63.2 persons per square kilometre, compared to 10.9 for the province. The age distribution of people living in the Village of Chipman for the 2021 Census indicates that the largest proportion of the population is in the 55-64 age group, followed by the 65-74 age group. The number of dwellings occupied by usual residents, or the main dwelling in which the person lives most of the time, in the Village is 605, while the total number of private dwellings is 647 (Statistics Canada 2022).

At the time of preparing this EIA Registration, economic data were not publicly available from the 2021 Census and as such, the 2016 Census dataset was reviewed. The median total income level of those that live in the Census Subdivision is $23,040, based on 2016 Census data. Most of the people who lived in the Census Subdivision in 2016 commuted within the Census Subdivision for work (57%). The majority of the workforce was in health care and social assistance fields as well as manufacturing industries (Statistics Canada 2017). In terms of occupations, 27% of residents work in trades or manufacturing related fields, followed by sales and service occupations at 24% (Statistics Canada 2017). Education levels are low, with over 40% of the population having their highest level of education as a high school diploma, and 28% without a high school diploma. By comparison, 28% of New Brunswick has their highest level of education as a high school diploma, and 22% have not completed high school (Statistics Canada 2017).

3.4 Land Use

The Project is located in the Village of Chipman, Chipman Parish, Queens County, in Southcentral New Brunswick, approximately 60 km northeast (straight-line distance) of the capital city of Fredericton. Chipman is a small rural community with land use generally focused on residential, forestry, and agricultural uses.

The PDA is located within the Regional Service Commission (RSC) 11, which is an administrative region comprised of 29 local service districts (LSDs), the Villages of Cambridge-Narrows, Chipman, Fredericton Junction, Gagetown, Millville, Minto, New Maryland, Stanley, and Tracy, the rural community of Hanwell, and the towns of Nackawic and Oromocto. Development in the Village of Chipman is guided by the Village of Chipman Rural Plan, adopted in 2010. RSC 11 facilitates the Village's development services including permitting and inspections (NBDELG 2022a).

The Province undertook local governance reform initiatives that dissolved the Village of Chipman at the end of 2022. The Village is now amalgamated with surrounding local service districts to become the municipality of Grand Lake (NBDELG 2022a). The Village of Chipman Rural Plan will remain in effect until the municipality of Grand Lake repeals the document by adopting a new land use plan.

Residential land use in the vicinity of the PDA is a linear pattern along the main roads, primarily Main Street, Maple Street and Red Bank Drive. Over 100 residential dwellings are located within a 1 km radius of the Project site. Other land uses within the general vicinity are limited to the Forest Avenue School as well as a cemetery west of the Project.

3.4.1 Infrastructure and Services

The Project is within RSC 11 and the Village of Chipman, which is surrounded by, but separate from Chipman Parish. The RSC provides solid waste collection, with emergency services provided by the Province of New Brunswick and policing provided by the Royal Canadian Mounted Police (RCMP). Residential lots near the Project are serviced by private, on-site wells and a municipal wastewater system. Storm water is managed by road-side ditching systems. New Brunswick Department of Transportation and Infrastructure (NBDTI) manages the highways that bypass the immediate Project area, whereas the local roads/streets that will service the PDA will be managed by the municipality.

3.4.2 Built Heritage

According to the New Brunswick Register of Historic Places, designated provincial and local historic places in the province could not be identified within the PDA. The nearest designated Provincial Historic Sites are the Chipman Community Heritage Centre and Darrah's Insurance Ltd. buildings at 238 and 267 Main Street respectively, both approximately 1.3 km southwest of the Project (NBDTHC 2022). Both buildings mentioned above are also listed on the Canadian Register of Historic Places (CRHP) (Parks Canada 2022).

3.4.3 Archaeological and Palaeontological Resources

Due to the distance from navigable watercourses, the potential for discovery of archaeological resources is anticipated to be low for the PDA.

The bedrock geology in the Project area consists of carboniferous-aged terrestrial sediments (i.e., sedimentary rock). Although sedimentary rock is conducive to fossil presence, the Project is located in a region that would have been impacted by the most recent glacial period (i.e., the Wisconsin Glaciation) and would have been beneath the Laurentide Ice Sheet from approximately 18,000 years Before Present (BP) until approximately 16,000-15,000 BP when the ice retreated in Atlantic Canada (Fader 2005).

3.4.4 Traditional Land and Resource Use

As stated previously, the Project lies within the Maquapit Ecodistrict, which is part of traditional territory of Wolastoqiyik and Mi'gmaq peoples, and was likely used for traditional purposes before the arrival of Europeans. The Maquapit Ecodistrict possesses marshes, lakes, and rivers with abundant fish, waterfowl, wild rice and other food sources, and is located along major native portage routes between the Saint John River, the Miramichi River, and the Northumberland coast (Zelazny 2007).

The areas surrounding the Project may still be used by Indigenous people for traditional practices such as hunting, fishing, ceremonial, and gathering purposes. It is more likely that hunting, fishing, ceremony, and gathering would currently take place within other areas with less restrictions for access and use.

4.0 Environmental Impact Assessment Registration Scope and Methods

Environmental impact assessment (EIA) is used as a planning tool in the initial stages of project conceptualization, planning, and design. Its intention is to identify or predict Project-related effects (based on results of scientific assessment or traditional knowledge), as well to design mitigation strategies to avoid, reduce, or eliminate adverse environmental effects. The scope of the assessment and the methods used to prepare this EIA Registration document, including the characterization of the factors to be considered, and the details of the assessment of each valued component (VC) of the environment are provided below.

4.1 Scope of the EIA Registration

As noted in **Table 1-2**, the proposed Project must be registered under the New Brunswick EIA Regulation. This EIA Registration document is intended to fulfill the requirements for registration of the Project under the provincial regulation, to initiate an EIA review of the Project by a technical review committee (TRC); however, as described in **Table 1-2**, there are no known requirements of the Project to be assessed under the federal *Impact Assessment Act* since the Project is not located on federal land and it is not listed in the *Physical Activities Regulations* under that Act.

As discussed in **Section 2.1.1**, the proposed Project includes the development of a residential subdivision. Development may include:

- Construction of a residential subdivision to support the installation of up to 75 family dwellings planned to be mini-homes;
- Development of a stormwater management basin, ditches, and greenspace such as parks and landscaping to create a welcoming and pleasant community environment;
- Development of residential subdivision infrastructure including local road network, electricity distribution infrastructure, individual and communal potable water wells, sanitary waste collection infrastructure, and the like to service the new portions of the residential subdivision only;
- The operation and routine maintenance of the subdivision by CHA including general landscaping during the summer months; and
- The maintenance of the finished residential properties until such time as they are sold to private owners, at which time the routine maintenance will become the responsibility of the homeowner.

The scope of the assessment carried out in this EIA Registration document includes the activities outlined above.

The scope of this EIA Registration does not include the following components or activities:

- The ongoing operation or maintenance of existing municipal, provincial, or utility-owned infrastructure in Chipman beyond that which is required for the residential subdivision, such as road development and maintenance, sewage collection and treatment infrastructure, electricity distribution infrastructure, and the like;
- The physical manufacturing of the mini-homes, since these may consist of modular components manufactured elsewhere and brought to the individual lots to be assembled in place;
- The ongoing operation and routine maintenance of the subdivision including general landscaping, snow and ice removal, garbage removal, and similar activities after the Project has been completed and accepted by the Village of Chipman, after which the responsibility for such activities will be handed over to the Village;
- The maintenance of the finished residential properties after they are sold to private owners, after which the routine maintenance will become the responsibility of the homeowner; and
- The decommissioning and abandonment of the Project or individual dwellings/properties after the end of their useful life or once they are no longer needed; their ultimate fate will be determined by the individual homeowners.

Dillon has prepared this EIA Registration to address the potential effects of the Project phases and activities described in **Section 2.3** on VCs The intention of the EIA Registration is to describe the following:

- Existing conditions generally in the PDA, based on desktop information and field surveys;
- Environmental interactions, proposed mitigation, and residual interactions for each VC of concern;
- Effects of the environment on the Project;
- Accidents, malfunctions, and unplanned events; and
- Consultation and engagement.

Supplemental information on wetlands within the PDA, specifically wetland functional assessments, could be provided at a later date as an addendum to the EIA. The supplemental information will provide more details on the environmental conditions within the PDA to support the information presented in this EIA Registration document.

Supplemental information on environmental surveys conducted by JDI personnel in 2022, including surface water, wetlands, vegetation and birds was also provided and available in **Appendix G**.

4.1.1 Selection of Valued Components

Valued components (VCs) are those components of the biophysical and human environments that are of value or interest to regulatory agencies, the public, other stakeholders, and Indigenous peoples. VCs are typically selected for assessment on the basis of: regulatory issues, legislation, guidelines, policies, and requirements; consultation with regulatory authorities, the public, stakeholders groups, and Indigenous groups; field reconnaissance, and professional judgment.

The VCs selected for this EIA Registration document and the rationale for their selection in relation to the Project are outlined below (**Table 4-1**).

Table 4-1: Valued Components for the Project, and Rationale for their Selection

Valued Component (VC)	Rationale for Selection of the VC
Atmospheric environment	• Emissions of particulate matter (e.g., dust) and combustion gases related to Project activities may interact with the atmospheric environment and adjacent residents and school.
Acoustic environment	• Sound related to Project activities may interact with adjacent residents and school.
Groundwater	• The Project may result in a change in surface water drainage and groundwater quantity as a result of lot development and installation and use of potable water wells.
Surface Water	• Although no permanent channels are present on the PDA, Project activities may directly interact with intermittent/ephemeral streams through site development and change in surface water drainage.
Fish and fish habitat	• Although the project will not directly affect watercourses, Project activities may interact indirectly with fish-bearing streams and fish habitat through sedimentation/erosion or spills during heavy rain events.
Vegetation and wetlands	• The Project may interact with vegetation and wetlands through the loss of vegetation and wetlands located in the PDA, with potential associated loss of biological functions through site development.
Wildlife and wildlife habitat	• The loss of immature vegetation on the PDA may result in the loss of wildlife habitat, and Project activities may interact with wildlife (e.g., sensory disturbance due to Project activities).
Socioeconomic environment	• The Project may interact with the socioeconomic environment with in a change in land use (i.e., change from a forested area to a residential subdivision). • The Project may result in increased trucking on provincial roads leading to the Project site during construction and increased traffic on provincial roads after completion of the Project. • The Project may interact with labour and economy through the generation of housing for employment and associated expenditures. This may increase community population numbers and increase demand on community resources.

Valued Component (VC)	Rationale for Selection of the VC
Heritage resources	• Any earth-moving activities related to the Project activities could result in the potential accidental discovery of previously unknown heritage resources that may be present on the PDA. • Heritage resources (e.g., archaeological, palaeontological, or built heritage resources) are protected under the New Brunswick *Heritage Conservation Act*. • Areas of high archaeological potential have been identified on-site.
Traditional land and resource use	• The Project is located in the traditional Wolastoqiyik territory. The PDA may have been historically used, and may also be currently used for practicing traditional activities such as hunting, fishing, trapping, and gathering through the practice of unextinguished Aboriginal and treaty rights. Consultation with Indigenous peoples is required at the planning stage of the Project to determine the extent of potential traditional land and resource use of the site.

4.1.2 Spatial Boundaries

The spatial boundaries for the assessment, which represent the area in which a potential effect could occur, are based on natural system boundaries for biophysical VCs and administrative/political boundaries for socioeconomic VCs. The spatial boundaries used in the EIA vary by VC and include the:

- **Project development area (PDA)**, the area of physical disturbance (or physical footprint) associated with the Project, as defined in **Section 2.1** (**Figure 2-3**); and
- **Local assessment area (LAA)**, where the Project may result in direct and indirect interactions with a VC. The LAA can be thought of as the “zone of influence” of the Project.

4.1.2.1 Local Assessment Area

The LAA is defined as the maximum area where Project-specific environmental interactions can be predicted and measured with a reasonable degree of accuracy and confidence (i.e., the zone of influence of the Project for each VC). The LAA, which can vary by VC, is summarized for each VC in **Table 4-2**. Further details on the LAAs used for each VC can be found in their respective VC sections of **Section 5.0**.

Table 4-2: Local Assessment Area for Valued Components

Valued Component	Local Assessment Area (LAA)
Atmospheric environment	A 1 km buffer around the PDA.
Acoustic environment	A 1 km buffer around the PDA.
Groundwater	A 250 m buffer around the PDA.
Surface water	A 30 m buffer on each side of watercourses within the PDA and watercourses that are within 30 m of the PDA.
Fish and fish habitat	A 30 m buffer on each side of watercourses within the PDA and watercourses that are within 30 m of the PDA.
Vegetation and wetlands	A 30 m buffer around the PDA including a 30 m buffer around any wetlands present in proximity of the PDA.

Valued Component	Local Assessment Area (LAA)
Wildlife and wildlife habitat	A 100 m buffer around the PDA.
Socioeconomic environment	The Village of Chipman.
Heritage resources	The footprint where ground disturbance will be taking place (the PDA).
Traditional land and resource use	The footprint where ground disturbance will be taking place (the PDA).

4.1.3 Temporal Boundaries

Temporal boundaries vary according to the different Project phases and potential effects. In typical construction phases, specific development-related effects are short-term (for example, effects related to the use of laydown areas for Project-related construction activities).

The temporal boundaries for the Project correspond to the timing of site preparation and construction activities of the construction phase as they are defined in the Project schedule in **Section 2.4**. It is currently anticipated that the construction phase may begin in the spring of 2023, on the condition that the EIA process is completed and appropriate permits and approvals have been received by CHA.

4.2 Environmental Impact Assessment Methods

This EIA Registration document was prepared through desktop level assessments and reconnaissance level field studies to confirm the predictions of the desktop assessments. In general, this EIA Registration document considers the following factors:

- Interactions between the physical activities associated with the Project and the existing environment;
- Mitigation measures that are technically and economically feasible and that would mitigate any anticipated significant adverse environmental effects of the Project, including requirements for follow-up studies or monitoring;
- Any change to the Project that may be caused by the environment;
- The environmental effects of malfunctions or accidents that may occur in connection with the Project; and
- Comments received from the public, Indigenous persons, First Nations, regulatory agencies, or other stakeholders.

As a first step in the EIA process, Dillon uses a streamlined and focussed approach in the preparation of the analysis of interactions between the Project and VCs. During the environmental effects analysis, Project-VC interactions are first identified through a matrix table. If a Project-VC interaction is not identified, a rationale is provided to explain its exclusion from the assessment.

Following the identification of Project-VC interactions, potential interactions that could occur with the VC in the absence of mitigation are outlined in each VC section, and mitigation and best management practices are outlined to lessen or eliminate the potential interaction between the Project and VCs.

Then, the anticipated Project-VC interactions following the planned application of mitigation are characterized, and potential environmental effects as a result of these interactions are predicted. The environmental assessment methods involved the following generalized steps:

- **Scope of VC** - This involves the scoping of the assessment for the VC, and includes a definition of the VC and a rationale for its selection and a description of the temporal and spatial boundaries. This step relies upon the scoping undertaken by regulatory authorities; consideration of the input of the public, stakeholders, and Indigenous communities (as applicable); and the professional judgment of Dillon and CHA.
- **Existing Conditions** - This step involves the establishment of existing (baseline) environmental conditions for the VC. In many cases, existing conditions expressly and/or implicitly include those environmental effects that may be or may have been caused by other past or present projects or activities that have been or are being carried out. Existing conditions were defined based on desktop information sources and field reconnaissance surveys.
- **Assessment of Project-VC interactions** - Project interactions with each VC are assessed. The assessment includes:
  - Description of how a potential interaction could occur (in the absence of mitigation);
  - Discussion of the mitigation and environmental protection measures that are proposed to avoid, reduce, or eliminate adverse interactions between the Project and the VC; and
  - Characterization of the interactions and prediction of potential environmental effects that could occur as a result of the interactions. All phases of the Project are assessed. The evaluation also considers the effects of the environment on the Project.
- **Summary** - A summary of the assessment for the VC is provided, leading to an overall conclusion in respect of the interactions and associated effects of the Project on the VC.

Accidents, malfunctions, and unplanned events that could occur from the Project are also assessed as part of the Project's EIA Registration.

5.0 Assessment of Environmental Interactions with the Project

An assessment of the environmental effects of the Project on each of the identified VCs is provided in **Section 5.0**. The identification of potential interactions between the Project and the VCs was completed in consideration of the overall Project and the proposed Project activities. The identification of Project-VC interactions was done for each Project phase in a matrix format (see **Section 5.1**) to determine which potential interactions may occur; justification was provided for those VCs for which the Project was not expected to interact.

For each VC for which an interaction with the Project was identified, a more detailed assessment was provided in a standalone section whereby:

- the scope of the VC was defined;
- existing conditions were established;
- potential interactions without mitigation were identified;
- mitigation to avoid, reduce, or eliminate environmental interactions were described; and
- residual interactions after the application of mitigation were discussed.

Where applicable, specific follow-up or monitoring plans to verify the effects predictions or the effectiveness of mitigation were described. The identification of potential interactions between the Project and the VCs was undertaken in consideration of the nature of the Project and its planned activities.

5.1 Project Interactions with the Environment

The potential interactions with the surrounding environment have been considered in terms of the current proposed plans for the Project, in particular the proposed development of a residential subdivision.

The initial screening (i.e., Project interaction matrix) provided in **Table 5-1** below helped to determine if an interaction was possible between the Project activities being carried out in each Project phase/activity and the VC. A qualitative rating system was used to evaluate the potential for interactions between the Project and the environment. One of the following two ratings was prescribed for each individual VC:

- An interaction between the Project and the environment could occur (which was identified with a checkmark in the matrix below), which were carried forward for further assessment; or

- No interaction occurred between the Project and the environment (which was identified by a blank cell in the matrix below), and therefore no further assessment was required and the issue was not discussed further.

Based on the Project description (refer to **Section 2.0**), the environmental setting (refer to **Section 3.0**), and the scope of the EIA (refer to **Section 4.0**), the potential interactions between the Project and the environment are summarized in **Table 5-1** below.

Table 5-1: Project Interactions between the Project and Valued Components

Valued Component (VC)	Activities to be Conducted	
	Construction	Operation
Atmospheric environment	✓	✓
Acoustic environment	✓	
Groundwater	✓	✓
Surface water	✓	
Fish and fish habitat	✓	
Vegetation and wetlands	✓	
Wildlife and wildlife habitat	✓	
Socioeconomic environment	✓	✓
Heritage resources	✓	
Traditional land and resource use	✓	✓

Legend: ✓ = Potential interaction

In **Table 5-1**, the interaction with a particular VC was identified when the interaction first occurred. VCs for which an interaction was anticipated to occur were carried forward in the environmental effects assessment in **Sections 5.2** to **5.11.** In the case of this Project, all identified VCs were carried forward for further assessment, although the Project was not expected to interact with several VCs during operation and thus an effects assessment was not conducted for those VCs during operation and the assessment was limited to the construction phase.

The rationale for several VCs having no interaction with the Project during operation relates mainly to the fact that interactions with these VCs would occur primarily during construction and once operation begins, no further disturbance of these VCs will occur beyond that which occurred during construction.

5.2 Atmospheric Environment

The potential interactions between the Project phases and activities and the atmospheric environment are assessed in this section.

5.2.1 Scope of VC

The atmospheric environment is defined as the layer of air above the earth's surface to a height of approximately 10 km. The atmospheric environment includes climate, air quality, and greenhouse gases (GHGs), which are characterized as follows:

- Climate is characterized by the long-term historical seasonal weather conditions of a region, which can include temperature, humidity, precipitation, sunshine, cloudiness, and winds, among other parameters. Statistical climate data from the federal government are typically averaged over a period of several decades, and climate "normals" are normally based on historical averages and extremes over a period of 30 years. The most recent climate normals publicly available from Environment and Climate Change Canada (ECCC) span a 30-year period of 1981 to 2010;
- Air quality is characterized by the composition of the ambient air, including the presence and quantity of air contaminants, such as particulate matter (PM), sulphur dioxide (SO_2), nitrogen oxides (NO_x), and others, in the atmosphere in comparison to applicable provincial air quality objectives; and
- Greenhouse gases (GHG), such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), are typically used as an indicator of the potential for environmental interactions with climate change. It is understood that GHG releases on a global scale from both natural processes or sources as well as from human activities are increasing global concentrations of GHGs in the atmosphere, contributing to climate change.

The atmospheric environment has been selected as a VC because the atmosphere helps maintain the health and well-being of humans, wildlife, vegetation, and other biota. The atmospheric environment constitutes a VC due to:

- Emissions of contaminants to the atmosphere during construction activities which may present a pathway for humans and biota to be exposed to air contaminants;
- Provisions regarding air contaminant emissions under the New Brunswick *Air Quality Regulation*; and
- Releases of GHGs and their accumulation in the atmosphere influence global climate and may affect emission reduction targets for GHGs that have been set or are being developed federally and provincially.

The assessment of the atmospheric environment considers the air contaminants that are typically associated with this type of project, which are regulated provincially (and in some cases federally). These air contaminants are generated from fuel combustion and fugitive dust generated from the movement of mobile equipment and material transfers during various construction activities. For the Project components and activities assessed herein, fugitive dust and combustion gases (including but not limited to sulphur dioxide [SO_2], carbon monoxide [CO], and nitrogen oxides [NOx]), and particulate matter (PM) are considered to be the potential contaminants of concern relating to air quality. Releases of GHGs from the combustion of fossil fuels in mobile equipment are also considered in relation to the potential for interactions with climate change.

Air quality in New Brunswick is regulated pursuant to the New Brunswick *Air Quality Regulation* under the *Clean Air Act*, administered by the NBDELG. Federally, the main instrument for managing air quality is the *Canadian Environmental Protection Act* (CEPA) as well as Canada-Wide Standards developed by the Canadian Council of Ministers of the Environment (CCME). In addition, the Canadian Ambient Air Quality Standards (CAAQS), developed by the CCME, provide additional ambient limits for nitrogen dioxide (NO_2), and additional standards for SO_2, fine particulate matter, and ozone (O_3) have been proposed. New Brunswick's *Air Quality Regulation* specifies maximum permissible ground-level concentrations for five air contaminants, namely total suspended particulate (TSP), CO, SO_2, NO_2, and hydrogen sulphide (H_2S) as presented in **Table 5-2** below.

Table 5-2: Ambient Air Quality Standards in New Brunswick

Air Contaminant	Averaging Period	New Brunswick *Air Quality Regulation* Maximum Permissible Ground Level Concentration (µg/m³)
Total suspended particulate (TSP)	24 hour	120
	Annual	70 (geometric mean)
Carbon monoxide (CO)	1 hour	35,000
	8 hour	15,000
Nitrogen dioxide (NO_2)	1 hour	400
	24 hour	200
	Annual	100
Sulphur dioxide (SO_2)	1 hour	900
	24 hour	300
	Annual	60
Hydrogen sulphide (H_2S)	1 hour	15
	24 hour	5

Source: New Brunswick Regulation 97-133

The LAA for the atmospheric environment includes the PDA as well as a 1 km around the PDA. Refer to **Figure 5-1** for a depiction of the LAA for the atmospheric environment. The nearest receptor to the Project is Chipman Forest Avenue School.

CHIPMAN HOUSING AUTHORITY INC.
Environmental Impact Assessment (EIA)

ATMOSPHERIC AND ACOUSTIC ENVIROMENT
FIGURE 5-1

- Atmospheric and Acoutic Source
- Highway
- Road
- Watercourse
- Local Assessment Area (PDA 1km Buffer)
- Project Development Area
- Property Boundary
- Waterbody

0 30 60 120 Meters

SCALE 1:10,000

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: RP
MAP CHECKED BY: AY
MAP PROJECTION: NAD_1983_CSRS_NEW_BRUNSWICK_STEREOGRAPHIC

DILLON CONSULTING

PROJECT: 22-4686
STATUS: DRAFT
DATE: 2022-10-11

FILE LOCATION: K:\2022\224686\Product\Client\2022EIA\Figure 5.1 LAA for Atmosphereic and Acuoustic Enviroment.mxd

5.2.2 Existing Conditions

Existing (baseline) conditions with respect to the atmospheric environment are discussed in this section.

5.2.2.1 Climate

New Brunswick has a humid continental climate, with slightly milder winters on the Gulf of St. Lawrence coastline. Northern New Brunswick experiences a subarctic climate, particularly in the more elevated area in the far north. Conversely, southern New Brunswick experiences a more moderate maritime climate than the northern or central parts of the province since the Bay of Fundy never fully freezes, thus moderating the winter temperatures and providing generally cooler summer temperatures compared to other inland locations. Inland portions of the province (including the Chipman area) tend to exhibit similar climate conditions to those in southern New Brunswick, with more hot humid days in summer but less fog than coastal regions.

Climate normals from the nearest representative weather station at Coles Island (located approximately 29 km straight-line distance from the Project) are presented in **Table 5-3**. Data at the Coles Island weather station are limited to temperature and precipitation; therefore, climate normals from the Fredericton (A) weather station Island (located approximately 66 km straight-line distance from the Project) are also presented in **Table 5-4** for additional context of climatic conditions of the regional area.

Table 5-3: Climate Normals, Coles Island, New Brunswick (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature Normals (1981 - 2010)													
Daily Average (°C)	-8.7	-8.0	-2.1	4.4	11.1	16.2	19.1	18.7	14.2	8.0	2.2	-4.9	5.8
Daily Maximum (°C)	-3.2	-2.0	3.3	9.5	17.2	22.6	25.1	24.8	20.0	13.0	6.3	-0.3	11.4
Daily Minimum (°C)	-14.1	-14.0	-7.5	-0.8	4.9	9.7	13.1	12.5	8.3	3.0	-1.8	-9.5	0.3
Precipitation Normals (1981 - 2010)													
Rainfall (mm)	42.4	27.6	56.7	65.5	94.5	73.8	84.2	71.6	88.1	109.3	79.4	54.7	847.7
Snowfall (cm)	53.1	47.6	45.0	21.6	1.3	0.0	0.0	0.0	0.0	1.0	15.3	46.4	231.3
Precipitation (mm)	95.5	75.2	101.6	87.1	95.8	73.8	84.2	71.6	88.1	110.3	94.7	101.1	1,079.0

Source: Canadian Climate Normals (GOC 2022a)

Table 5-4: Climate Normals, Fredericton A, New Brunswick (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature Normals (1981 - 2010)													
Daily Average (°C)	-9.4	-7.9	-2.4	4.5	11.1	16.2	19.3	18.4	13.6	7.5	1.5	-5.7	5.6
Daily Maximum (°C)	-3.8	-2.0	3.0	10.0	17.6	22.7	25.5	24.8	20.0	13.2	6.0	-0.7	11.4
Daily Minimum (°C)	-15.0	-13.7	-7.8	-1.0	4.6	9.7	13.0	12.1	7.1	1.6	-3.0	-10.7	-0.2
Precipitation Normals (1981 - 2010)													
Rainfall (mm)	38.0	31.4	46.7	68.3	94.5	82.4	88.3	85.6	87.5	88.2	92.9	55.3	859.1
Snowfall (cm)	69.9	47.5	49.4	18.6	1.4	0.0	0.0	0.0	0.0	0.8	14.3	50.5	252.3
Precipitation (mm)	95.3	73.1	93.2	85.9	96.2	82.4	88.3	85.6	87.5	89.1	106.3	94.9	1,077.7
Wind Normals (1981 - 2010)													
Maximum Hourly Wind Speed (km/h)	64	80	64	72	64	64	48	53	65	64	67	60	N/A
Direction of Maximum Hourly Speed*	W	S	W	SE	NW	W	SW	W	SE	NE	NW	NE	N/A

Source: Canadian Climate Normals (GOC 2022b)

Notes:

* indicates the direction from which the wind is blowing

N/A = not applicable

5.2.2.2 Ambient Air Quality

There is no ambient air quality monitoring station within the immediate vicinity of the Project. As well, no monitoring station is located in the regional area that collects data for every parameter; therefore, for the purpose of this EIA Registration, air quality is characterized using data collected from the NBDELG's ambient air quality monitoring station at Fredericton (approximately 66 km west-southwest of Chipman) as the closest representative station to the Project. The Fredericton monitoring station measures particulate matter less than 2.5 microns ($PM_{2.5}$), nitrogen dioxide (NO_2), and ground-level ozone (O_3). Although Fredericton is the closest ambient air quality monitoring station, the J.D. Irving Sawmill Grand Lake Timber is located in Chipman which may influence air quality in the area; therefore, the Fredericton air quality monitoring station may not be fully representative of conditions in Chipman.

The maximum measured concentrations from the Fredericton air quality monitoring station data for the respective averaging periods of each contaminant during 2019, as reported in the NBDELG's most recent ambient air quality monitoring report titled "2020 Air Quality Monitoring Results" (NBDELG 2022b) and its supplementary data report (NBDELG 2022c), are presented in **Table 5-5**. It is noted that since the data presented in these reports is in graphical form (i.e., raw numerical values are not presented in the reports), the values in the **Table 5-5** below are interpolated from the graphs and should be considered approximate.

Table 5-5: Ambient Air Quality Monitoring Data – 2020 Maximums – Fredericton Air Quality Monitoring Station

Air Contaminant	Averaging Period	Maximum Ground-Level Concentration Recorded in 2020
Particulate matter less than 2.5 microns ($PM_{2.5}$)	24 hour	21 $\mu g/m^3$
Nitrogen dioxide (NO_2)	1 hour	42 ppb
Ground-level ozone (O_3)	1 hour	54 ppb

The maximum reported values for each contaminant are below their respective ambient air quality standards and objectives.

NBDELG (2022b) identifies provincial "air zones" which assists the Department in managing air quality in these zones. The Central Air Zone, within which the PDA is located, is described as follows:

> *"The central air zone is the largest of the three provincial air zones, and occupies New Brunswick's middle latitudes. It encompasses five of New Brunswick's major population centers: Moncton, Dieppe, Fredericton, Miramichi, and Edmundston. Although small by international standards, these cities can experience "big city" air quality issues (that is, the combined impact from many small pollution sources in close proximity - vehicles, homes, businesses, etc.)." pg. 11*

In consideration of this information and the data presented in **Table 5-5**, the ambient air quality in the Fredericton region, and by extension the LAA, is generally moderate to good, most of the time.

5.2.2.3 Greenhouse Gases

Greenhouse gas (GHG) emissions in Canada totalled 672 megatonnes (Mt CO_2e, as CO_2-equivalents) in 2020 (ECCC 2022a), as published in Canada's most recent annual report on GHG emissions. Total GHGs for the province of New Brunswick were 12.4 Mt CO_2e in 2020, whereas they were 16.2 Mt CO_2e in 1990 and 19.8 Mt CO_2e in 2005 (ECCC 2022b). Since 2005, New Brunswick has seen a 62.6% decrease in total GHG emissions. There is no specific information available relating to GHG emissions from Chipman or surrounding areas.

5.2.3 Assessment of Potential Interactions between the Project and the Atmospheric Environment

The environmental effects of the Project on the atmospheric environment are assessed in this section.

5.2.3.1 Potential Interactions

Without mitigation, the Project could interact with the atmospheric environment in the following ways:

- Emissions of combustion gases from the combustion of fossil fuels by heavy equipment and vehicles associated with Project construction activities and from transport of materials on- and off-site could result in the release of air contaminants that could disperse in the atmosphere to off-site receptors which may include nearby residents, students and faculty at Forest Avenue School and any wildlife nearby;
- Emissions of fugitive dust from unpaved roads and parking areas, earth moving activities, and transport of materials on- and off-site during construction activities could be generated and disperse in the atmosphere to off-site receptors;
- Combustion of fossil fuels from the operation of mobile equipment and on-site trucks during construction activities could result in emissions of GHGs; and
- Generation of GHGs in the local area related to energy demands for home heating and cooling during the operation phase of the Project.

5.2.3.2 Mitigation

The following mitigation measures should be implemented to reduce environmental effects on the atmospheric environment:

- Vehicles and equipment should be maintained in proper working order to emission suppression standards;
- Limit the conduct of intrusive activities where possible to 7:00 a.m. to 7:00 p.m., Monday to Saturday and excluding holidays where possible;
- Implement a non-idling policy;
- Use of low sulphur fuel in combustion engines; and
- Homes should be built with energy efficient designs and materials.

5.2.3.3 Characterization of Potential Interactions Following Mitigation

Interactions between the Project and the atmospheric environment are expected to be primarily related to the Project construction phase, in particular the operation of heavy mobile equipment and vehicles and the transport of materials on- and off-site. Activities during construction have the potential to result in changes to the local air quality (i.e., the air quality of the PDA and immediately surrounding area) through the generation of emissions of fugitive dust and particulate matter from material movement as well as combustion emissions associated with the combustion of fossil fuels in heavy equipment.

Emissions of combustion gases from the combustion of fossil fuels by heavy equipment and vehicles during construction activities and from the transport of materials on- and off-site should be mitigated by implementing a non-idling policy and ensuring that equipment is in good working order. Furthermore, it is anticipated that equipment with the PDA should be operating intermittently over the course of the construction phase and that not all equipment would be operating simultaneously.

The emissions of GHGs from the operation of mobile equipment and on-site trucks during construction activities will be mitigated by a no-idling policy. Equipment will also be in good working order to reduce emissions of GHGs. Given the relatively straightforward nature of the Project, and short duration of the construction phase, GHG emissions are not expected to be substantive.

As stated previously in **Section 2.6.1**, in emissions during the operation phase of the Project will be indirectly related to the home energy needs connected to the provincial power grid; however, the use of energy efficient home designs and building materials, which are proposed to be used for the project, should limit energy needs. It is anticipated that the homes would be heated by electric baseboard and/or split system heat pumps. Furthermore, given the relatively small size of the Project, it is not anticipated that the increase in emissions due to the long term use of the homes within the subdivision to be substantive.

5.2.4 Summary

The effects of the Project on ambient air quality due to fugitive dust and emissions from heavy equipment are expected to be temporary, intermittent, localized and minimal, using standard mitigation as identified. It is unlikely that Project-related emissions will exceed New Brunswick air quality standards or objectives.

Greenhouse gas emissions from the Project are not anticipated to materially contribute to overall emissions in the region or the province, given the low magnitude of these emissions and the temporary nature of the emissions.

In light of the above, the potential interactions between the Project and the atmospheric environment are not expected to be substantive.

Given the relatively straightforward nature of the Project, the limited activities arising from it, and the anticipated lack of substantive interactions with the atmospheric environment, no follow-up or monitoring is proposed to monitor environmental interactions with the atmospheric environment.

5.3 Acoustic Environment

The potential interactions between the Project and the acoustic environment are assessed in this section.

5.3.1 Scope of VC

The acoustic environment focuses on ambient noise within the PDA and LAA, both natural and human-made. It is identified as a VC because noise is defined as a contaminant in the New Brunswick *Air Quality Regulation – Clean Air Act*, and noise levels may be of concern in relation to human health, socioeconomic values, and potential disturbance of ecological functions.

Potential changes to the acoustic environment may affect humans and wildlife. Components considered under this VC are Project-related sound pressure levels that could affect nearby receptors such as the Forest Avenue School and nearby residences. Unwanted changes to sound pressure levels that are nuisance is generally referred to as noise.

The assessment of potential interactions on the acoustic environment is characterized by the type, frequency, intensity, and duration of noise (unwanted sound) in the outdoor environment. Vibration, or oscillation in matter that may lead to noise or stress in materials of adjacent structures, is also considered as an element of the acoustic environment. Given the nature of the Project phases and activities to be carried out for the Project, substantive sources of vibration are not expected, and as such the focus of the acoustic environment VC is noise.

Specific regulations or guidelines related to sound quality have not been established in New Brunswick and may be addressed through the Certificate of Approvals process for industrial facilities under the *Air Quality Regulation*. In the absence of local guidance, the following generally accepted criteria that have been applied in Certificates of Approval in New Brunswick in the past are proposed for the purpose of the assessment (Glynn, M., pers. comm., 2012):

- 65 A-weighted decibels (dBA) measured as a 1-hour equivalent sound level (Leq) from 06:00 to 22:00 (daytime); and
- 55 dBA measured as a 1-hour Leq from 22:00 to 06:00 (nighttime).

The LAA for the acoustic environment includes the PDA as well as a 1 km buffer around the PDA (**Figure 5-1**).

5.3.2 Existing Conditions

The emission of sound waves from natural and manmade sources, their propagation through the atmosphere, and their detection through auditory or other means at a noise sensitive receptor in the ambient environment characterizes sound quality. Sound pressure level in units of A-weighted decibels (dBA) is the typical measure of sound. The A-weighting scale is the most commonly used scale for expressing the perception of audible noise by humans. Since sound propagation and attenuation occurs largely as a function of increasing distance from the source (among other lesser factors such as topography as well shielding by natural and human-made obstructions), the potential interactions of Project-related noise with a human receptor located in the acoustic environment are more related to the distance between the noise source and receptor rather than specific location or setting. Therefore, for the purposes of this assessment, we focus on predicted noise levels at the Forest Avenue School as the nearest noise sensitive receptor, which is located approximately 250 m from the centre of PDA, with the assumption that Project-related interactions with the acoustic environment at other receptors farther away would be lesser.

Since no baseline noise monitoring has been completed for the Project, the baseline noise levels assumed to be present at or near the Project were estimated using guidance provided by Health Canada (2017), Alberta Energy Regulator (AER 2007), and United States Environmental Protection Agency (USEPA 1974). Based on the population density (Statistics Canada 2022) and the lack of other potential substantive noise sources near the PDA (most are in forested areas), it was determined that the noise levels within the Project area would be expected to be typical of a quiet rural area, with estimated baseline sound levels of approximately 45 dBA (USEPA 1974; Health Canada 2017).

Given the rural character and low population density of the area (63.2 people/km^2 [Statistics Canada 2022]) with no substantive industrial or commercial sources of noise nearby, baseline noise monitoring is not considered to be necessary to adequately characterize the baseline ambient sound levels.

5.3.3 Assessment of Potential Interactions between the Project and the Acoustic Environment

The potential interactions and effects of the Project on the acoustic environment are assessed in this section.

5.3.3.1 Potential Interactions

Without mitigation, the Project could produce changes in the acoustic environment at nearby acoustic sensitive receptors from movement of materials, earth moving, heavy equipment, and general construction activities during construction.

There are no substantive sources of noise during the operation phase beyond those typically occurring in suburban residential subdivisions.

5.3.3.2 Mitigation

The following mitigation measures should be used to control nuisance noise during the Project:

- Scheduling restrictions, where possible (or alternative mitigation implemented), to ensure that construction activities with elevated noise emissions occur during the daytime (7:00 a.m. to 7:00 p.m.), Monday to Friday excluding holidays. Non-intrusive activities should occur during the nighttime (7:00 p.m. to 7:00 a.m.) or on weekends or holidays;
- Vehicles and equipment should be maintained in good working order with quality mufflers;

- Regular discussions should be conducted with workers and contractors on noise minimization practices;
- Drivers should be informed of the designated vehicle routes, parking locations, no-idling policy, normal delivery hours, and use of engine brakes policy; and
- Use of standard communication procedures, via telephone or email, to communicate with local residents who have questions or concerns related to Project-related matters including noise.

5.3.3.3 Characterization of Potential Interactions Following Mitigation

Potential interactions with the acoustic environment following the application of mitigation are assessed below. New Brunswick has no specific regulations or guidelines for noise; therefore, the generally accepted criteria of 65 dBA for the daytime is used.

Activities related to site preparation and lot construction have the potential to result in noise emissions with potential disturbance effects for humans or wildlife outside of the PDA. To determine the potential interactions that Project-related activities may have on nearby receptors, acoustic modelling of the potential sound emissions and their associated levels at the nearest discrete receptor (the southern edge of the school building, located approximately 250 m from the centre PDA) was undertaken.

The United States Department of Transportation’s Federal Highway Administration Roadway Construction Noise Model (RCNM) (USDOT 2006) was used to predict noise levels from Project-related activities. While the model was initially designed to predict the change in sound levels from the construction of highways, it has been used throughout Canada and the United States on a wide variety of industrial sites. A list of anticipated heavy equipment, and the measured sound pressure levels (USDOT 2006) associated with them, is provided in **Table 5-6**.

Table 5-6: Typical Construction Equipment Sound Pressure Levels during the Project (USDOT 2006)

Description	Maximum (Lmax, dBA measured at 15 m from the equipment)	Assumed Number of Each Type of Equipment Used During the Project
Dozer	85	1
Backhoe	80	1
Chain Saw	85	1
Excavator	85	1
Flatbed Truck	84	1
Drill Rig	85	1
Concrete Mixer	85	1
Dump Truck	84	1
Grader	85	1

The RCNM was used to predict the equivalent sound level (Leq) at the closest receptor previously mentioned. The RCNM predicted that the Leq for the receptor located 250 m away from the centre of the PDA (i.e., the school) was 61.7 dBA, which is below the accepted criteria of 65 dBA. This represents a conservative estimate of noise levels since the actual Project activities for site preparation, and lot construction should have a limited duration and not all equipment will be operating at the same time. A worst case scenario would have tree harvesting equipment (i.e., chainsaws and an excavator/mulcher) 50 m away from the school during clearing. Assuming a small amount of shielding offered by the remaining tree buffer (estimated 3 dBA), the Leq for this scenario is 66.4 dBA, slightly above the accepted criteria. Since this is the nearest equipment could possibly be, the noise generated in this scenario would be temporary once equipment moves further away from the school as clearing progresses. Increasing the distance by 10 m (or 60 m from the edge of the school) returns noise levels below the 65 dBA daytime criteria. Most equipment, when assessed individually (e.g., if only a backhoe was running), are below or close to 65 dBA. Furthermore, most lots are located farther than 50 m from the school. Increasing the distance to 150 m results in equivalent sound levels below the 65 dBA criteria; and most residential lots will be located further than 150 m from the school (refer to the conceptual subdivision layout in **Figure 2-3**). Since not all equipment will be operating at the same time and distances between operating equipment and the school will be greater than 150 m away for the most part, the noise levels generated from the Project are not expected to be substantive.

5.3.4 Summary

During the site preparation and lot construction, sources of noise are expected to be primarily related to operation of heavy equipment. Project activities have the potential to result in changes in local noise levels due to the operation of the heavy machinery required. Excessive noise levels are expected to be fairly localized, short-term, intermittent, and reversible. As such, and in consideration of the noise modelling results being at or less than the recommended levels provided in guidance from regulatory agencies for the majority of the PDA, the potential interactions of the Project-related activities on the acoustic environment are not expected to be substantive.

5.4 Groundwater

The potential interactions between the Project and groundwater are assessed in this section.

5.4.1 Scope of VC

Water is essential for life on Earth. As humans, we need water for drinking, bathing, sanitation, recreation, and for the production of food and goods. Fish, wildlife, and vegetation also rely on the availability of water to live and flourish. Changes in the availability of water or the quality of the water may affect the lives of people and other living things.

Groundwater is considered a valued component (VC) because it is an important part of the hydrologic cycle through infiltration of precipitation or surface water, and it is important to local ecosystems and for potable water supplies. There is potential for groundwater to be affected by the Project through changes in groundwater quality or quantity arising from the installation of drinking water wells for the residential units.

In general, groundwater flows from recharge areas (areas of high elevation) to discharge areas (areas of low elevation), which are commonly lakes, streams, and rivers. Groundwater is contained in aquifers, which are geological units such as gravels, sands, or fractured bedrock. The natural quality of the groundwater contained in aquifers varies depending on the geochemical composition of the material (i.e., soil, sediment and/or bedrock) in which the water flows.

5.4.1.1 Regulations and Policies Relevant to Groundwater

Where applicable, the Project will adhere to standard provincial and federal legislation and associated regulations, including the following:

Federal

- Canadian Council of Ministers of the Environment (CCME) Environmental Quality Guidelines; and
- Guidelines for Canadian Drinking Water Quality (GCDWQ) – administered by Health Canada (rev. 2020).

Provincial

- *Clean Water Act* – administered by the New Brunswick Department of Environment and Local Government (NBDELG); and
- *Clean Environment Act* – administered by the NBDELG.

The construction of potable wells and the extraction of groundwater is regulated under the New Brunswick *Clean Water Act* and associated *Water Well Regulation* and *Potable Water Regulation*. Some groundwater sources used as public drinking water supplies are protected under the *Wellfield Protected Area Designation Order - Clean Water Act.*

Objectives for the quality of surface water and groundwater as a source of drinking water are provided in Health Canada's *Guidelines for Canadian Drinking Water Quality* (GCDWQ) (Health Canada 2020). Though not having force of law unless formally adopted by provincial legislation, these guidelines provide guidance to decision-makers with respect to the potability of drinking water for human use.

The local assessment area (LAA) for groundwater is defined as an approximate 250 m radius surrounding the PDA, in recognition of the localized effect of drinking water well disturbance on groundwater.

5.4.2 Existing Conditions

The following is a review of historic, public and provincial information that provides hydrogeological information for the Project areas including but not limited to: provincial watershed and wellfield information, provincial potable well database, and previous hydrogeological studies.

Surficial and Bedrock Geology

Based on forest soil maps of New Brunswick (Colpitts et al. 1995), the native surficial soils in the Project area are from the Harcourt map unit made up of compact tills from weathered red mudstones, grey-red lithic-feldspathic sandstones, quartzose sandstones, and polymictic conglomerates. The texture class of the parent materials (greater than 30 cm below surface) of the Harcourt soil unit are fine (sandy clay to clay materials), the texture of the solum (i.e., A and B horizons) is medium to coarse (silt and sandy materials). The soil depth to contrasting layer (compact subsoil or bedrock) is 30 to 100 cm. Coarse fragment content (percentage of soil particles greater than 2 mm) within the soil unit profile is described as low to medium (0 – 50%). The Harcourt soil unit within the PDA is also described as moderately well drained (Colpitts et al. 1995).

The bedrock geology of the study areas varies. Based on the Department of Natural Resources' Bedrock Geology Map of New Brunswick (NBDNR 2008), the bedrock geology in the areas can be generalized as late carboniferous aged terrestrial sediments. This bedrock can be porous and/or fractured to be suitable as an aquifer for groundwater.

5.4.2.1 Potable and Exploratory Wells

The NBDELG's Online Well Log System (OWLS) database was used to identify private potable water wells within 250 m of the PDA (see **Figure 5-2**). The OWLS database does not provide spatial coordinates of wells, nor does it provide records of wells completed prior to 1994. As such, aerial imagery was used to supplement the OWLS system to identify the approximate locations of private potable wells adjacent to the Project. The OWLS query yielded results for 9 water wells near or within the 250 m radius surrounding the Project. Available information regarding well construction details are outlined below in **Table 5-7**.

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Environmental Impact Assessment (EIA)

GROUNDWATER
FIGURE 5-2

- Highway
- Road
- Watercourse
- Project Development Area
- Project Development Area 250m Buffer
- Property Boundary
- Provincially Significant Wetland (NBDELG 2021)
- Wetland (NBDELG 2021)
- Waterbody

0 30 60 120 Meters

SCALE 1:5,000

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: RP
MAP CHECKED BY: AY
MAP PROJECTION: NAD_1983_CSRS_NEW_BRUNSWICK_STEREOGRAPHIC

DILLON CONSULTING

PROJECT: 22-4686
STATUS: DRAFT
DATE: 2022-10-11

FILE LOCATION: K:\2022\224686\Product\Client\2022EIA\Figure 5.4 Groundwater.mxd

On February 22, 2022, three test wells were installed within the PDA in support of a preliminary groundwater assessment (**Appendix A**). Construction details from the associated well driller's report is also included in **Table 5-7**.

Table 5-7: Well Construction Details For Nine Private Wells Within 250 m of the Project (NBDELG 2022d) and Three Test Wells Within the PDA (Appendix A)

Well Identification	Overall Well Depth (m)	Well Casing Diameter (cm)	Well Casing Depth (m)	Estimated Safe Yield (L/min)[1]
DW1	30.48	15.24	8.23	13.65
DW2	24.38	15.24	6.1	9.1
DW3	18.29	15.24	8.23	91.0
DW4	30.48	15.24	12.19	13.65
DW5	42.67	15.24	21.34	136.5
DW6	36.58	15.24	12.19	18.2
DW7	25.91	20.32	6.1	15.02
DW8	15.24	15.24	6.1	13.65
DW9	24.38	15.24	10.36	18.2
TW1	60.96	15.24	11.58	9.09
TW2	60.96	15.24	11.58	9.09
TW3	67.06	15.24	11.58	159.11

Notes:

[1] The estimated safe yield is based upon the well driller's estimate at the time of well drilling and may not represent the long term sustainability of the well. DW indicates a potable water well from OWLS. TW indicates a test well drilled for the preliminary groundwater assessment.

Based on geological classifications from the Water Well Driller's Reports during the groundwater assessment drilling program on the Project site, bedrock was generally encountered at a depth of 6 m and consisted of sandstone and siltstone.

The subject property has an elevation difference of approximately 16 m from the highest point in the southeast to the lowest point in the northwest, gradually sloping downward and west towards the Salmon River. Based on available aerial mapping and topography data regional groundwater/surface water drainage conditions are also anticipated to flow to the west towards the Salmon River, which is located approximately 850 m west of the site.

The groundwater assessment that was completed found adequate quantities of clean water at the preliminary stage to support the preliminary development plan.

Analytical samples were also collected from two of the test wells (i.e., TW1 and TW2) during the pumping periods for the groundwater assessment. Select samples were submitted for analysis of methyl tertiary-butyl ether (MtBE); benzene, toluene, ethylbenzene, xylene (BTEX); petroleum hydrocarbons (PHCs); general chemistry; total metals; and microbiological parameters (i.e., total coliforms, and E.coli).

The samples were collected, preserved as directed by the laboratory, and submitted to Research and Productivity Council (RPC) in Fredericton, NB, for analysis. RPC is accredited by the Standards Council of Canada (SCC) for each of the analytical methods utilized and have in-house QA/QC programs to govern samples analysis and analytical data quality assurance. Analytical results can be found in **Appendix A**, a summary of the results is presented as follows:

- Counts of total coliforms and E.Coli were not observed in the samples collected from TW1 and TW2, and therefore the samples met the Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ);
- Concentrations of MtBE, BTEX and PHCs were below the laboratory detection limits and were therefore below the applicable Atlantic Risk-Based Corrective Action (RBCA) Tier I Risk Based Screening Levels (RBSLs) (residential, potable, coarse-grained);
- Concentrations of aluminum and iron in the sample collected from TW1 were found to be above operational and aesthetic-based GCDWQ guidelines;
- Concentrations of manganese in TW1 were found to be above health-based GCDWQ guidelines; and
- Analytical results for general chemistry and metals in the samples collected from TW2 were within the GCDWQ criteria.

In general, concentrations of select metal parameters in TW1 were higher than the corresponding parameters in TW2. These elevated concentrations could be attributed to a cave-in observed in TW1 and the lesser duration of pumping when compared to TW2. Aluminum, iron, and manganese are commonly found in groundwater throughout New Brunswick and the concentrations observed on the PDA are anticipated to be associated with naturally occurring groundwater conditions.

5.4.3 Assessment of Potential Interactions between the Project and Groundwater

The potential interactions between the Project and groundwater that may have an effect on groundwater quality are assessed below.

5.4.3.1 Potential Interactions

Without mitigation, the Project may interact with groundwater in the following ways:

- Water quality could be affected by accidental release of lubricants and or refined fuels (i.e., gasoline, diesel) from vehicles and equipment during potable water well construction activities—should this occur, it would be considered an accident, malfunction, or unplanned event that is assessed in **Section 7.0**;
- Water quality (i.e., turbidity of shallow groundwater) could be affected by the excavation of soils for lot and potable water well construction; and
- Water quantity of the local groundwater aquifer could be affected by the installation and use of residential potable water wells.

5.4.3.2 Mitigation

Standard mitigation and best management practices that are relevant to the groundwater VC should be implemented for the life extension activities of the Project. These are based on normal operating procedures and regulatory requirements, and include mitigation specific to the groundwater VC, such as the following:

- The area of disturbance associated with the development of the physical components of the proposed Project should be minimized to the extent possible to limit the associated environmental effects associated with such disturbance.
- Spill response measures should be put in place to address unplanned Project-related releases. Project-related accidents, malfunctions, and unplanned events are assessed in **Section 7.0**.
- Proper erosion and sediment control measures will be installed and checked regularly and prior to and after storm events to ensure they are continuing to operate properly to minimize potential effects to adjacent habitat.
- Exposed soils will be stabilized as soon as practical to minimize emissions of particulate matter, erosion, and the release of sediment-laden runoff.
- All fuels and lubricants used during construction activities will be stored according to containment standards (e.g., secondary containment) in designated areas and will not be located within 30 m preferential pathways (i.e., drilled wells, watercourses, wetlands).
- Special precautions should be implemented while refueling machinery to prevent spills (e.g., absorbent pads located below nozzles and spill response kits located at the refueling location).
- Any spills of petroleum in the PDA will be remediated to the appropriate criteria selected by a Site Professional applying the Atlantic Risk-based Corrective Action Version 4 User Guidance.
- In order to address water quality and quantity concerns related to the Project, the preliminary groundwater assessment recommended further pumping and analytical testing as part of the installation process, with storage and treatment added as necessary to meet the needs of each home.

5.4.3.3 Characterization of Potential Interactions Following Mitigation

The Project activities have the potential to result in changes to groundwater quantity and quality without the proper mitigation employed. Substantive interactions between the Project and groundwater that would result in a decline in groundwater quality and quantity are not anticipated, considering the following scenarios:

- Proper well construction as well as further pumping and analytical testing to determine suitability for residential use, followed by installation of storage and treatment options and follow-up monitoring as required to adhere to applicable regulations and guidelines.

- Considering the potential for refined fuels (i.e., gasoline, diesel and/or lubricants) that may be spilled on-site, several precautions should be implemented to prevent the petroleum product from interacting with shallow groundwater. For example, fuels and lubricants will be stored at least 30 metres from preferential pathways and in/on secondary containment units to prevent spills.
- Absorbent pads should be placed under refueling devices to protect the ground surface from any potential spill of petroleum hydrocarbons. In the event that lubricants or fuels are discharged to the ground surface during the Project, an absorbent pad and/or granular absorbent material should immediately be employed by on-site personnel to limit petroleum infiltration into soils. An oil absorbent boom should be placed topographically downgradient of the spill if it is suspected that the quantity of petroleum product will runoff.
- Remedial action may include excavation of impacted soils and disposal of the material at an NBDELG approved facility. Further, confirmatory soil samples would be collected from any excavation to ensure that all losses, if any, are remediated to the appropriate level to conserve the quality and sustainable yield of shallow potable water as identified in the preliminary groundwater assessment report.

5.4.4 Summary

In summary, the potential groundwater interactions associated with the Project will be ongoing in nature given that homeowners will continue to use the local aquifer for an indeterminate time. However, in light of the Project as currently planned and the planned mitigation measures to reduce or eliminate negative environmental effects, the potential interactions between the Project and groundwater are not expected to be substantive. This conclusion will be re-evaluated once lot specific information is gathered during installation of the individual wells.

5.5 Surface Water

The potential interactions between the Project and surface water are assessed in this section.

Water is essential for life on Earth. As humans, we need water for drinking, bathing, sanitation, recreation, and for the production of food and goods. Fish, wildlife, and vegetation also rely on the availability of water to live and flourish. Changes in the availability of water and the quality of the water may affect the lives of people and other living things.

5.5.1 Scope of VC

Surface water consists of wetlands, watercourses (mapped and unmapped), water bodies, and surface water drainage channels within the areas that may be potentially affected by the Project. Surface water was selected as a valued component (VC) based on the importance of the resource to both humans and biota, including its importance in supporting fish and fish habitat and other aquatic life, and because of the potential for these resources to be affected by the Project through changes in surface water quality and/or quantity.

The potential interactions of the Project with surface water quantity and quality resulting from site preparation and lot construction are considered for this VC. Assessment of interactions with the surface water VC are particularly important components due to the potential for impacts along any tributaries to the Salmon River. This VC includes water levels, flows, surface water quality, and sediment quality. Discussion will include activities that may affect surface water. Potential interactions with the VC are discussed within the context of the Project.

In general, surface water flows from high topographic elevations and flows downgradient to topographic lows (e.g., lakes, rivers, wetlands, etc.). The natural quality of surface water is dependent on its natural course in the environment and the interactions it has with anthropogenic and non-anthropogenic materials prior to discharging to water bodies. Potential interactions of the Project with the VC during the site preparation and lot construction are discussed.

5.5.1.1 Regulations and Policies Relevant to Surface Water

Where applicable, the Project will adhere to standard provincial and federal government legislation and associated regulations and guidelines, including the following related to surface water:

Federal

- *Canadian Environmental Protection Act* (CEPA) – administered by Environment and Climate Change Canada (ECCC);
- *Fisheries Act* – administered by both Fisheries and Oceans Canada (DFO) and ECCC, the Act has requirements in relation to surface water, such as requirements prohibiting harmful alteration, disruption or destruction (HADD) of fish habitat (administered by DFO), requirement for flow maintenance for fish passage (administered by DFO), and prohibiting the release of deleterious substances (administered by ECCC);
- Canadian Council of Ministers of the Environment (CCME) Environmental Quality Guidelines (CCME 1999); and
- Guidelines for Canadian Drinking Water Quality (GCDWQ; Health Canada 2020) – administered by Health Canada (rev. 2020).

Provincial

- *Clean Water Act* – administered by the New Brunswick Department of Environment and Local Government (NBDELG); and
- *Clean Environment Act* – administered by the NBDELG.

Watercourses and areas meeting the definition of a wetland in New Brunswick are regulated by the New Brunswick *Clean Water Act* including its *Watercourse and Wetland Alteration Regulation*, and the New Brunswick "Wetlands Conservation Policy" (NBDNRE-NBDELG 2002). Surface water supplies used as public drinking water sources are protected under the *Watershed Protected Area Designation Order – Clean Water Act*.

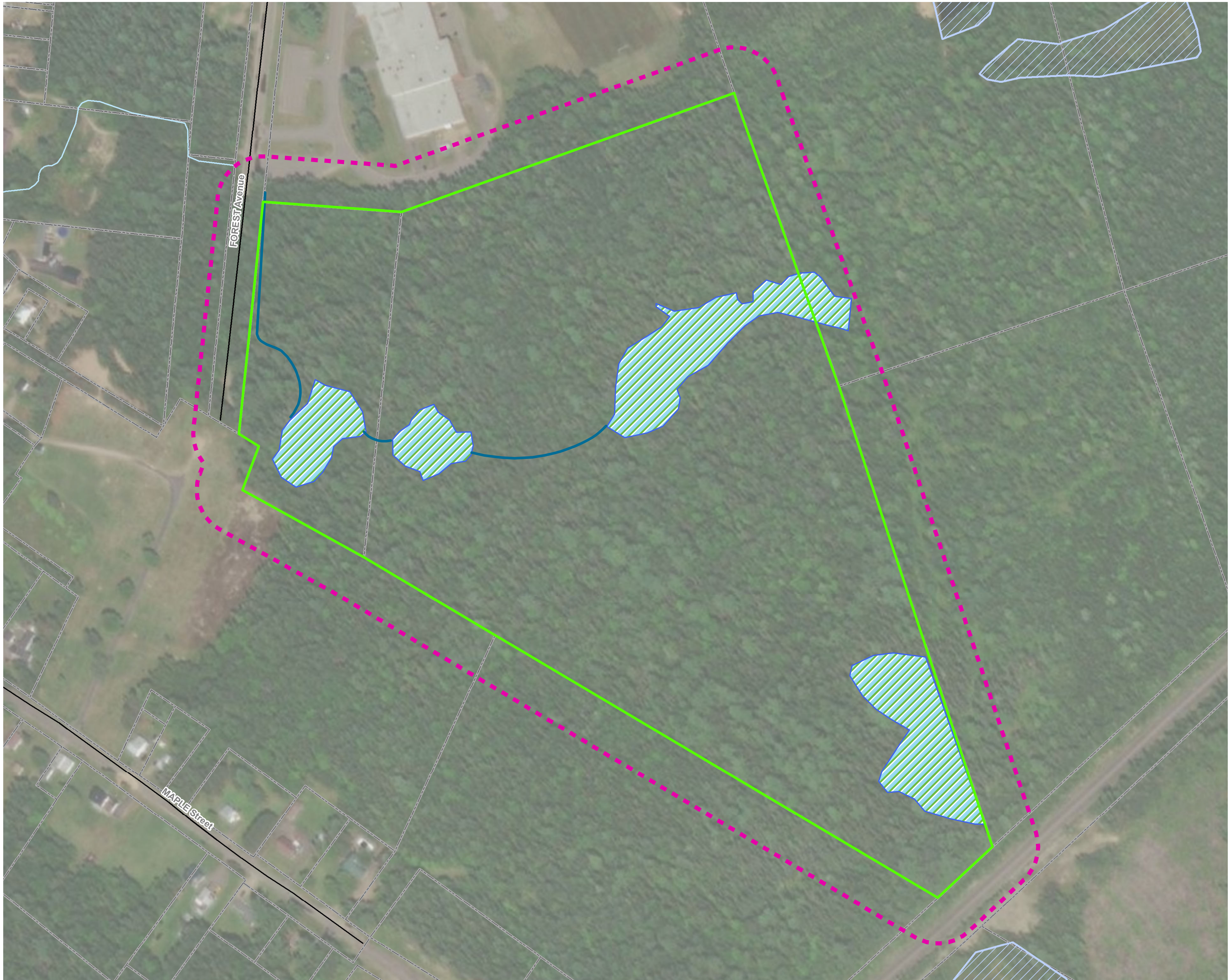
Objectives for the quality of drinking water are provided in Health Canada's "Guidelines for Canadian Drinking Water Quality" (Health Canada 2020). Additionally, the Canadian Council of Ministers of Environment's (CCME) Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG FWAL) (CCME 1999) provide environmental quality objectives for protecting fish from lethal and sub-lethal effects. Though not having force of law unless formally adopted by provincial legislation, these guidelines provide guidance to decision-makers with respect to the suitability of water for various uses as well as the potability of drinking water for human use.

The local assessment area (LAA) for surface water includes the watercourses and water bodies located within 30 m of the PDA, including a 30 m riparian buffer on each side of watercourses.

5.5.2 Existing Conditions

The Project is located in the Salmon River drainage basin, which and flows southwesterly from its headwaters near Harcourt into Grand Lake and the Saint John River. The Salmon River watershed makes up the majority of the Grand Lake and Jemseg River basin, which has a total contributing watershed area of approximately 3,950 km^2 (NBDNRED 2022), which consists of predominantly undeveloped wooded terrain. Grand Lake discharges to the Saint John River, which flows south to the city of Saint John and then into the Bay of Fundy.

Based on a review of online mapping (GeoNB), there are no mapped watercourses in the PDA. The nearest mapped watercourse is an unnamed first order tributary to the Salmon River located approximately 32 m northwest of the PDA on the opposite side of Forest Avenue. Field reconnaissance also revealed no watercourses with a distinct channel or mineral soil bed. A drainage swale, originating in the centre of the PDA appears to drain the wetland features on the site. This general path of lower topographical elevation drains west across the PDA before connecting to the Forest Avenue road ditch. Since this drainage pattern is ephemeral in nature, does not contain a gravel bed, and only carries flow during high rain events, it is not expected to be fish bearing. Online LiDAR and aerial mapping also indicated the potential presence of unmapped wetlands. Field reconnaissance surveys determined wetlands in the PDA with approximately 1.13 hectares (ha) of total area. Refer to **Figure 5-3** for water features identified within or near the PDA.



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MAPPED AND UNMAPPED WATER FEATURES WITHIN OR NEAR THE PDA
FIGURE 5-3

- Road
- Project Development Area
- Project Development Area 30m Buffer
- Property Boundary

Mapped Water Features

- Watercourse
- Wetland (NBDELG 2021)

Unmapped Water Features

- Watercourse
- Wetland

0 15 30 60 Meters

SCALE 1:2,463

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: GAM
MAP CHECKED BY: AY
MAP PROJECTION: NAD_1983_CSRS_NEW_BRUNSWICK_STEREOGRAPHIC

DILLON CONSULTING

PROJECT: 22-4686
STATUS: DRAFT
DATE: 2022-10-21

FILE LOCATION: K:\2022\224686\Product\Client\2022EIA\Figure 5.4 Mapped Water FeaturesNEW.mxd

Given that water features were dry at the time of field reconnaissance, surface water quality was not assessed. Surface water quality generally reflects that over the underlying groundwater and geological conditions. As discussed in **Section 5.4.2**, the quality of the preliminary groundwater samples, except some exceedances of metal concentrations, were good. It is anticipated that high concentrations of metals (i.e., iron, aluminum, and manganese) in one groundwater sample were due to natural geological conditions. Given the generally good groundwater quality and undisturbed nature of the Project area, it is anticipated that surface water quality within the PDA is also generally good.

5.5.3 Assessment of Potential Interactions between the Project and Surface Water

The potential interactions between the Project and surface water that may have an effect on surface water quantity and quality are assessed below.

5.5.3.1 Potential Interactions

Without mitigation, the Project may interact with surface water in the following ways:

- Surface water quality could be affected by accidental release of lubricants and/or refined fuels (i.e., gasoline and/or diesel) from vehicles and equipment during site preparation and lot construction, it would be considered an accident, malfunction, or unplanned event that is assessed in **Section 7.0**;
- Surface water quality could be affected by equipment interactions with surface water from site preparation, mobilization of equipment, and/or demobilization of equipment. Effects to surface water through this interaction could include runoff impacted by lubricated machinery or disturbance of soils that would lead to erosion;
- Surface water quality could be affected by erosion or sedimentation of excavated and stockpiled soils;
- Surface water quality could be affected by interaction with waste materials generated on the project site; and
- Surface water features and drainage may be altered by the construction certain lots and infrastructure within the wetland area as well as construction of a stormwater retention basin at the western edge of the PDA where a drainage swale.

5.5.3.2 Mitigation

Standard mitigation and best management practices that are relevant to the surface water VC should be implemented for the Project. These are based on normal operating procedures and regulatory requirements, and include mitigation specific to the surface water VC, such as the following:

- Application for a watercourse and wetland alteration (WAWA) permit, if required, for any alterations in, or within 30 m of, a watercourse or wetland (if present). A copy of the permit will be maintained on-site and the conditions of the permit will be followed;

- The area of disturbance of the Project will be limited to that which is necessary to achieve the Project purpose;
- Natural vegetation will be preserved when possible;
- The area of exposed soil should be limited, and the length of time soil is exposed without mitigation (e.g., mulching, seeding, rock cover) should be reduced through scheduled work progression;
- Erosion and sedimentation control structures (e.g., check dams, silt curtains) will be maintained throughout the site preparation, lot and related infrastructure construction, in particular before and after heavy rain events. These structures will remain in place until the area is stabilized or naturally re-vegetated;
- A plan for handling fill and construction materials for the site should be communicated to the contractor (i.e., if stockpiling is required, materials should be stored away from any watercourse or removed from site to a pre-determined location) with an intent to minimize soil stockpiled, and the duration that soil is stockpiled at the site;
- Fill and excavated materials should not be stockpiled for long periods of time to reduce the likelihood of sedimentation. Fill/excavation material piles should be covered with tarps if left standing for more than 24 hours;
- All fuels and lubricants used during the Project should be stored according to containment standards (e.g., secondary containment) in designated areas. Storage areas will not be located within 30 m of watercourses, wetlands (if present), or water supply areas (including the location of known private wells);
- Temporary storage of waste materials on-site will be located at least 30 m from watercourses, wetlands (if present), and water supply areas (including private wells);
- Refueling of machinery will not occur within 30 m of watercourses and water supply areas. Where stationary equipment is situated near a wetland (if present), special precautions should be implemented to prevent spills during refueling (e.g., absorbent pads located below nozzles and spill response kits located at the refueling location);
- Emergency response plans should be in place for spill response with spill kits and trained personnel present on-site at all times; and
- Wetlands and unnamed tributaries that are directly affected by the construction of the residential subdivision will be compensated, as applicable, under the New Brunswick *Clean Water Act* and New Brunswick Wetlands Conservation Policy (NBDNRE-NBDELG 2002). Further information on potential effects to wetlands is provided in **Section 5.5**.

5.5.3.3 Characterization of Potential Interactions Following Mitigation

The residential subdivision development could result in negative changes to surface water quality and quantity without the proper mitigation employed. Development of the subdivision may result in surface water contained within the wetlands and drainage features located within the PDA to be drained. This potential residual effect is expected to be limited to the PDA and the watercourses that extend from the PDA to the LAA. Interactions between the Project and surface water that could result in a substantive decline in surface water quality and/or quantity are not anticipated, considering the following factors:

- Substantive effects from construction activities are not expected to extend to the downstream reaches of the unnamed tributary and to Salmon River, given the relatively small Project footprint area.
- As described in the conceptual subdivision layout, habitat creation and enhancement opportunities may exist within the planned greenspace park areas and stormwater retention basin as offsetting/compensation options for the potential loss of any wetlands.
- Fuels and lubricants will be stored at least 30 metres from any wetland or watercourse and in/on secondary containment units to prevent spills. Absorbent pads should be placed under refueling devices to protect the ground surface from any potential spill of petroleum hydrocarbons.
- In the event that lubricants or fuels are discharged to the ground surface during the Project, an absorbent pad and/or granular absorbent material will immediately be employed by on-site personnel to limit petroleum runoff to surface water features. An oil absorbent boom should be placed topographically downgradient of the spill if it is suspected that the quantity of petroleum product will runoff.
- Remedial action for spills may include excavation of all impacted soils and disposal of the material at an NBDELG approved facility. Further, confirmatory soil samples would be collected from any excavation to ensure that all losses, if any, are remediated to the appropriate level to conserve the quality of local surface water.
- Considering the potential for sediment disturbance that may initially occur during the site preparation and mobilization phase, vehicles and equipment travelling on access roads to the lots may loosen surficial soil such that it becomes sediment. In the event of a rainfall event, loosened sediment may be eroded and displaced to surface water features. The increase in discharged sediment beyond background levels may decrease the water quality of surface water features. Given the potential for sedimentation of surface water features beyond natural levels, in the event that soil is loosened within 30 metres of a wetland or watercourse precautions should be implemented to prevent erosion of the material. Precautions may include implementing a local silt fence and/or re-compacting the material.
- Soils will be stockpiled in an area at least 30 m away from any wetland or watercourse until it is determined that the soil is suitable to be used as backfill. Temporary storage of stockpiled soil on the ground surface has the potential to allow soil to migrate off-site as sediment in runoff. Considering the potential for sediment to runoff into local surface water features, stockpiles will

not be placed within 30 m of a wetland or watercourse. In the event that it is suspected that rain water will cause substantive sediment erosion from any soil stockpile, the field team may opt to postpone soil excavation in consideration of the risk to local surface water bodies. Further, prior to any soil disturbance, materials required for mitigation efforts should be obtained and installed when possible and extra/replacement materials should be obtained and available for replacement in the event of failure (see **Section 7.3.2** for more information associated with failure of erosion and sediment control structures).

- Any grubbing, clearing or grading along roadways and lots within 30 m of a watercourse or wetland may require a WAWA permit. If required, no works will commence without such permit, and all conditional requirements outlined will be followed, this will ensure minimal (if any) interactions with surface water.
- Following lot and house construction, all exposed erodible soil should be landscaped and permanently stabilized with grass seed mix and blanketed with mulch. If final grading takes place outside the growing season when vegetation can become re-established, temporary stabilization should be upgraded to perform its function throughout winter and snowmelt/spring break-up conditions. Wherever temporary over-winter stabilization is used, it should be replaced with grass seed mix in the next growing season.

With the implementation of the planned mitigation indicated above, including obtaining a WAWA permit (if necessary) for any activity carried out within 30 m of a watercourse or wetland, as well as implementation of any required compensation plans, interactions between the Project and surface water is not anticipated to be substantive and are limited to the local environment temporarily. However, as is the case with many projects in close proximity to environmentally sensitive areas, unforeseen accidents, malfunctions and unplanned events have potential to impact local watercourses and wetlands. Environmental interactions that may arise through accidents, malfunctions and unplanned events are outlined in **Section 7.0**.

5.5.4 Summary

Given that the Project may involve landscaping, grading, ditching, and installation of a stormwater retention basin, the Project will permanently alter surface water features and drainage in the footprint of the subdivision development. However, with planned mitigation and environmental protection measures, the residual environmental effects of the Project on surface water resources during all phases of the Project will be limited to the PDA and are not expected to be substantive.

5.6 Fish and Fish Habitat

The potential environmental effects of the Project on fish and fish habitat (including aquatic species at risk) are assessed in this section.

5.6.1 Scope of VC

The fish and fish habitat valued component (VC) includes aquatic life such as freshwater fish, benthic invertebrate species, and the habitat that supports them, as well as aquatic species at risk (SAR). Fish and fish habitat are considered a VC: because of their importance in supporting aquatic life; as a fisheries resource; as food source for humans, other fish, and wildlife; for providing recreational opportunities; and because they are of importance to the public, stakeholders, and Indigenous communities.

Fish and fish habitat are protected through the federal *Fisheries Act* as well as the New Brunswick *Fish and Wildlife Act* and the New Brunswick *Watercourse and Wetland Alteration Regulation – Clean Water Act*. The federal *Fisheries Act* provides protection for all fish and fish habitat (DFO 2019). Section 35(1) of the *Fisheries Act* prohibits the harmful alteration, disruption or destruction (HADD) of fish habitat; Section 34.4(1) prohibits the death of fish by means other than fishing; and Section 36(3) prohibits the release of a deleterious substance into waters frequented by fish. Additionally, aquatic SAR are protected under both the federal *Species at Risk Act* (SARA) and New Brunswick *Species at Risk Act* (NB SARA). Although the Canadian Council of Ministers of Environment's (CCME) Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG FWAL) (CCME 1999) do not have force of law on their own, they provide environmental quality objectives for protecting fish from lethal and sub-lethal effects.

In this EIA Registration document, we define "species at risk" (abbreviated SAR) as those species that are listed as "Extirpated", "Endangered", "Threatened", or "Special Concern" on Schedule 1 of SARA or on the NB SARA. We also define "species of conservation concern" (abbreviated SOCC) as those species that are not SAR but are listed in other parts of SARA, NB SARA, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or are regionally rare or endangered by the Atlantic Canada Conservation Data Centre (AC CDC) (i.e., those species with AC CDC S-ranks of "extremely rare" [S1], "rare" [S2], or "uncommon" [S3]).

For the purpose of this EIA Registration document, the local assessment area (LAA) for fish and fish habitat includes the watercourses and water bodies located within 30 m of the PDA, including the 30 m riparian buffer on each side of watercourses (refer to **Figure 5-3**).

5.6.2 Existing Conditions

Watercourses in New Brunswick are defined as: "*A feature in which the primary function is the conveyance or containment of water, which includes: a) the bed, banks and sides of any watercourse that is depicted on the New Brunswick Hydrographic Network layer (available on GeoNB Map Viewer); b) the bed, banks and sides of any incised channel greater than 0.5 metres in width that displays a rock or soil (mineral or organic) bed, that is not depicted on New Brunswick Hydrographic Network layer (available on GeoNB Map Viewer); water/flow does not have to be continuous and may be absent during any time of year; or c) a natural or man-made basin (i.e. lakes and ponds).*" (NBDELG 2018b)

The Project is located within the Salmon River watershed, which is a sub-basin to the Grand Lake and larger Saint John River watershed. There are 53 fish species reported in the Saint John River Basin fish species in the Saint John River watershed (CRI 2011). These include: American eel (*Anguilla rostrata*), Atlantic salmon (*Salmo salar*), banded killifish (*Fundulus diaphanous*), yellow perch (*Perca flavescens*), four-spined stickleback (*Apeltes quadracus*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), smallmouth bass (*Micropterus dolomieu*), brown bullhead catfish (*Ameiurus nebulosus*), common shiner (*Luxilus cornutus*), and white sucker (*Catostomus commersonii*) (NBDELG 2007), among others. Due to its connection with the Salmon River, the watercourse located in the PDA has the potential to support these fish species as well.

A report generated by the AC CDC (2022) indicated no records of aquatic species at risk or species of conservation concern within 5 km of the PDA.

As stated previously in **Section 5.5** discussing surface water features, reconnaissance level field surveys conducted on the site on July 25, 2022 and September 16, 2022 revealed that water features on-site at the time were dry, ephemeral in nature, and not likely to support fish species.

5.6.3 Assessment of Potential Interactions between the Project and Fish and Fish Habitat

The potential interactions between the Project and fish and fish habitat are assessed below.

5.6.3.1 Potential Interactions

Though no in-water work is required for the Project and there is a general lack of fish and fish habitat within the PDA, temporary interactions with fish and fish habitat during subdivision construction may occur if water exists in the drainage features during construction phases. There is potential for runoff from the Project areas to reach downstream reaches if appropriate mitigation measures are not in place.

5.6.3.2 Mitigation

The following general mitigation measures for the aquatic environment should be applied as part of the Project:

- No work is to be conducted within 30 m of a watercourse without first obtaining and complying with a watercourse and wetland alteration (WAWA) permit;
- Soil will not be stockpiled within 30 m of a watercourse;
- All chemicals and petroleum products should be managed in accordance with manufacturer’s specifications and stored more than 30 m from a watercourse;
- Refueling equipment and vehicles will be conducted more than 30 m from a watercourse/wetland and where possible over an impermeable surface;
- All waste materials should be secured and/or stabilized until they can be transported off-site for disposal to prevent them from entering any aquatic habitat;
- Ground disturbance work should not be completed during significant storm events;

- Erosion and sediment control (ESC) structures should be inspected weekly, as well as prior to heavy rainfall (>25 mm over 24 hours) events to ensure they are continuing to operate properly;
- Routine maintenance of ESC measures should be performed to address concerns identified during the inspections to ensure they are continuing to operate properly; and
- In the event of a significant ESC failure that results in non-compliance with a permit/approval, all work will be immediately stopped, and all available resources will immediately focus on mitigating the failure(s) in an effort to minimize negative impacts.

5.6.3.3 Characterization of Potential Interactions Following Mitigation

Construction activities have the potential to result in changes to fish and fish habitat without the proper mitigation employed. Although there are no mapped watercourses in the Project area, there are drainage features which provide a pathway to downstream fish habitat in the first order tributary to the Salmon River. Currently, the Project may involve alterations to these drainage features in the form of stormwater retention basin, lot, and road construction (see **Figure 2-3**). Given the small area of the alterations and the nature of the features likely only containing water after significant rain events, the alterations to the drainage area are not likely to cause substantial effect to the downstream flow regime.

The largest potential risk to fish and fish habitat lies in the potential for sediment migration through runoff into local surface water features from exposed soils created during Project activities. Mitigation of this potential impact should therefore be a priority and should follow mitigation measures described above. Materials required for mitigation efforts will be obtained and installed before the occurrence of soil disturbance when possible and extra/replacement materials should be obtained and available for replacement in the event of failure (see **Section 7.3.2** for more information associated with failure of erosion and sediment control structures). Special attention should also be given to the local weather forecast, and inspection of mitigation measures should be inspected before any rain events are predicted to address maintenance issues that may be required following mitigation. Upon completion of construction activities, final grades should be established and permanently stabilized to mitigate future sedimentation inputs caused by runoff. See **Section 5.5** for more detailed information on mitigation of impacts to surface water.

With the implementation and proper maintenance of the planned mitigation indicated above, interactions between the Project and fish and fish habitat are not anticipated to be substantive and are limited to the local environment temporarily. With limited vectors for the transport of sediment toward the previously discussed watercourses in the Project area and proposed mitigation measures, the potential risks to fish and fish habitat as a result of Project activity are not considered to be substantive.

As is the case with many projects in close proximity to environmentally sensitive areas, however, unforeseen accidents, malfunctions, and unplanned events (such as spills) have potential to impact local watercourses. Environmental interactions that may arise through accidents, malfunctions, and unplanned events are outlined in **Section 7.3.**

5.6.4 Summary

Based on a high level assessment, the potential fish and fish habitat interactions associated with the Project are limited in nature. Given the above, and in light of the Project as currently planned and planned mitigation to reduce or eliminate negative environmental effects, the potential interactions between the Project and fish and fish habitat are not expected to be substantive.

5.7 Vegetation and Wetlands

The potential interactions between the Project and vegetation and wetlands, including vegetation species at risk (SAR), are assessed in this section.

5.7.1 Scope of VC

Wetlands are defined as land where the water table is at, near, or above the land's surface, or land which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophytic vegetation, and various kinds of biological activities adapted to the wet environment (NBDNRE-NBDELG 2002; NTNB 2018).

Vegetation includes terrestrial and aquatic plant species (both vascular and non-vascular, such as mosses) as well as lichens.

Vegetation and wetlands was selected as a VC because they are valued in their relationship with water resources, wildlife and wildlife habitat, and other biological and physical components addressed as VCs in this EIA Registration document. In addition, SAR (including plants) are protected under federal and provincial legislation (pursuant to the federal *Species at Risk Act* [SARA] and the New Brunswick *Species at Risk Act* [NB SARA]), and SAR and other rare plant species are considered valued, including species of conservation concern (SOCC).

In this EIA Registration document, we define "species at risk" (SAR) as those species that are listed as "Extirpated", "Endangered", "Threatened", or "Special Concern" on Schedule 1 of the federal SARA or on the NB SARA. We also define "species of conservation concern" (SOCC) as those species that are not SAR but are listed in other parts of SARA, NB SARA, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or as regionally rare or endangered by the AC CDC (i.e., those species with AC CDC S-ranks of extremely rare [S1], rare [S2], or uncommon [S3]).

New Brunswick's wetlands have been given specific protection pursuant to the New Brunswick *Clean Environment Act* and the *Clean Water Act*. The New Brunswick Department of Environment and Local Government (NBDELG) requires a permit for any alteration within 30 m of the banks of a watercourse or the delineated boundaries of a wetland. Wetlands often support rare or uncommon vegetation species assemblages, and the New Brunswick Wetlands Conservation Policy and regulatory processes are guided towards the goal of achieving no net loss of wetland function (NBDNRE-NBDELG 2002). In addition, wetlands are widely recognized as providing a host of ecosystem functions and benefits including but not limited to: filtering out pollutants and heavy metals, mitigating flood events, and providing habitat to many SAR and sensitive species in New Brunswick such as the wood turtle (*Glyptemys insculpta*), Least Bittern (*Ixobrychus exilis*), and showy lady's-slipper (*Cypripedium reginae*), among others (NTNB 2018). Wetland compensation for alterations of a delineated wetland is often required as a condition of a watercourse and wetland alteration (WAWA) permit when a net loss of wetland function occurs, usually at a ratio of two units of wetland to be restored for every unit of wetland altered.

This VC covers the vegetation component of terrestrial and aquatic habitats, as well as wetlands including their habitat functions. It does not cover the wildlife (including wildlife SAR) that may be using the habitats, which is addressed in **Section 5.8 (Wildlife and Wildlife Habitat)**, nor does it address aquatic wildlife (including fish and aquatic SAR) which is addressed in **Section 5.6 (Fish and Fish Habitat)**.

The local assessment area (LAA) for vegetation and wetlands is defined as the footprint of where ground disturbance will be taking place (the PDA) plus a 30 m buffer surrounding the PDA, including a 30 m buffer around any wetlands present in proximity of the PDA (**Figure 5-4**).

5.7.2 Existing Conditions

The information regarding the presence and characterization of wetlands and the characterization of vegetation communities within the PDA and surrounding areas was derived from several sources including existing databases and secondary information sources (i.e., desktop analysis) as well as from vegetation surveys, wetland delineation and functional assessment conducted on site.

The methods used during the desktop analysis, followed by the results of these analyses, are presented below.

5.7.2.1 Desktop Analysis Methods and Results

Dillon reviewed readily-available information from reputable sources. The information was reviewed to evaluate the potential for vegetation SOCC and/or vegetation SAR within the general area of the Project. Dillon completed a review of the following sources and data lists for the purpose of characterizing existing conditions for this EIA Registration document:

- A custom AC CDC report (AC CDC 2022, refer to **Appendix C**);
- Various NBDNRED and NBDELG publications;
- The federal SAR registry;
- The provincial SAR registry;
- Publicly-available Geographic Information Systems (GIS) map layers and databases;
- High-resolution aerial photography; and
- GeoNB wetland and watercourse mapping.

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VEGETATION AND WETLANDS LOCAL ASSESSMENT AREA (LAA) AND WETLANDS IN VACINITY OF THE LAA
FIGURE 5-4

Road
Watercourse
Wetland (NBDELG 2021)
Project Development Area
Local Assessment Area (LAA)
Property Boundary

0 15 30 60 Meters
SCALE 1:2,463
N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: GAM
MAP CHECKED BY: AY
MAP PROJECTION: NAD_1983_CSRS_NEW_BRUNSWICK_STEREOGRAPHIC

DILLON CONSULTING

PROJECT: 22-4686
STATUS: DRAFT
DATE: 2022-10-21

FILE LOCATION: K:\2022\224686\Product\Client\2022EIA\Figure 5.5 Veg and Wetlands.mxd

Wetlands

According to provincial wetland and watercourse mapping (GeoNB), there are no mapped wetlands within the PDA. The NBDELG classifies wetlands into two categories: regulated wetlands of various types (e.g., freshwater marsh, aquatic bed, bog, fen, forested and shrub wetland), and Provincially Significant Wetlands (PSWs). PSWs are wetlands having provincial, national, or international importance (i.e., species at risk, coastal wetlands, unique forested wetlands, some floodplain wetlands) (NBDELG 2021a).

The closest mapped wetland to the PDA is a regulated wetland located on the opposite side of the railway line on the southern edge of the PDA. The 30 m buffer of this wetland is approximately 15 m from the boundary of the PDA. Several other regulated wetlands exist further south and west of the PDA. Two PSWs exist approximately 500 m west of the PDA, one being contiguous to the unnamed first order tributary to the Salmon River, which makes this PSW hydraulically connected to the PDA. Several other PSWs exist further west and north of the PDA, these are generally associated with floodplain wetlands to the Salmon River. Refer to **Figure 5-4** for a depiction of all the mapped wetlands in the vicinity of the PDA.

Vegetation Communities

The desktop analysis for vegetation included a review of publicly-available aerial imagery and parcel information (i.e., GeoNB online webmap datasets). The New Brunswick forest inventory is another publicly-available GeoNB GIS database that was reviewed for information on forest types within the PDA. A report generated by the AC CDC (2022) indicated no records of SAR or SOCC in the PDA or LAA. However, the report indicated three records of vascular plant species of conservation concern within 5 km of the centre of the PDA: Canada cinquefoil (*Potentilla canadensis*), long-leaved starwort (*Stellaria longifolia*), and perennial yellow nutsedge (*Cyperus esculentus*). These three plant species are not listed under COSEWIC, SARA or NB SARA. Canada cinquefoil is classified by the AC CDC as extremely rare (S1); long-leaved starwort and perennial yellow nutsedge are both classified as uncommon (S3) (refer to **Appendix C**).

5.7.2.2 Wetland Determination, Delineation, and Functional Assessment

Vegetation and wetlands in the PDA were surveyed by qualified J.D. Irving biologists and Dillon personnel on July 25, 2022 and September 16, 2022, following a desktop analysis for the PDA and LAA. Recognized wetland delineators Kelly Honeyman from J.D. Irving, and Chris Kennedy from Dillon carried out the wetland delineations. At the time of writing, the wetland functional assessment report undertaken by Dillon was not complete, but may be provided separately from this EIA Registration document if required.

Wetland delineations and functional assessments within the PDA followed the methodologies described below.

Wetland Determination and Delineation Field Survey Methods

The field wetland determination and delineation methods described herein are based upon established protocols for wetland delineation, as outlined by the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987). Wetland determination and delineation is focused on establishing the wetland-upland edge, and is based upon the presence of positive indicators for three parameters:

- hydric soils;
- hydrophytic vegetation; and
- wetland hydrology.

A positive indicator must typically be present for all three parameters in order to definitively identify the boundary (edge) of a wetland. Sample points for these three parameters were established at representative locations within the wetlands.

Upon positive wetland determination (i.e., positive indicators identified for soils, hydrology and vegetation), a wetland edge condition was established based on the indicators identified at the three-parameter sample points. This edge condition was used to navigate around the perimeter of the wetland, which was in turn georeferenced with a Garmin Map64S handheld Geographical Positioning System (GPS) unit (3 to 5 m accuracy).

In order to assure the accuracy of the boundary being delineated, additional soil samples were made using a soil auger at regular intervals during the delineation. In so doing, the presence of hydrology and soil indicators were able to be confirmed, and corroborated with the observation of wetland vegetation and topographic relief, all of which assist in the definition of the wetland edge condition.

Hydric Soils

Hydric soil conditions are formed when an area is exposed to flooding or saturation for a sufficient length of time during the growing season such that an anaerobic (oxygen free) environment is formed in the soil. These anaerobic conditions may manifest themselves in a variety of ways, such as through the formation of redox features (reduction-oxidation), organic soils (i.e., peat), or formation of hydrogen sulphide (rotten egg odour), among many other indicators. Interpretation of soil profiles, their associated colour, texture and presence/absence of any hydric soil indicators provides the basis for judgement of whether or not any given soil is a hydric soil (USDA 2010).

Soil sampling was performed to a depth of approximately 50 cm (or to point of refusal) to identify conditions in both wetland and upland soils. Soil horizons were documented in terms of their texture, thickness, colour (Munsell value/chroma/hue), and presence of hydric soil indicators (where applicable). Hydric soil indicators were determined as per the document titled *Field Indicators of Hydric Soils in the United States* (USDA 2010). Wetland Delineation Data Sheets were used to record data collected in the field. The data sheets provide the detailed soil information for each sample point, as well as list the various possible hydric soil indicators.

Hydrophytic Vegetation

Hydrophytic vegetation arises in areas where saturation or inundation by water is of duration sufficient to exert a controlling influence on the plant community assemblage. In such areas, plant species which are adapted to high-moisture environments tend to dominate. In order for a given area to classify as a wetland, hydrophytic vegetation should account for the majority (>50%) of the sample sites' total vegetation (Environmental Laboratory 1987).

For every plant species, there is a wetland indicator status, which may be interpreted as that species' estimated probability of occurring within a wetland (Environmental Laboratory 1987). If the majority of plant cover in the sample area is comprised of species with facultative (FAC), facultative wetland (FACW), or obligate (OBL) statuses, then the positive indicator for hydrophytic vegetation is met. Wetland indicator statuses for plant species were determined as per USDA Region 1 (Nova Scotia and New Brunswick) listings for interpreting USDA Wetland Indicator Statuses.

Species encountered at each of the sample locations were analysed at three strata (tree, shrub, and herbaceous) and were documented in terms of their percent (%) cover within a given plot size (10 m, 5 m, and 2 m radius, respectively) and their wetland indicator status (i.e., FAC, FACW, or OBL).

Wetland Hydrology

Both in the soil pits prepared and over the greater area of the wetland, observations were made concerning the presence of a hydrological regime, which would sustain wetland processes. Taken into consideration were: the site context, site location, and the microtopography of the wetland area.

Primary hydrology indicators (of which at least one must be present) include surface water, high water table, saturation, and sediment deposits, among many other others (Environmental Laboratory 1987). Secondary indicators (of which two are required, in the absence of a primary indicator) include surface soil cracks, drainage patterns, and moss trim lines, among others.

Wetland Functional Assessment Field Methods: Wetland Ecosystem Services Protocol Atlantic Canada (WESP-AC)

WESP-AC represents a standardized approach to the way data is collected and interpreted to indirectly yield relative estimates of a wide variety of important wetland functions and their associated benefits.

WESP-AC generates scores (0 to 10 scale) and ratings ("Lower", "Moderate", or "Higher") for a variety of wetland functions using visual assessments of weighted ecological indicators. The number of indicators that is applied to estimate a particular wetland function depends on which function is being assessed. The indicators are then combined in a spreadsheet using logic-based, mathematical models to generate the score and rating for each wetland function and benefit (NBDELG 2018c). Together, they provide a profile of "what a wetland does".

For each function, the scores and ratings represent a particular wetland's standing relative to those in a statistical sample of non-tidal wetlands previously assessed in the province (98 for New Brunswick) (NBDELG 2018c). **Table 5-8** provides a list of various functions, their definitions, and potential benefits.

Table 5-8: Benefits of Wetland Functions Scored by WESP-AC

Function	Definition	Potential Benefits
Hydrologic Functions:		
Water Storage and Delay	The effectiveness for storing runoff or delaying the downslope movement of surface water for long or short periods.	Flood control, maintain ecological systems
Stream Flow Support	The effectiveness for contributing water to streams especially during the driest part of a growing season.	Support fish and other aquatic life
Water Quality Maintenance Functions:		
Water Cooling	The effectiveness for maintaining or reducing temperature of downslope waters.	Support cold water fish and other aquatic life
Sediment and Retention Stabilization	The effectiveness for intercepting and filtering suspended inorganic sediments thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilizing underlying sediments or soil	Maintain quality of receiving waters. Protect shoreline structures from erosion.
Phosphorous Retention	The effectiveness for retaining phosphorus for long periods (>1 growing season)	Maintain quality of receiving waters.
Nitrate Removal and Retention	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas while generating little or no nitrous oxide (a potent greenhouse gas).	Maintain quality of receiving waters.
Organic Nutrient Transport	The effectiveness for producing and subsequently exporting organic nutrients (mainly carbon), either particulate or dissolved.	Support food chains in receiving waters.
Ecological (Habitat) Functions:		
Fish Habitat	The capacity to support an abundance and diversity of native fish (both anadromous and resident species)	Support recreational and ecological values.
Aquatic Invertebrate Habitat	The capacity to support or contribute to an abundance or diversity of invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, clams, snails, water beetles, shrimp, aquatic worms, and others.	Support salmon and other aquatic life. Maintain regional biodiversity.
Amphibian and Reptile Habitat	The capacity to support or contribute to an abundance or diversity of native frogs, toads, salamanders, and turtles.	Maintain regional biodiversity
Waterbird Feeding Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region.	Support hunting and ecological values. Maintain regional biodiversity.

Function	Definition	Potential Benefits
Waterbird Nesting Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that nest in the region.	Maintain regional biodiversity.
Songbird, Raptor, and Mammal Habitat	The capacity to support or contribute to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water	Maintain regional biodiversity.
Native Plant Habitat and Pollinator Habitat	The capacity to support or contribute to a diversity of native, hydrophytic, vascular plant species, communities, and/or functional groups, as well as the pollinating insects linked to them	Maintain regional biodiversity and food chains.
Public Use and Recognition*	Prior designation of the wetland, by a natural resource or environmental agency, as some type of special protected area. Also, the potential and actual use of a wetland for low-intensity outdoor recreation, education, or research	Commercial and social benefits of recreation. Protection of public investments.

Source: NBDELG (2018b)

Note:

*Considered a benefit rather than a function of wetlands

5.7.2.3 Vegetation Assessment Field Survey Methods

In addition to the wetland delineations, upland vascular vegetation communities were inventoried in the field by J.D. Irving and Dillon biologists skilled in the identification of common and rare plant species of New Brunswick. The vascular plant inventory for the PDA was completed on July 25, 2022 by JDI personnel using a point survey methodology where vegetation species, tree composition, and vegetation abundance within the selected sites was determined. Survey sites were dispersed throughout the PDA (**Figure 5-5**). Dillon personnel completed a vegetation inventory on the site on September 16, 2022. These surveys were conducted in a random meandering fashion within and around the PDA focusing on unique habitats.

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VEGETATION SURVEY SITES
FIGURE 5-5

- Vegetation Sites
- Highway
- Road
- Watercourse
- Project Development Area
- Property Boundary
- Waterbody

0 30 60 120 Meters
SCALE 1:2,500

N
W E
S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: RP
MAP CHECKED BY: AY
MAP PROJECTION: NAD_1983_CSRS_NEW_BRUNSWICK_STEREOGRAPHIC

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PROJECT: 22-4686
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FILE LOCATION: K:\2022\224686\Product\Client\2022EIA\Figure 5.7 Vegetation Survey Sites.mxd

5.7.2.4 Results

Vegetation Assessment Survey Results (Upland Vegetation Communities)

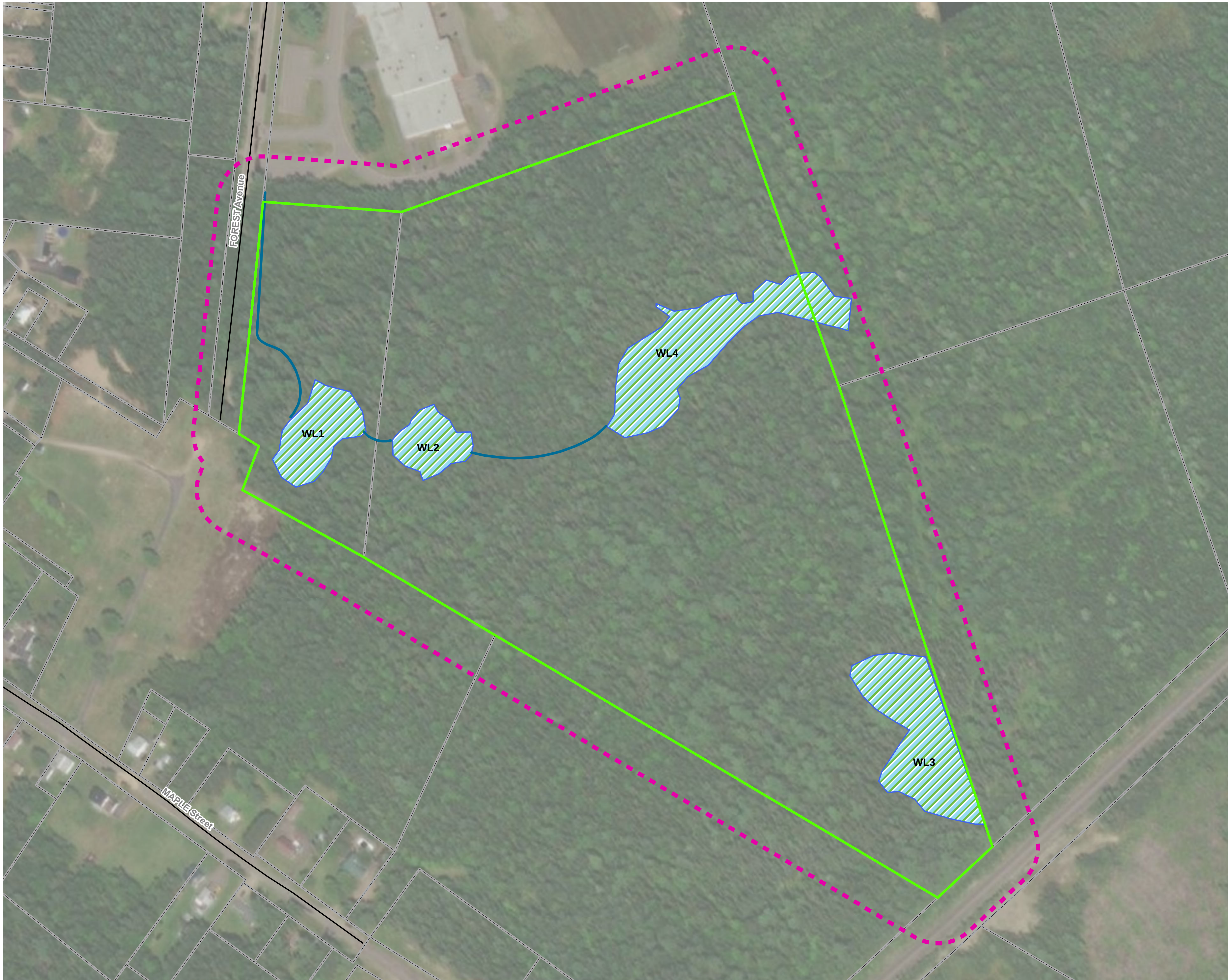
Based on a desktop analysis, the land within and around the PDA is predominantly forested with some residential areas. The residential properties are expected to contain ornamental tree, shrub, and herbaceous plant species. According to the New Brunswick forest inventory (i.e., publicly available GeoNB GIS database) the forest types within the PDA consist of typical forest types including softwood forests consisting of primarily red spruce (*Picea rubens*), black spruce (*Picea mariana*), white pine (*Pinus strobus*), and balsam fir (*Abies balsamea*).

The majority of tree species composition encountered during the vegetation surveys were: white pine (*Pinus strobus*), balsam fir (*Abies balsamea*), and red spruce (*Picea rubens*), which is consistent with the results of the desktop assessment. There were no vegetation SAR or SOCC identified within the PDA during the vegetation surveys. The conservation status ranks (S-ranks) for all species encountered was S5 ("secure" [i.e., common, widespread, and abundant in the province]) and S4 ("apparently secure" [i.e., uncommon but not rare; some cause for long-term concern due to declines or other factors]).

Refer to plant species lists provided in **Appendix D** for a complete iteration of plant species observed during the vegetation surveys and photographs taken at the sites can be found in **Appendix F**.

Wetland Determination and Delineation Field Survey Results

During the field analysis on July 25, 2022 and September 16, 2022, four unmapped wetlands were identified and delineated within the PDA (refer to **Figure 5-6**). The delineated wetlands are summarized in **Table 5-9**.



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APPROXIMATE BOUNDARY OF WETLAND FEATURES (UNMAPPED) WITHIN THE PDA
FIGURE 5-6

- Road
- Project Development Area
- Project Development Area 30m Buffer
- Property Boundary

Unmapped Water Features

- Watercourse
- Wetland

0 15 30 60 Meters

SCALE 1:2,463

N E S W

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: GAM
MAP CHECKED BY: AY
MAP PROJECTION: NAD_1983_CSRS_NEW_BRUNSWICK_STEREOGRAPHIC

DILLON CONSULTING

PROJECT: 22-4686
STATUS: DRAFT
DATE: 2022-10-21

FILE LOCATION: K:\2022\224686\Product\Client\2022EIA\Figure 5.6 Wetland Features Within PDA.mxd

Table 5-9: Summary of Wetland Findings

Wetland Identifier	Wetland Type	Area (ha) of Wetland to be Potentially Affected by the Project activities
Wetland 1 (WL1)	Forested swamp wetland	0.15
Wetland 2 (WL2)	Forested swamp wetland	0.19
Wetland 3 (WL3)	Forested swamp wetland	0.39
Wetland 4 (WL4)	Forested swamp wetland	0.40
	Total:	**1.13**

Approximately 1.13 ha of unmapped wetland may be permanently lost as a result of the Project. The four wetlands within the PDA are forested swamp types and shared similarities between their vegetation communities, soil conditions and hydrologic characteristics. The overstory of these forested swamp wetlands was dominated by black spruce (*Picea mariana*). The sporadic shrub layer contained mostly northern wild raisin (*Viburnum cassinoides*) and speckled alder (*Alnus incana*) saplings. The herbaceous layer was dominated by cinnamon fern (*Osmunda cinnamomea*) and tussock sedge (*Carex stricta*).

The vegetation communities identified in the wetlands comprised of greater than 50% wet-adapted vegetation species based on their indicator status (i.e., obligate, facultative wet, facultative, facultative upland, upland; Environmental Laboratory 1987); therefore, these wetlands are considered to have “hydrophytic” or wet adapted vegetation communities. There were no flora SAR or SOCC observed during desktop or field delineations for these wetlands.

The wetlands also had sphagnum moss and peat moss layers at the surface that are slower to decompose due to wet conditions and wet soil indicators in the form of iron concentrations in the sand and sandy clay soils, indicating that the water table regularly moves into the soil. Field sheets from the wetland delineations are presented **Appendix E**.

5.7.3 Assessment of Potential Interactions between the Project and Vegetation and Wetlands

The potential interactions between the Project and vegetation and wetlands are assessed below.

5.7.3.1 Potential Interactions

Based on a desktop review, there are sections of the subdivision development that are required within a wetland. The construction and operation phases of the Project would result in the direct loss of approximately 1.13 ha of unmapped (field identified) wetlands within the PDA, but no PSW wetlands are located in the PDA nor is it expected that they will be directly affected by the Project. This direct loss may require a Watercourse and Wetland Alteration (WAWA) permit through the NBDELG. Any permanent wetland loss of wetland function associated with the development of the subdivision may need compensation (at the discretion of NBDELG), in alignment with New Brunswick’s Wetland

Conservation Policy (NBDNRE-NBDELG 2002), which mandates a no net loss of wetland function associated with wetland alterations.

Though no other work in wetlands is anticipated, there is potential for runoff from the PDA to reach waterways and downstream wetlands if appropriate mitigation measures are not in place. Project activities also have the potential to alter natural drainage patterns and increase erosion into the watercourses and wetlands in the LAA.

During site development and lot construction, it will be necessary to clear and grub vegetation within the PDA, resulting in the loss of mature and immature vegetation. Mature trees and vegetation should be preserved to the extent possible.

5.7.3.2 Mitigation

During the site preparation, and lot construction process, the following mitigation measures for vegetation and wetlands should be applied:

- The area to be disturbed by the Project will be minimized to the extent possible (i.e., limited to the area which is required to accomplish the Project objectives);
- Efforts should be made to maintain as much mature vegetation along the edges of the site;
- Obtaining a watercourse and wetland alteration (WAWA) permit, if necessary, for any alterations to wetlands (and their 30 m buffers), including wetland compensation at the discretion of NBDELG;
- Construction and operation activities will comply with the conditions of the WAWA permit;
- Soil will not be stockpiled within 30 m of a wetland;
- All chemicals and petroleum products will be managed in accordance with manufacturer specifications and stored more than 30 m from a wetland;
- Refueling equipment and vehicles will be conducted more than 30 m from a wetland and where possible over an impermeable surface;
- All waste materials should be secured and/or stabilized until they can be transported off-site for disposal to prevent them from entering any aquatic habitat;
- Ground disturbance work should not be completed during significant storm events;
- The source of any new fill material should be from approved local borrow sources and the material should be inspected prior to use to avoid the introduction of invasive species;
- Proper erosion and sediment control measures will be installed and checked regularly to confirm they are continuing to operate properly to minimize potential effects to wetlands;
- Natural vegetation will be preserved when possible to maintain habitat, especially in riparian areas;
- All construction equipment should be properly cleaned prior to mobilizing to site to avoid potential introduction of invasive species;

- During Project activities, efforts will be made to avoid areas where SOCC or SAR are known to be present, or other management implemented upon discussion with applicable regulatory authorities; and
- For forest clearing activities, JDI utilizes a number of best management practises, guidelines and educational documents (see **Appendix G**). These will be implemented for the clearing and grubbing phases of the Project.

5.7.3.3 Characterization of Potential Interactions Following Mitigation

The Project will result in the loss of vegetation within the PDA via clearing and grubbing so that the subdivision can be developed. There are no known occurrences of plant SAR or SOCC on the PDA based on field surveys conducted in 2022, and mature vegetation will be maintained within the PDA to the extent possible. Forest habitat is ample in the LAA and beyond, and the loss of immature vegetation will not result in a change in species distribution or threats to the population on a landscape level. Once the dwellings are complete and landscaping is completed, some vegetation species in the form of manicured lawns and ornamental trees and shrubs will again occupy portions of the PDA, and although this will not consist of native vegetation that previously occupied the PDA, it will restore some habitat function for some wildlife species. Thus, the Project is not expected to result in a substantive long term effect on vegetation.

The Project may result in the permanent, direct loss of approximately 1.13 ha of unmapped wetlands within the PDA, to allow for the construction of residential lots, roads, and a green space area. This is an unavoidable loss to accomplish the Project, which would occur during construction and persist through the life of the Project. A WAWA permit, with applicable compensation for the permanent loss of wetland at the discretion of NBDELG, will be obtained if necessary to authorize this loss.

During operation, it is anticipated that additional indirect loss of, or alterations to, wetlands and wetland functions located on some neighbouring properties to the Project site may occur from localized changes in surface water hydrology arising from the reshaping of the PDA. Although not specifically located on the PDA and not subject to direct disturbance as a result of the Project activities, a PSW that is contiguous to the unnamed watercourse (on the opposite side of Forest Avenue in the northwest corner of the Project) may experience indirect effects. However, the stormwater management basin should be designed with the goal of ensuring that net runoff is the same after development as it was prior to development, which will mitigate this effect.

Without mitigation, construction activities and some operation activities could result in direct net loss of functions to existing and nearby wetlands. The implementation of the practice ‘avoid’, ‘minimize’ and/or ‘compensate’ should be considered for all potential impacts to wetlands within the PDA and LAA. Applicable authorization (i.e., WAWA permit and associated compensation) will be secured with NBDELG prior to undertaking construction activities within 30 m that could affect wetlands. Projects that are deemed by NBDELG to cause a ‘net loss’ to wetland function under the New Brunswick Wetlands Conservation Policy (NBDNRE-NBDELG 2002) require compensation at a 2:1 ratio.

For construction equipment mobilizing to the site and working within 30 m of a wetland, contractors will be required to properly clean equipment prior to mobilizing to the site so as to avoid the transfer of vegetative invasive species to the area. Preventative erosion and sediment control measures during Project activities, especially during any road construction, are expected to prevent any sedimentation effects that could negatively affect vegetation communities and wetlands.

5.7.4 Summary

Based on the above, with planned mitigation, authorization, compensation (as applicable), and properly installed environmental protection measures, and given that no SAR or SOCC were identified during the 2022 vegetation surveys, the potential interactions between the Project and vegetation and wetlands are not expected to be substantive. Adaptive management and compensation measures should be implemented as necessary to address any changes to valued vegetation communities if they arise.

5.8 Wildlife and Wildlife Habitat

The potential interactions between the Project and wildlife (including species at risk and birds) and their habitats are assessed in this section.

5.8.1 Scope of VC

Wildlife and wildlife habitat includes wildlife (fauna) and the habitats that support wildlife species. This valued component (VC) is focussed on birds, mammals (including bats), invertebrates, and herptiles (i.e., reptiles and amphibians) within terrestrial components of their lifecycle, as well as the habitats that support them. Wildlife and wildlife habitat has been selected as a VC because, in general, the environment around the PDA, including the Salmon River and its tributaries, support terrestrial wildlife and are important to the public for the biodiversity they support.

There is the potential for interactions between wildlife, its habitat, and proposed Project activities. Particular focus is placed on wildlife species at risk (SAR) and species of conservation concern (SOCC) as identified by provincial and federal regulatory agencies. SAR/SOCC are often susceptible to changes in the environment and are therefore useful indicators of ecosystem health and regional biodiversity.

Both provincial and federal legislation provides protection to designated bird, mammal, herptile, and other SAR. SAR are protected under the federal *Species at Risk Act* (SARA) and the New Brunswick *Species at Risk Act* (NB SARA). The federal SARA provides protection for SAR in Canada that are listed on Schedule 1 of SARA. It provides a framework to facilitate recovery of species listed as Threatened, Endangered, or Extirpated and to prevent species listed as Special Concern from becoming Threatened or Endangered. SARA provides protection for both SAR and their critical habitat or residences by prohibiting: 1) the killing, harming, or harassing of Endangered or Threatened SAR (sections 32 and 36); 2) the destruction of critical habitat of an Endangered or Threatened SAR (sections 58, 60, and 61); and 3) damage or destruction of residence of SAR (section 33 of SARA). Residence descriptions, where defined, may afford additional protection to migratory birds that are not afforded under the *Migratory*

Bird Regulations. Similarly, NB SARA provides for the protection, designation, recovery, and other relevant aspects of conservation of SAR in New Brunswick, including habitat protection. NB SARA facilitates the conservation and management of wildlife species to prevent further declines and promote recovery.

In addition, most bird species, specifically, are protected under the *Migratory Birds Convention Act* (MBCA). The vast majority of bird species found in New Brunswick are migratory and either breed in the province during the summer months, or pass through it during the spring and fall migratory periods. Jurisdiction for many migratory birds is federal, since migratory birds cross both provincial and international boundaries. The MBCA is the federal law which protects migratory birds in Canada (with similar legislation in the United States). The Act prohibits killing, injuring, or harassing migratory birds, their nests, or their young. Migratory birds that are protected under the MBCA in Canada, and that are relevant to the Project include:

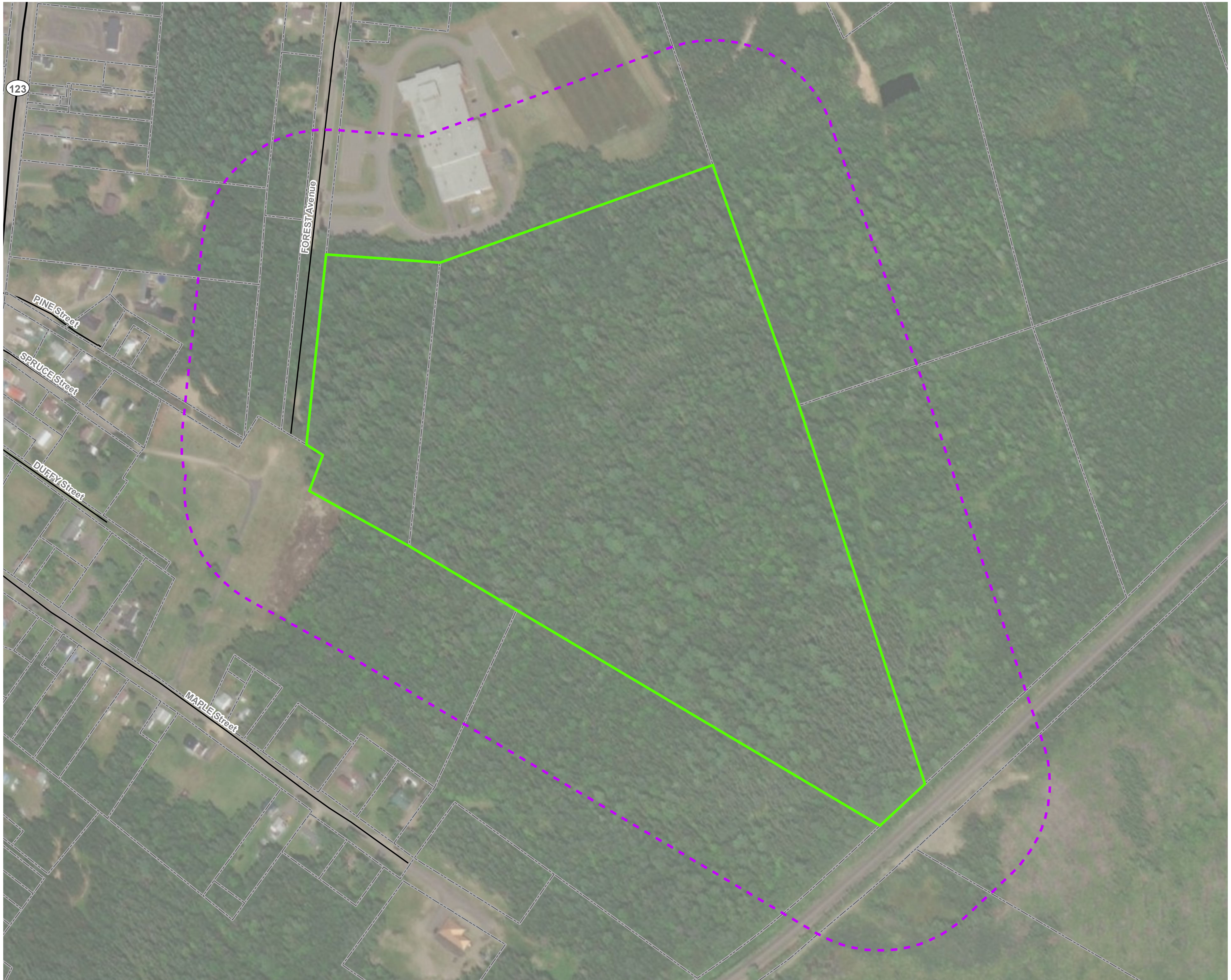
- Waterfowl (e.g., ducks and geese);
- Rails (e.g., coots, gallinules, sora, etc.);
- Shorebirds (e.g., plovers and sandpipers); and
- Songbirds (e.g., thrushes and warblers).

Birds not addressed under federal jurisdiction include grouse, quail, pheasants, ptarmigan, hawks, owls, eagles, falcons, cormorants, pelicans, crows, jays, and kingfishers. Most birds not included in this list are protected under provincial laws, most notably the New Brunswick *Fish and Wildlife Act*. The New Brunswick *Fish and Wildlife Act* protects all fish and wildlife species (including all vertebrate animals or birds) from angling, hunting, trapping and other forms of intentional take, except under the authority of permits or licences. The Act also prohibits the disturbance, gathering or collection of the nests or eggs of any bird species, except under the authority of a permit.

In this EIA Registration document, we define “species at risk” (SAR) as those species that are listed as “Extirpated”, “Endangered”, “Threatened”, or “Special Concern” on Schedule 1 of the federal SARA or on the NB SARA. We also define “species of conservation concern” (SOCC) as those species that are not SAR but are listed in other parts of SARA, NB SARA, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or as regionally rare or endangered by the Atlantic Canada Conservation Data Centre (AC CDC) (i.e., those species with AC CDC S-ranks of extremely rare [S1], rare [S2], or uncommon [S3]).

The wildlife and wildlife habitat VC has connections to the vegetation and wetlands VC (**Section 5.7**) because of its relationship with vegetation, hydrology, landforms, and soil components that are key components of wildlife habitat. Vegetation communities and wetlands (and plant SAR) which comprise habitat are discussed in **Section 5.7**. Aquatic wildlife/fish are considered in **Section 5.6**.

The local assessment area (LAA) for wildlife and wildlife habitat is defined as the footprint of ground disturbance (the PDA), plus a 100 m buffer surrounding the PDA (**Figure 5-7**), in recognition of the potential for sensory disturbance to wildlife as a result of Project-related activities.



CHIPMAN HOUSING AUTHORITY INC.

Environmental Impact Assessment (EIA)

WILDLIFE AND WILDLIFE HABITAT LOCAL ASSESSMENT AREA (LAA)

FIGURE 5-7

- Road
- Highway
- Project Development Area
- Local Assessment Area (LAA)
- Property Boundary

0 15 30 60 Meters

SCALE 1:3,000

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED, CANVEC
SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

MAP CREATED BY: GAM
MAP CHECKED BY: AY
MAP PROJECTION: NAD_1983_CSRS_NEW_BRUNSWICK_STEREOGRAPHIC

DILLON CONSULTING

PROJECT: 22-4686

STATUS: FINAL

DATE: 2022-10-21

FILE LOCATION: K:\2022\224686\Product\Client\2022EIA\Figure 5.8 Wildlife and Wildlife Habitat Local Assessment Area (LAA).mxd

5.8.2 Existing Conditions

The information regarding the presence and characterization of wildlife and wildlife habitat in the LAA was derived from several desktop information sources including existing databases and secondary information sources, including a review of historical observation data maintained by the AC CDC. Targeted surveys for wildlife (including bats, birds, and herptiles) were not conducted in support of this EIA Registration; incidental observations of wildlife that were made by field personnel while conducting wetland delineations and vegetation surveys were noted by the field teams. Given that clearing of trees and vegetation will be conducted with all necessary precautions to avoid harm to breeding birds, their nests and eggs and since the single drainage feature on the PDA was dry and ephemeral at the time of the field reconnaissance surveys in July and September 2022 (therefore with little potential to contain habitat for herptiles), wildlife field surveys were not considered to be required, in the professional judgment of the study team.

5.8.2.1 Desktop Analysis Methods and Data Sources

Information regarding the use of the LAA by wildlife and presence of wildlife habitat was derived from several sources including existing databases and secondary information sources. To provide information on potential occurrences of rare and endangered wildlife, and unique or sensitive wildlife habitats potentially existing within or near the PDA, a review of the following existing data and information sources was conducted:

- Listed species by COSEWIC;
- Listed species under the federal SARA;
- Listed species under NB SARA; and
- Ranked species by the NBDNRED.

In addition, a site-specific AC CDC report (AC CDC 2022) was obtained (**Appendix C**). The report provided recorded historical observations of SAR/SOCC flora and fauna species, as well as identified environmentally sensitive or managed areas within a 5 kilometre radius of the centre of the PDA. The AC CDC report also identifies wildlife SOCC identified as “extremely rare” (S1), “rare” (S2), or “uncommon” (S3).

Other available background information sources and mapping reviewed to identify and assess wildlife and wildlife habitat presence at and near the PDA included:

- Ecological Reserves in the Maritimes;
- Environmentally Sensitive Areas (ESAs) database;
- Atlas of Breeding Birds of the Maritime Provinces (MBBA);
- Important Bird Areas (IBAs) of Canada;
- Federally-designated migratory bird sanctuaries;

- Provincially-identified deer wintering areas (DWAs); and
- Identified Protected Natural Areas (PNAs) and Wildlife Management Zones (WMZ).

5.8.2.2 Desktop Analysis Results – Resident and Migratory Birds

General Status of Wildlife Species

NBDNRED's *General Status of Wild Species* (NBDNRED 2022) reports that there are 449 extant bird species known to occur in New Brunswick, of which 143 are considered accidental (NBDNRED 2022). Of the species that regularly occur in the province during at least part of their lifecycle, 14 species are listed as "At Risk", 12 are listed as "May be At Risk", and 56 are considered "Sensitive".

Maritimes Breeding Bird Atlas

The Maritime Breeding Bird Atlas (MBBA) database (Stewart et al. 2015) provides information on the presence of breeding bird species in counts conducted between 2006 and 2010. Within the MBBA Second Atlas, the LAA lies within Region #8, Boiestown-Doaktown.

The LAA falls in Square # 20KS71. During the most recent MBBA period of 2006-2010, a total of 68 species were recorded within this square. Of these species, 23 were confirmed as breeding, 11 were probable breeders, and 34 were possible breeders. There were 15 SAR detected during the most recent MBBA period in this square. These species included: Bald Eagle (*Haliaeetus leucocephalus*), Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*), Bicknell's Thrush (*Catharus bicknelli*), Bobolink (*Dolichonyx oryzivorus*), Canada Warbler (*Cardellina Canadensis*), Chimney Swift (*Chaetura pelagica*), Common Nighthawk (*Chordeiles minor*), Eastern Meadowlark (*Sturnella magna*), Eastern Wood-pewee (*Contopus virens*), Evening Grosbeak (*Coccothraustes vespertinus*), Olive-sided Flycatcher (*Contopus cooperi*), Rusty Blackbird (*Euphagus carolinus*), Whip-poor-will (*Caprimulgus vociferous*), and Wood Thrush (*Hylocichla mustelina*).

Important Bird Areas (IBAs)

As reported by Bird Studies Canada (BSC), there are no IBAs in the vicinity of the LAA. The Lower Saint John River (Sheffield/Jemseg) IBA (NB010) is the closest IBA to the LAA, approximately 40 km south of the Project. The Lower Saint John River site, located in south-central New Brunswick, extends 25 km along the St. John River, from 5 km northeast of the town of Oromocto to 25 km east of Oromocto (BSC 2022). The site includes the Portobello National Wildlife Area, Gilbert Island, French Lake, Big Timber Lake, Grand Lake Meadows, and the southern edge of Grand Lake. The habitat in this area consists of a unique hardwood and flora complex, being under tidal influence and subject to extensive spring flooding, it is the largest wetland complex in Atlantic Canada (BSC 2022). Habitats here include marshy islands, backwaters, creeks and marshes that extend 2 to 5 km beyond the main riverbanks. These extensive marshes and backwaters of the Lower Saint John River provide breeding habitat for the nationally vulnerable Yellow Rail (*Coturnicops noveboracensis*). The area is also the largest breeding concentration in the northeast for Black Terns (*Chlidonias niger*), and supports the only breeding population of Greater Scaup (*Aythya marila*) in Atlantic Canada. Thousands of waterfowl also use the site during migration (BSC 2022).

According to the custom AC CDC report (AC CDC 2022), there are no historical records of observations of bird SAR or SOCC in the PDA or LAA. A review of the AC CDC data as compiled indicated that there were 7 avian SAR historically observed within 5 km of the PDA. In addition, there were 11 avian SOCC historically observed. **Table 5-10** shows the 18 SAR or SOCC identified in the 2022 AC CDC report.

Table 5-10: Avian Species at Risk and Conservation Concern Historically Observed Within 5 Kilometres of the PDA

Common Name	Scientific Name	COSEWIC Status	SARA Status	NB SARA Status	AC CDC S-Rank[1]
Wood Thrush	*Hylocichla mustelina*	Threatened	Threatened	Threatened	S1S2B
Bank Swallow	*Riparia*	Threatened	Threatened	-	S2B
Chimney Swift	*Chaetura pelagica*	Threatened	Threatened	Threatened	S2S3B,S2M
Barn Swallow	*Hirundo rustica*	Special Concern	Threatened	Threatened	S2B
Bobolink	*Dolichonyx oryzivorus*	Special Concern	Threatened	Threatened	S3B
Common Nighthawk	*Chordeiles minor*	Special Concern	Threatened	Threatened	S3B,S4M
Red-shouldered Hawk	*Buteo lineatus*	Not at Risk	-	-	S1S2B
Common Tern	*Sterna hirundo*	Not at Risk	-	-	S3B,SUM
Bald Eagle*	*Haliaeetus leucocephalus*	Not at Risk	Threatened	Threatened	S4
Purple Martin	*Progne subis*	-	-	-	S1B
Cliff Swallow	*Petrochelidon pyrrhonota*	-	-	-	S2B
Ring-billed Gull	*Larus delawarensis*	-	-	-	S2S3B,S4N,S5M
Red Crossbill	*Loxia curvirostra*	-	-	-	S3
Killdeer	*Charadrius vociferus*	-	-	-	S3B
Great Crested Flycatcher	*Myiarchus crinitus*	-	-	-	S3B
Brown-headed Cowbird	*Molothrus ater*	-	-	-	S3B
Eastern Kingbird	*Tyrannus*	-	-	-	S3S4B
Spotted Sandpiper	*Actitis macularius*	-	-	-	S3S4B,S4M

Notes:

[1] AC CDC S-Ranks as follows- 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; S#S#: a numeric range rank used to indicate any range of uncertainty about the status of the species or community; B: breeding;
N: nonbreeding; M: migrant; U: unrankable (AC CDC 2022).
*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 the AC CDC report.

5.8.2.3 Desktop Analysis Results – Mammals (Including Bats)

NBDNRED's *General Status of Wild Species* (NBDNRED 2022) reports that there are 49 species of mammals known to occur within New Brunswick, and an additional 10 which are extinct, extirpated, or unverified. Of these 49 species, Canada lynx (*Lynx canadensis*) is listed as Endangered under NB SARA, and three bat species are listed as Endangered under Schedule 1 of SARA, including the little brown bat (little myotis; *Myotis lucifugus*), Northern long-eared bat (Northern myotis; *Myotis septentrionalis*), and Eastern pipistrelle (tri-coloured bat; *Perimyotis subflavus*).

According to the AC CDC report (AC CDC 2022), there are no historical records of observations of mammal SAR or SOCC (including bat hibernacula) in the PDA or LAA.

5.8.2.4 Desktop Analysis Results – Terrestrial Invertebrates

Lists of butterfly and odonate (dragonfly and damselfly) species in New Brunswick are maintained in the NBDNRED's *General Status of Wild Species* database (NBDNRED 2022). The database currently lists 80 butterfly and 131 odonate species known to occur in the province. Of these species, one (Maritime ringlet, *Coenonympha nipisiquit*, a butterfly) is an SAR listed as Endangered under SARA and NB SARA, 15 (4 butterflies and 11 odonates) are considered May be At Risk SOCCs, and 13 (one butterfly and 12 odonates) are considered Sensitive (i.e., neither SAR nor SOCC). The Maritime ringlet and skillet clubtail (*Gomphus ventricosus*, an odonate) are SAR that are listed as Endangered under SARA, while the monarch butterfly (*Danaus plexippus*) and pygmy snaketail (*Ophiogomphus howei*, an odonate) are considered to be SAR as they are listed as Special Concern under Schedule 1 of SARA.

The skillet clubtail, cobblestone tiger beetle, and the Maritime ringlet have very limited populations in New Brunswick that are not located in the immediate vicinity of the Salmon River. The cobblestone tiger beetle is endemic to only the Saint John River system and Grand Lake (Environment Canada 2013). The known distribution of the Grand Lake populations are approximately 25 km south of Chipman, so they are not likely to be in the vicinity of the Project (Environment Canada 2013). The breeding population of the skillet clubtail is only known in the Maritimes from records along the Saint John River from Fredericton to around Gagetown. Adults were also observed on two tributaries of the Saint John River (i.e., Salmon and Canaan Rivers). However, with only adult records from these rivers, it is currently unknown whether breeding populations exist. So there exists a potential for individuals to be located in the PDA, however this is unlikely (ECCC 2021). Lastly, the Maritime ringlet is restricted to areas directly around the Chaleur Bay in Northern New Brunswick and portions of the Gaspé region of Québec (COSEWIC 2009) and due to the Project's distance from the Chaleur Bay (approximately 180 km south), it is not expected to be present during the Project phases.

A review of the AC CDC report (2022) indicated that three terrestrial invertebrate SAR and two terrestrial invertebrate SAR have historically been observed within 5 km of the PDA (**Table 5-11**). According to the report, there are no historical records of observations of terrestrial invertebrate SAR or SOCC in the PDA or LAA.

Table 5-11: Terrestrial Invertebrates Historically Observed Within 5 Kilometres of the PDA (AC CDC 2022)

Common Name	Scientific Name	COSEWIC Status	SARA Status	NB SARA Status	AC CDC S-Rank[1]
Skillet Clubtail	*Gomphurus ventricosus*	Special Concern	Endangered	Endangered	S2
Monarch	*Danaus plexippus*	Endangered	Special Concern	Special Concern	S2S3?B
Yellow-banded bumblebee	*Bombus terricola*	Special Concern	Special Concern	-	S4
Spike-lip Crater Snail	*Appalachina sayana*	Not at Risk	-	-	S3?
Tidewater Mucket	*Atlanticoncha ochracea*	-	-	-	S3

Notes:

[1] AC CDC S-Ranks as follows- 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; S#S#: a numeric range rank used to indicate any range of uncertainty about the status of the species or community; B: breeding; N: nonbreeding; M: migrant; U: unrankable (AC CDC 2022).

5.8.2.5 Desktop Analysis Results – Herptiles

NBDNRED's *General Status of Wild Species* database (NBDNRED 2022) reports that there are seven reptile and 16 amphibian species known to occur in New Brunswick. Of these species, snapping turtle (*Chelydra serpentina*) is listed as Special Concern under NB SARA and SARA, and wood turtle (*Glyptemys insculpta*) is listed as Threatened under SARA and NB SARA. Eastern painted turtle (*Chrysemys picta*) is also listed as Special Concern under Schedule 1 of SARA, but is not listed provincially.

Wood turtles are generally associated with watercourses and their riparian habitats in forested areas (ECCC 2020). Individuals nest on sandy and gravelly riverbanks (ECCC 2020) but will also make use of other features such as sand pits and road embankments near watercourses that provide a sandy or gravelly substrate. Snapping turtles generally inhabit ponds, sloughs, streams, rivers, and shallow bays that are characterized by slow moving water, aquatic vegetation, and soft, muddy bottoms (COSEWIC 2008). Both wood turtles and snapping turtles are known to overwinter in deep pools in larger rivers and deep ponds (ECCC 2020; COSEWIC 2008).

According to the AC CDC report (2022), there are no historical records of observations herptile SAR or SOCC in the PDA or LAA. There have been historical sightings of wood turtle and eastern painted turtle within 5 km of the PDA. Because these species are location sensitive, AC CDC was not able to provide the location of theses sightings.

5.8.2.6 Incidental Wildlife Observations

Incidental wildlife observations were noted while the vegetation and wetland surveys were being conducted by Dillon personnel on September 16, 2022. The only two species of note were an Eastern phoebe (*Sayornis phoebe*) and what was suspected to be a pine warbler (*Setophaga pinus*). No other wildlife or signs of wildlife were noted.

5.8.3 Assessment of Potential Interactions between the Project and Wildlife and Wildlife Habitat

As part of the desktop assessment, the habitat requirements of wildlife species identified as potentially occurring within and/or near the Project were compared to the range of environmental conditions within the surrounding area to determine if suitable habitat was present for these taxa. Knowledge of the habitats present within the LAA was determined through an interpretation of aerial photography, topographic, and geological mapping. In instances where appropriate habitat was present, mitigation was identified, and potential impacts were assessed.

5.8.3.1 Potential Interactions

Project activities such as heavy equipment operation have the potential to interact with wildlife and wildlife habitat. Potential interactions with wildlife or their habitats include direct mortality, habitat loss and fragmentation, and sensory disturbance. These potential interactions are discussed in this section.

Migratory Birds

The primary possible interactions with birds due to the Project include habitat loss, destruction of nests, direct mortality due to collision, and sensory disturbance. The Project may interact with birds and bird habitat in the following ways:

- Direct mortality via collision with equipment and materials during the Project activities;
- Activities may destroy or alter habitat for bird SAR or SOCC or migratory bird habitat;
- Sensory disturbances from Project activities may deter birds from migrating into and using the PDA; and
- Sensory disturbances from Project activities may result in the abandonment of nests or increased rates of predation and exposure of hatchings and eggs during temporary abandonment.

Mammals (Including Bats)

The Project may interact with mammals and their habitat in the following ways:

- Brushing or removing vegetation will cause loss of vegetation that provides habitat for wildlife;
- Disturbance from vehicles and heavy equipment may cause wildlife avoidance or disruption of wildlife activities (such as breeding and/or feeding);
- Sensory disturbance from noise, vibration, dust, and air contaminant emissions may cause a disruption to wildlife species;
- Mobile equipment used during Project activities may cause direct injury or death of wildlife, particularly to small wildlife such as rodents and shrews, through collisions or destruction of dens and food sources;
- Wildlife could be attracted to the site for food or food scraps; and

- Medium and large-sized mammals are unlikely to suffer direct mortality from Project activities as they would likely avoid the area in response to human presence and noise; however, such avoidance or behaviour could result in changes to normal movements, migration patterns, and other life cycle processes.

Herptiles

The Project may interact with herptiles and their habitat through direct mortality via collision with various equipment required around the site at different phases of the Project. Though the PDA itself is not expected to provide habitat for herptiles, the presence of the nearby Salmon River may provide habitat for wood turtle and other rare turtle species. The main threat to these Threatened species is via vehicle collision.

5.8.3.2 Mitigation

The following mitigation measures are planned to reduce environmental effects on wildlife and wildlife habitat:

- The size of the footprint will be limited to that necessary to accomplish the Project purpose;
- Vegetation will be retained where possible to maintain wildlife habitat;
- Activities that may harm or harass migratory birds will be scheduled to the extent possible outside of the normal migratory bird breeding season (from April 8th to August 28th for nesting zone C3) to ensure that nesting activity is not disturbed and that eggs and flightless young are not inadvertently harassed or destroyed. At a minimum, if complete avoidance of these activities during the specified timeframe is not feasible, nest searches will be undertaken by a qualified biologist and avoidance setbacks should be established around active nests. Nest searches will only be completed following consultation with CWS and turtle nest searches undertaken by a qualified biologist if preferential habitat is identified;
- If encountered, turtle nesting areas will not be disturbed during the late May to mid-July period;
- Machinery and equipment should be cleaned prior to entering the site to limit the potential spread of exotic or invasive plant species;
- Food and food waste should be stored and disposed of properly to avoid attracting wildlife;
- On-site workers should receive training and reference material that will help them identify bird species that could be attracted to habitats created by Project operations (e.g., Bank Swallow and Common Nighthawk). If workers encounter birds that they suspect may be nesting within or near the construction site, a biologist should be contacted to determine whether nesting is occurring and to locate the nest. No flagging of the nest will occur to minimize chances of predation;
- If a species at risk is encountered, contact will be made to a Species at Risk biologist at NBDNRED at (506) 453-5873 to discuss immediate actions and future mitigation;

- To minimize disruptions with wildlife activity at night, the Project construction activities should be limited to daylight hours. If night work is required, approval may be required and lighting requirements should meet ECCC standards to minimize the potential impacts to migratory birds and bats;
- Any nuisance wildlife as identified under the *Nuisance Wildlife Regulation* (97-141) of the New Brunswick *Fish and Wildlife Act* identified as disrupting Project-related activities may only be removed by a licensed Nuisance Wildlife Control Officer or a licensed trapper; and
- In the case of wildlife encounters, the following should be implemented:
    - No attempt should be made by any worker to chase, catch, divert, follow or otherwise harass wildlife by vehicle or on foot, and
    - Equipment and vehicles will yield the right-of-way to wildlife.

5.8.3.3 Characterization of Potential Interactions Following Mitigation

Project activities will result in the permanent loss of wildlife habitat, and may interact with wildlife through sensory disturbances such as noise, vibration, or light, or by increased traffic during the Project activities. Due to the nature of the LAA and surrounding areas being mostly forested, there exists ample vegetation and forested land in proximity to the Project for wildlife species to use.

AC CDC records indicate that no mammal or herptile species at risk (SAR) have been historically observed on the PDA, and no mammal or herptile SAR were incidentally observed during the field surveys conducted for the Project. Project activities, such as the operation of heavy machinery are likely to result in such sensory disturbance that most wildlife will likely avoid the area while work is taking place, thereby limiting the potential for wildlife encounters, injury, or mortality of wildlife species. Suitable habitat in the vicinity of the Project is abundant.

Although the vegetation in the PDA may provide habitat for bird species, including SAR (e.g., Common Nighthawk, Canada Warbler, and Olive-sided Flycatcher), the Project is located in a larger surrounding area with ample vegetation and forested land for bird species to use. Development of the Project is likely to result in sensory disturbance to birds and thus birds are likely to avoid the areas where construction activities are to take place, thereby limiting the potential for injury or mortality of bird species. Given the relatively limited area of disturbance associated with the Project, the environmental setting, and implementation of the mitigation measures outlined in **Section 5.8.3.2**, substantive interactions between the Project and birds and bird habitat are not anticipated. Given the lack of reported bat hibernacula in the vicinity of the Project, adverse interactions with bats are not expected.

The Project is surrounded by habitat for wood turtles. During field surveys, no turtles were observed incidentally. Due to the location of major watercourses (i.e., Salmon River) being relatively removed from the PDA, with care taken and the implementation of mitigation measures outlined in **Section 5.8.3.2**, there should be no impact to turtles or turtle habitat.

5.8.4 Summary

Assuming application of the mitigation measures described above, including conducting vegetation clearing activities outside of the Environment and Climate Change Canada recommended timing window for the Project location to facilitate compliance with the MBCA, and a worker education program for identifying species at risk and species of conservation concern, the residual environmental effects of the Project on wildlife and wildlife habitat during all phases of the Project are not anticipated to be substantive.

5.9 Socioeconomic Environment

The potential interactions between the Project and the socioeconomic environment are assessed in this section.

5.9.1 Scope of VC

The Project has the potential to interact with the socioeconomic environment in substantial ways, influencing land use, employment, and the local economy. These potential interactions concern regulatory agencies, non-governmental organizations, and the general public because they have a direct influence on the lives of those living and working in the vicinity of the Project. The socioeconomic environment has therefore been selected as a valued component (VC) in recognition of these concerns and values of New Brunswickers.

The scope of the socioeconomic environment VC generally includes potential interactions of the Project with residential, agricultural, forestry, recreation, and transportation land uses and the employment and economic conditions that may change as a result of the Project. As described in **Section 2.0** of this EIA Registration document, the Project has the potential to interact with the socioeconomic environment by introducing new residents, working populations to the area, and overall tax-based growth. These interactions are largely positive given the region's need for both younger populations and newcomers, to which the development is targeted. The housing stock in the Village has remained otherwise stagnant, and a new subdivision will allow workers and families to increase the local tax-base. Increased residents bring opportunities for local businesses to be impacted by an increased population and increased spending power in the region.

The local assessment area (LAA) for the socioeconomic environment is defined as the Village of Chipman Census Subdivision from Statistics Canada.

5.9.2 Existing Conditions

Existing socioeconomic conditions in the Project area are described in this section.

5.9.2.1 Demographic Overview

The Village of Chipman is located within Queens County and inside the boundaries of Chipman Parish, though the Village of Chipman is a separate Census Subdivision. The population of the Chipman Village Census Subdivision is 1,201 in 2021, an 8.8% increase from 2016 population numbers (Statistics Canada 2022). The population of the Village is above the provincial median age of 46.8, with a medium age of 56.8 (Statistics Canada 2022). These data are in line with the province of New Brunswick's trends of aging populations.

5.9.2.2 Local Government Structure

There are twelve service regions in New Brunswick directed by Regional Service Commissions (RSC) that are responsible for delivery of local land use planning, solid waste management, and sports and recreation services. Each commission is made up of the area's incorporated municipalities and unincorporated Local Service Districts (LSDs).

The PDA is located within the Regional Service Commission (RSC) 11, which is comprised of 29 local service districts (LSDs), the Villages of Cambridge-Narrows, Chipman, Fredericton Junction, Gagetown, Millville, Minto, New Maryland, Stanley, and Tracy, the rural community of Hanwell, and the towns of Nackawic and Oromocto.

As mentioned in **Section 3.3**, the Province is undertaking local governance reform initiatives that will dissolve the Village of Chipman by the end of 2022. The Village will be amalgamated with surrounding local service districts to become the municipality of Grand Lake (NBDELG 2022a). The Village of Chipman Rural Plan will remain in effect until the municipality of Grand Lake repeals the document by adopting a new land use plan.

5.9.2.3 Land Use Planning

Development in the Village of Chipman is guided by a Rural Plan (Village of Chipman 2017). The Rural Plan sets out policy and guidelines for the efficient development of lands within the Village. Development is also subject to provincial regulations. Permitting and inspections are managed by RSC 11 (NBDELG 2022a).

5.9.2.4 Residential Land Use

Residential land use in the vicinity of the PDA is a linear pattern along the main roads, primarily Main Street, Maple Street, and Red Bank Drive. Over 100 residential dwellings are located within a 1 km radius of the PDA. Other land uses within the general vicinity include the Chipman Forest Avenue School, the local Royal Canadian Mounted Police office, as well as a cemetery west of the Project site.

5.9.2.5 Commercial Land Use

There are several commercial businesses within or near 1 km of the PDA. There is a commercial donut shop, an auto repair shop, and a convenience and drug store on Main Street, also known as Route 10.

The Chipman marina is also within 1 km of the PDA. An independent grocery store is located at 165 Main Street, 650 m southeast from the PDA. Along Main Street is also a home-based computer business as well as a funeral home.

5.9.2.6 Institutional Land Use

The PDA directly abuts the Chipman Forest Avenue School. Chipman Health Services, Chipman Outreach, and Service New Brunswick are located on Civic Court, approximately 1 km from the PDA. The Chipman Community Care Youth Centre and New Brunswick Ranger Office are located less than 1 km north of the PDA. Policing services are provided by the Royal Canadian Mounted Police, which is located at 33 Forest Avenue, behind the Chipman Forest Avenue School.

5.9.2.7 Industrial and Resource Use

There is limited industrial or resource use in proximity to the PDA. Resource uses including resource extraction and agricultural-type uses are generally located outside of the Village of Chipman. The Grand Lake Timber sawmill and lumber yard are located 1.2 km southwest of the PDA. There are some agricultural uses in the general area including blueberry farms, but none in close proximity to the PDA.

5.9.2.8 Forestry Land and Resource Use

Forestry is an important industry in New Brunswick and occurs at varying scales throughout the rural regions of the province. The Grand Lake Timber sawmill is located within the Village of Chipman, and is the Village’s largest employer. Forest harvesting is a key economic driver in the region. Coal mining operations, once highly active in the Chipman and nearby Minto areas, permanently ceased in the early 2000s.

5.9.2.9 Recreational Land Use

The PDA is in close proximity to a variety of recreation amenities catering to a broad range of age groups. The Village’s location along the Salmon River and near Grand Lake mean that there are a significant amount of recreational opportunities provided by, or focused on, the natural environment. Among the closest of these is the Chipman marina, located approximately 1 km southeast of the PDA. At a similar distance from the PDA is the Chipman Centennial Arena, which is located 1 km southward. Stewart McLeod Park is located directly north of the Village of Chipman, and along Salmon River are Riverfront Park and Hamilton Baird Park. There are several campgrounds near the Village of Chipman and along Salmon River that are not in the immediate vicinity of the PDA. There are many more recreational activities that take place near and along the banks of Grand Lake such as camping, hiking/walking, fishing, and boating.

5.9.2.10 Transportation Land Use

Route 10 is referred to as Main Street within the Village boundary. It is a collector highway and the primary transportation route through the Village of Chipman. Route 10 becomes Route 123 where Main

Street intersects with Bridge Street. Route 123 is a collector highway and continues North and runs past Gaspereau Forks and connects with Route 8, between Fredericton and Miramichi. Route 10 continues southward, until it intersects with the TransCanada Highway (Route 2). Chipman also has a network of local roads. The CN Rail network runs through the community in close proximity to the PDA, and borders a small portion of the PDA. The Chipman Airport is a small private facility located roughly 4.4 km southeast of Chipman.

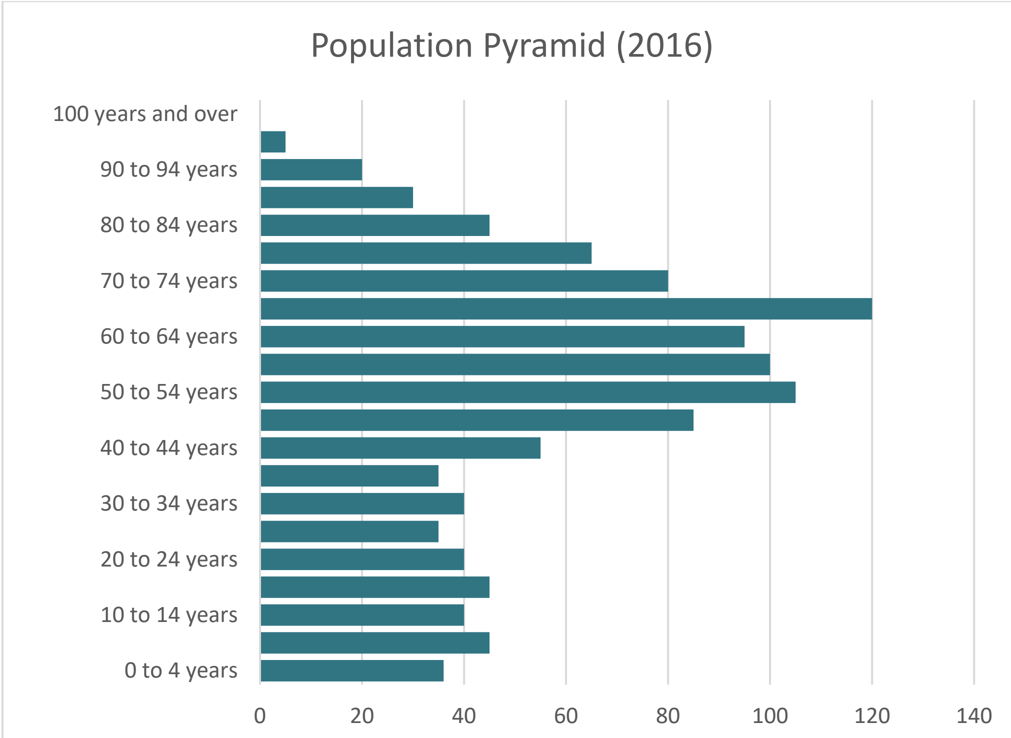
5.9.2.11 Infrastructure and Services

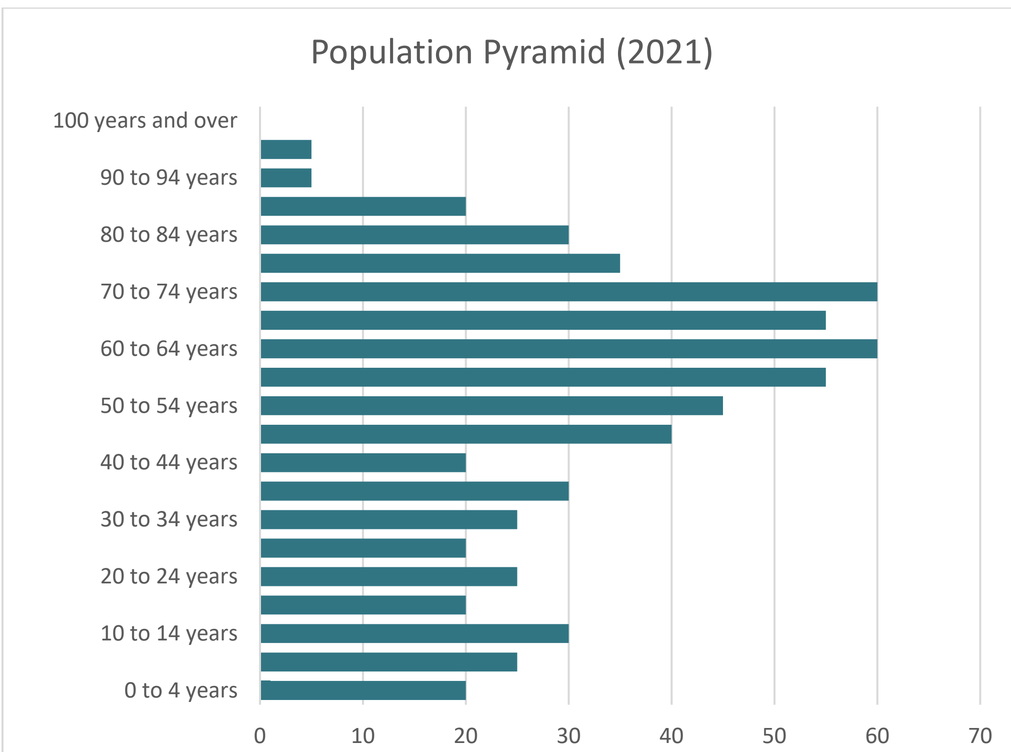
The PDA is within the Village of Chipman and the Regional Service Commission 11. The Regional Service Commission provides solid waste collection services. Policing services are provided by the Royal Canadian Mounted Police. Residential lots near the Project are serviced by private, on-site wells and a municipal wastewater system that is maintained by the Village. Stormwater is managed by road-side ditching systems. New Brunswick Department of Transportation and Infrastructure (NBDTI) manages the highways that serve the Village of Chipman, and the Village owns the local roads that serve the PDA.

5.9.2.12 Demographics

Similar to smaller communities throughout New Brunswick, the population of Chipman has continued to age throughout the years. A population pyramid is used to show the distribution of both age between the 2016 and 2021 census periods (**Figure 5-8**). Population pyramids of more rapidly aging communities are heavier towards the top, which is visualized with both of the 2016 and 2021 population pyramids for Chipman. These graphs show a clear need to increase the working age population, as well as to retain younger populations and newcomers (Statistics Canada 2017; Statistics Canada 2022).

Figure 5-8: Village of Chipman Population Pyramids 2016 and 2021





Examining the changes in population from 2016 to 2021 reveals both opportunities and challenges. The population of Chipman grew by 90 residents, or by 9%, which represents a significant population increase. However, there was a slight decline in residents at their prime working ages, between 25 and 54. The population of residents nearing retirement, between the ages of 55 and 64, was the largest increase in population (**Table 5-12**). The population pyramids, in combination with the table on population changes, illustrate a clear need for strategies that attract and retain workers, including younger populations and newcomers to the region.

Table 5-12: Age Group Distribution for the Village of Chipman (2016 and 2021)

Age Group	2016 Census Year	% of Total	2021 Census Year	% of Total	Change 2011-2016
0-24	210	19%	235	20%	25
25-54	340	31%	335	28%	-5
55-64	195	18%	240	20%	45
65+	360	33%	385	32%	25
Total	***1105***			***1195***	***90***

5.9.2.13 Employment and Economy

The total median annual income of households in Chipman was $50,000 during the year 2020. This is lower than the both provincial and national numbers, at $70,000 and $84,000, respectively. The average annual total income for households in Chipman is $62,000, which is also below provincial and national averages (Statistics Canada 2022). Both average and median incomes are included in this report because they produce different numbers which represent the population's income as a whole. The average produces a number which represents the typical Chipman resident's income, and is calculated by adding all values together (i.e., the income of each individual in the workforce) and dividing the sum by the total number of people in the labour force. The median income describes the middle value in a list of sorted values, which is useful for determining a single value to represent the typical income in the Village of Chipman, particularly because it cannot get skewed by outliers (i.e., extreme, infrequent high incomes or extreme, infrequent low incomes) in the same way average values can. Analyzing the typical income of residents with both measurements provides well-rounded insight into the incomes of the Village as a whole (**Figure 5-9**).

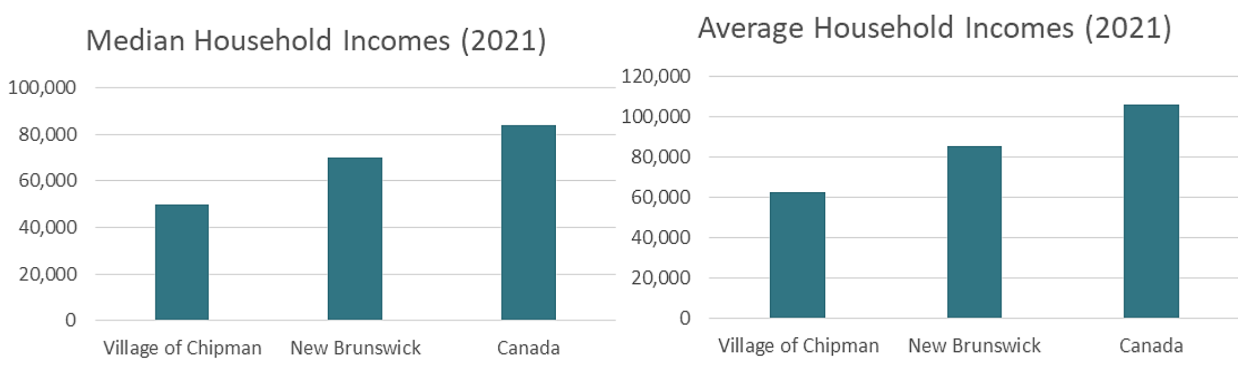


Figure 5-9: Median and Average Household Incomes in Chipman (2021)

At the time of writing, only the 2016 census data on labour and employment were available. The Village of Chipman struggles with a high unemployment rate of 15.6%, which is well above both provincial and national numbers. The unemployment rate in Chipman is nearly double the national unemployment rate of 7%.

Of the industries in the Village, occupations are concentrated in trades, transport and equipment operations at 27% (**Figure 5-10**). Sales and service occupations also make up a significant percentage of jobs, at 25.7%. The remainder of occupations classification make up a comparatively small proportion of jobs, with business and finance occupations at 10%, manufacturing occupations at 9%, health occupations at 6.7% and natural resource occupations at 5.6%. The Village of Chipman is comparatively strong in manufacturing compared to the remainder of the province, where only 15.7% of occupations in New Brunswick are in this sector (Statistics Canada 2017).

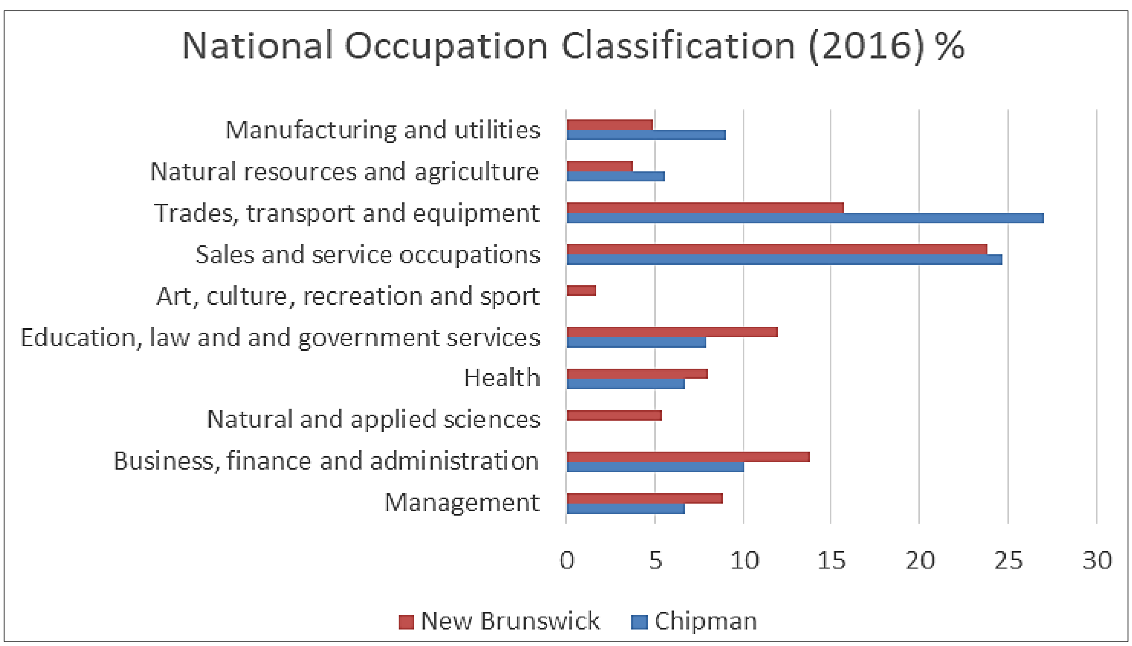


Figure 5-10: National Occupation Classifications, Chipman and New Brunswick (2016)

The Village of Chipman has a lower level of education compared to New Brunswick as a whole (**Figure 5-11**). Nearly 20% of Chipman residents aged 25 to 26 do not have a high school diploma or certificate, compared to 14% of New Brunswickers. Further, 53.4% of Chipman residents report their highest level of education being a high school diploma or equivalent, versus 28.5% of the remainder of the province. There is a roughly equal rate of residents of the Village and the province having completed education in the trades, both with 5% of the population having a trade certificate. Only 2.9% of Chipman residents have a Bachelor's degree or above, compared to 20.2% of New Brunswick.

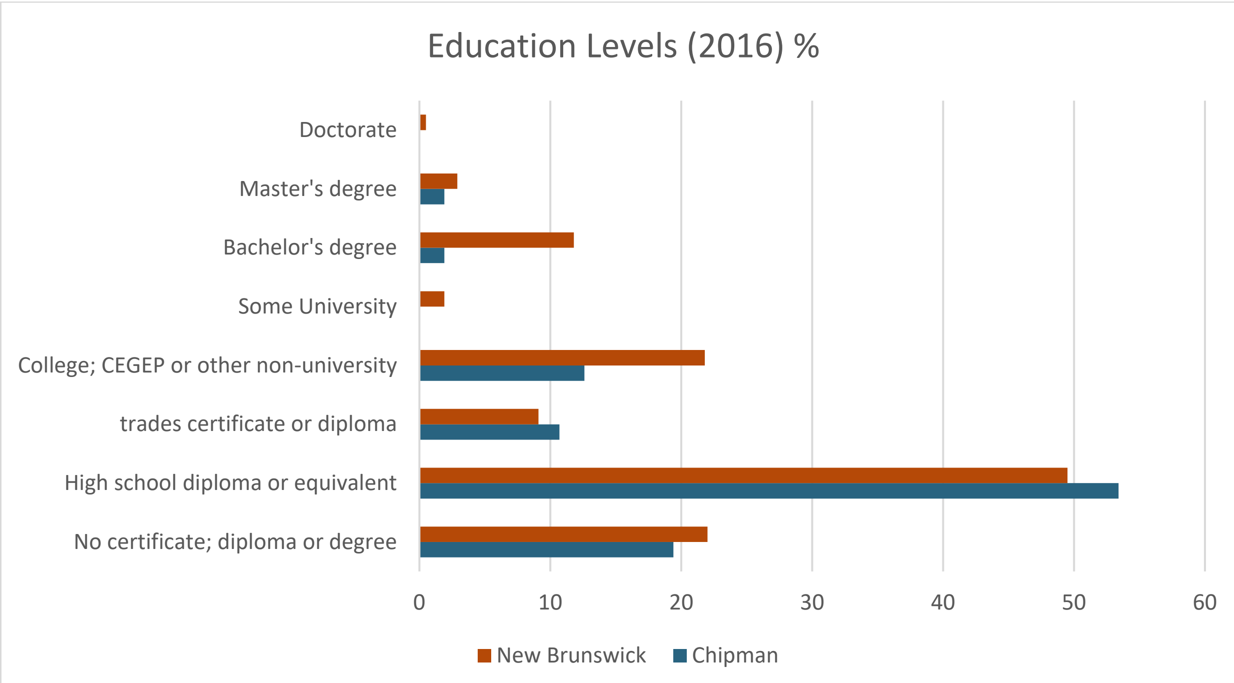


Figure 5-11: Education Levels, Chipman and New Brunswick (2016)

5.9.3 Assessment of Potential Interactions between the Project and the Socioeconomic Environment

5.9.3.1 Potential Effects

Effects on Residential Land Use

Construction of the Project may have some potential to affect nearby residences as a result of light, noise, and dust generated by equipment operation. As the proposed residential units are model and modular homes that are constructed off-site, disruptive effects from the construction phase of the Project should be minimal. Residences in the immediate area are likely to observe a strengthening of a suburban character, as new residents relocate to the subdivision once complete. This effect does not represent a disruption of everyday life, and is instead a regular sign of a growing community where employment opportunities are present.

The interaction of the Project with groundwater resources are discussed in **Section 5.4**.

Effects on Commercial Land Use

No negative effects on commercial land use are expected. Although, with an increased population in the region of up to 75 residential units, commercial land uses may experience an increase in demand for their services. Employers in both commercial and industrial sectors who are in search of workers may also observe an increased labour pool in the community.

Effects on Institutional Land Use

The increased population associated with the growth in residential units may lead to increased school enrollment, as well as an increased use of sports fields, playgrounds, and other facilities operated by the Chipman Forest Avenue School. Places of worship, or other community uses, such as municipally owned parks, may also see a slight increase in attendance or use.

Any accidents or malfunctions associated with construction of the Project have the potential to result in an increase in calls for the Chipman Fire Department, as well as other emergency response organizations whose geographic area of response includes the preferred transportation route. Accidents and malfunctions are assessed in **Section 7.0**.

Effects on Industrial and Resource Land Use

Given the limited amount of current industrial land use in the LAA, no interactions are anticipated as a result of the Project on industrial land use, except that the Project will make available housing units that are currently unavailable in Chipman, contributing positively to the local economy and industrial facilities.

Effects on Agricultural Land Use

Impacts to local agricultural land uses are expected to be very minimal, since the Project will not directly interact with current agricultural uses within the LAA. The Project may increase agricultural land use within the LAA with the presence of small gardens on the proposed properties.

Effects on Forestry and Resource Land Use

The Project will involve clearing the vegetation in the PDA. Clearing will be completed largely using a mechanical harvester supplemented by a bulldozer and manual methods (e.g., chain saws, brush saws) if required. Mature trees should be maintained to the extent possible. The Project may limit forestry and resource land use on lands adjacent to the future residential development. The siting of a residential subdivision assumes a degree of separation from more intensive land uses.

Effects on Recreational Land Use

The subdivision may include a stormwater basin as part of its landscaping plan. This basin will provide recreational opportunities, including lookouts, seating, and a trail loop. Recreation and naturalized spaces are included in the proposed subdivision. Recreation activities and uses in the area may see a greater number of participants with the addition of new residents once construction is completed and occupancy is permitted.

There may be noise during the construction phase heard periodically at the adjacent school. These impacts will no longer be present once the operation phase of the Project begins.

Effects on Transportation Land Use

Traffic volumes on local roads are not expected to change significantly during the construction phase of the Project. A new subdivision will create an increase in vehicle users and vehicular trips in the area, equivalent to an estimated 75 new vehicles. This increase in traffic volume is not expected to be disruptive to the community or the area.

Effects on Employment and Economy

The increase in population will raised the demand for Village shops and services, a positive effect of the Project. As the homes are prefabricated, the number of construction jobs created in the Village are expected to be minimal, though a small amount of spin-off employment opportunities are possible. The increase in in population, both consumers, as well as workers in sectors throughout the region is the most substantive effect on employment and the local economy.

5.9.3.2 Mitigation

Mitigation measures to reduce the effects of the Project on the socioeconomic environment are identified below.

Residential Land Use

- Vehicles and equipment should be well muffled and maintained, and dust suppression should be applied to internal site roads during dry periods.
- The landscaping plan includes maintaining mature trees where possible, green space, and a stormwater management basin. See **Sections 2.2.3**, **2.2.4** and **2.2.5** for more information on green space.
- Directional lighting should be used on site with a downward lateral focus to minimize light leaving the site.

Commercial and Institutional Land Use

- There are no commercial or institutional facilities within the LAA that would be expected to interact with the Project except for accidents and malfunctions, thus no mitigation is proposed.

Agricultural Land Use

- There are no known agricultural operations nor known agricultural groundwater or surface water supplies within 1 km of the PDA that could interact with the Project. Therefore, no residual effects are expected and no mitigation is proposed. An assessment of the environmental effects and the Project design and mitigation measures planned to address Project effects on water resources is provided in **Section 5.4** and **Section 5.5**.

Forestry Land and Resource Use

- Mature vegetation should be retained within the PDA to the extent possible.

Recreational Land Use

- The PDA is privately-owned, near a suburban community, and does not represent a loss for potential land available for hunting, fishing, or trapping in the region. Given proximity of residences to the PDA within an incorporated municipality, hunting is likely prohibited in most locations (i.e., the New Brunswick *Fish and Wildlife* Act prohibits hunting within 400 m of a dwelling).

Transportation Land Use

- Using larger payloads (if possible) enables fewer trips than would be possible on other trucking routes.
- Truck drivers will adhere to posted speed limits and warning signage and adjust driving to meet weather and road conditions.
- It is possible that oversized loads (very wide or heavy loads) may be required for equipment used during construction and operation. Transportation of these loads on public roads may require special permits from NBDTI and may require special markings, lead and follow vehicles, and temporary traffic interruptions.
- All necessary permits will be obtained and industry best practices should be followed for special moves or traffic interruptions on public roads.
- Transportation accidents and collisions are addressed in **Section 7.0**.

Employment and Economy

- No mitigation is proposed.

5.9.3.3 Characterization of Potential Interactions Following Mitigation

The project will extend and increase the existing suburban character of the area, as the Project involves up to 75 dwellings with a proposed street network and pedestrian access points.

The Project also has the potential to interact with the socioeconomic environment through temporary disturbance such as noise and dust. This will be temporary and is expected to result in minimal to no long term disruptions. With the implementation of the planned mitigation indicated above, negative interactions between the Project and the socioeconomic environment are expected to be minimal.

5.9.4 Summary

It is anticipated that activities at the Project site may create temporary, short-term and minimal nuisances to some nearby residences along Maple Street, Spruce Street, and Forest Avenue. This may include construction noise and increased dust from large vehicles. These possible interactions are limited and temporary and can be mitigated by scheduling construction activities to occur between 7:00 a.m. to 7:00 p.m., Monday to Friday and excluding holidays, and avoiding intrusive activities during the evening, overnight, weekends, and holidays. Overall, the potential negative interactions between the Project site and the socioeconomic setting are not expected to be substantive. The positive effects of the Project are related to an increase in residences, workers, and consumers with spending abilities.

5.10 Heritage Resources

Heritage resources, both naturally occurring and human-made, are those resources related to the past that remain to inform present and future societies of that past. Heritage resources include archaeological resources (e.g., artifacts, features, structures), palaeontological resources (e.g., fossils), and built heritage resources (e.g., historic buildings, complexes). The integrity of heritage resources may be susceptible to ground-disturbing activities; therefore, Project activities related to surface or sub-surface ground disturbance have the potential for interaction with heritage resources, if and where they are present.

The potential environmental interactions between the Project and heritage resources, which includes archaeological resources (e.g., artifacts, features, structures), palaeontological resources (e.g., fossils), and built heritage resources (e.g., historic buildings, complexes), are assessed in this section.

5.10.1 Scope of VC

Heritage resources have been selected as a valued component (VC) because of their importance to the people of New Brunswick. The preservation and management of heritage resources, particularly those resources that relate to the individual identities, community history, culture, or traditions of Indigenous peoples, is important to the people of New Brunswick.

Heritage resources are recognized and managed by provincial and federal regulatory agencies. In New Brunswick, heritage resources are protected under the New Brunswick *Heritage Conservation Act*, which is administered by the Archaeology and Heritage Branch (AHB) of the New Brunswick Department of Tourism, Heritage and Culture (NBDTHC), and are considered to be very important and highly valued by the people of New Brunswick (GNB 2020a). The *Heritage Conservation Act* outlines the Province's ownership of all archaeological, palaeontological, and burial site heritage objects (GNB 2020a). Any such objects determined to be of Indigenous origin are specifically held "in trust" by the Government of New Brunswick on behalf of Indigenous people and their communities (GNB 2020a). The Act also protects locally or provincially designated heritage places.

The following definitions for selected heritage resources are derived from the provincial *Heritage Conservation Act*:

- Archaeological Object: "*an object which shows evidence of manufacture, alteration or use by humans that may provide information about past human activities and which meets any criteria set by regulation, and includes a sample collected from that object*".

- Archaeological Site: "*a place where evidence of past human activities, such as archaeological objects and features, is discovered on, buried or partially buried beneath the land, or submerged or partially submerged beneath the surface of a watercourse or permanent body of water*".
- Burial Ground: "*a place that has been used for the placement of human remains or burial objects, but does not include a cemetery regulated under the Cemetery Companies Act*".
- Burial Object: "*an object that is directly associated with the interment of a human, but does not include human remains*".
- Palaeontological Object: "*a work of nature consisting of or containing any remains, trace or imprint of a multicellular plant or animal or a stromatolite preserved in the Earth's crust since some past geologic time; does not include human remains*".
- Palaeontological Site: "*a place where evidence of palaeontological objects is discovered in rock or unconsolidated sediment, exposed at the surface, buried or partially buried beneath the land, or submerged or partially submerged beneath the surface of a watercourse or permanent body of water*".

Archaeological resources (i.e., burial objects or archaeological objects) tend to be found in surficial soils (normally in the layers above bedrock or glacial till), whereas palaeontological objects (i.e., fossils) tend to be found in certain types of bedrock that are conducive to fossil formation (e.g., sedimentary rock). The discovery of these resources can provide valuable information about the history of human activity or use in the distant past (in the case of archaeological objects), or natural history and evolution of wildlife and vegetation in earlier eras (in the case of palaeontological objects).

The Province of New Brunswick provides guidance for conducting heritage assessments under its "Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick" (Archaeological Services 2012). The Guidelines consider the first 50 m away from a watercourse as well as 100 m from the confluence of watercourses to be of high archaeological potential; the next 30 m (from 51 m to 80 m from the watercourse) are considered to be of medium archaeological potential, and all other areas are generally considered to be of low archaeological potential (Archaeological Services 2012). Together, areas of high and medium archaeological potential are sometimes termed "elevated archaeological potential", for brevity. Under these guidelines, when substantive ground disturbance is expected, a systematic Archaeological Impact Assessment (AIA) acceptable to the AHB must be undertaken to confirm whether archaeological resources are likely to be present.

The local assessment area (LAA) for heritage resources is limited to the footprint where ground disturbance will be taking place (i.e., the PDA).

5.10.2 Existing Conditions

As the site is located less than 1 km from the Salmon River, like with most major watercourses, increases the potential for harbouring heritage resources (especially archaeological resources) since these waterways have been historically used by Indigenous peoples as "highways" of the past.

In addition to historical events, various environmental and factors such as glaciation, sea level fluctuation, topography, soil types, hydrology, and vegetation can influence settlement patterns and contribute to the archaeological potential of an area.

Existing conditions with respect to the overall historical context of the area, as well as, for archaeological resources, palaeontological resources, and built heritage resources, are discussed in this section.

5.10.2.1 Historical Background

The Acadians settled in some areas of what is now known as New Brunswick in the 1600s; in low lying areas such as those of southeastern New Brunswick, they built dykes to drain the marshes, creating some of the most fertile farmland in the North America. They also constructed the first dry dock in Canada at the confluence of the Aulac and La Coupe rivers, about 8 km from Cumberland Basin. In 1766, immigrants from Saxony via Pennsylvania moved onto the dyked and other lands around present-day Moncton. The Germans subsequently were joined by Planters from New England, as well as by Acadians returning from exile. By the 1860s, The Bend (later called Moncton) and Sackville had become centres of agriculture, shipbuilding, and education (Zelazny 2007).

Forestry has traditionally been the dominant industry in New Brunswick, well into the early decades of the 20th century.

The area now called the Village of Chipman was founded by settlers prior to 1820, largely from Maine, who established sawmills along the Salmon and Gaspereau Rivers. There was a wave of immigration to the Chipman area between the 1820s and the 1850s, with newcomers arriving largely from Ireland. The forest industry around Chipman grew rapidly throughout the 19th century, as lumbermills, the construction of railways, and a coal mining industry drew workers and families. L.E. Shaw's brick and tile plant opened in the 1930s (Village of Chipman, n.d.).

With the loss of coal mining and its manufacturing base, the population began to decline towards the end of the 20th century. The Village continues to be home to the J.D. Irving head office for Central New Brunswick Woodlands Region, and the Grand Lake Timber sawmill (Village of Chipman, n.d.).

5.10.2.2 Archaeological and Palaeontological Resources

Most of the PDA is greater than 100 m from mapped watercourses, though the northwest corner of PID #45080470 is within 80 m of a watercourse (GeoNB 2022). Though no AIA was conducted for this EIA Registration, the majority of the PDA has been assessed as having low archaeological potential. An AIA is planned to be undertaken for the area within the PDA that was identified by AHB as having an elevated archaeological potential prior to development. The regulator has assessed PID #45211679 as having low archaeological potential and no further archaeological assessment is recommended (Hamilton, A., pers. comm., 2022).

The potential for palaeontological resources to be present can vary based on the nature of bedrock and the geological history of the region. As discussed in **Section 3.1.4**, the bedrock geology in the Project area consists of carboniferous-aged terrestrial sediments (i.e., sedimentary rock). Although sedimentary rock is conducive to fossil presence, the Project is located in a region that would have been impacted by the most recent glacial period (i.e., the Wisconsin Glaciation) and would have been beneath the Laurentide Ice Sheet from approximately 18,000 years Before Present (BP) until approximately 16,000-15,000 BP when the ice retreated in Atlantic Canada (Fader 2005).

5.10.2.3 Built Heritage

As stated in **Section 3.4.3**, designated provincial and local historic places in the province could not be identified within the PDA. The nearest designated Provincial Historic Sites are the Chipman Community Heritage Centre and Darrah's Insurance Ltd. buildings at 238 and 267 Main Street respectively, both approximately 1.3 km southwest of the Project (NBDTHC 2022). Both buildings mentioned above are also listed on the Canadian Register of Historic Places (CRHP) (Parks Canada 2022).

5.10.3 Assessment of Potential Interactions between the Project and Heritage Resources

This section details the assessment of the potential interactions between the Project and heritage resources. This will include characterizing the potential interactions between Project activities and heritage resources and identify key mitigation measures to reduce these interactions. The assessment will also include the characterization of any residual interactions that may exist after the implementation of mitigation measures. For this section, heritage resources include archaeological resources (e.g., artifacts, features, structures), palaeontological resources (e.g., fossils), and built heritage resources (e.g., historic buildings, complexes).

5.10.3.1 Potential Interactions

The Project has the potential to interact with heritage resources via accidental discovery of archaeological or palaeontological resources during soil excavation activities. Project activities that include ground moving, such as excavation, have the potential to uncover previously undiscovered heritage resources. Without mitigation, environmental effects include the potential permanent destruction of any previously undiscovered archaeological or palaeontological resources that might be present within the PDA.

5.10.3.2 Mitigation

The following mitigation measures, through careful design and planning, are recommended to reduce the potential for adverse interactions with heritage resources:

- Minimize the extent of disturbance of the Project site by planning as small a disturbance area as possible;
- Planned avoidance of known areas of elevated archaeological potential, to the extent practical; and
- Contingency and emergency response procedures should be developed and implemented.

If any archaeological resources are accidentally identified at any point over the course of the Project, the following mitigation measures should be employed:

- Work in the area must cease immediately and the area secured;
- AHB must be contacted at (506) 453-2738 for further direction;
- Until a qualified archaeologist arrives at the site, no one shall disturb, move or re-bury any uncovered archaeological object; and
- Activities at the site may resume only when authorized by AHB and once mitigation measures have been completed.

Other contingency and emergency response procedures to be implemented in response to the accidental discovery of heritage resources should be documented and implemented as part of the Project. In addition to the above and in the event that evidence of burials or human remains are encountered:

- Contact and Inform the Lead Police Agency (RCMP or municipal police force) in accordance with AHB Guidelines (Archaeological Services 2012, pg. 57).

5.10.3.3 Characterization of Potential Interactions Following Mitigation

Once operational there is a low likelihood of discovering previously undiscovered (or unknown) archaeological or palaeontological objects for the majority of the PDA.

The PDA is mostly located over 100 m from watercourses, and is not considered to have high potential for harbouring heritage resources. The implementation of the other mitigation measures (i.e., archaeological monitoring and archaeological contingency and emergency response planning) will reduce the likelihood of substantive interactions between the Project and archaeological resources following the implementation of mitigation methods. Consequently, the residual interactions between the Project and heritage resources are not anticipated to be substantive.

5.10.4 Summary

Based on a high level review (i.e., desktop assessment), most of the Project does not include areas that are considered to exhibit elevated potential for harbouring heritage resources. There is thus a low potential for interaction between the Project and heritage resources. The interactions will be associated with the clearing, grubbing, site grading and lot construction, as well as project operation.

However, the development of appropriate mitigation in the event that any archaeological resources are present in areas identified for ground disturbing activities will reduce interactions with heritage resources. Therefore, the residual potential interactions between the Project and heritage resources are not expected to be substantive.

5.11 Traditional Land and Resource Use

The potential interactions between the Project and traditional land and resource use are assessed in this section.

The information presented in this section is intended to provide a high-level overview of traditional land and resource use in the general area of the Project. This will include traditional land and resource use at, or near the PDA. The information and assessments provided below are derived from publicly-available literature and general knowledge and information relating to traditional land and resource use near the PDA and the Village of Chipman. This information and preliminary assessment is not intended to supersede or prejudice the specific traditional land or resource use information or knowledge that may be shared by Indigenous communities. Rather, it is an attempt to provide information from general knowledge and secondary sources of information that is intended to complement the traditional knowledge that might become available from Indigenous people in this regard.

A traditional land use and/or knowledge study has not been completed as part of the Project.

5.11.1 Scope of VC

Traditional land and resource use refers to the activities undertaken by Indigenous peoples that were carried out dating back to pre-contact periods (GNB 2011). These activities may have included the building and settling of encampments, seasonal travel, hunting, fishing, trapping, gathering of food and medicines, practicing ceremonial traditions, and burial activities. Evidence of these traditional land and resource uses can be found in archaeological evidence (i.e., archaeological sites, burial sites, and associated objects) and through Indigenous traditional knowledge.

Traditional land and resource use has been selected as a valued component (VC) in order to:

- Acknowledge the lands and resources that have been used, and continue to be used, for traditional purposes by Indigenous persons;
- Assess the potential interactions between Project activities and traditional land and resource use as required under the New Brunswick EIA Regulation; and
- Assist CHA in providing information to the Government of New Brunswick in fulfilling its duty to consult with First Nation communities regarding the Project.

This section is intended to provide information about the potential interaction of Project activities on traditional land and resource use, and to identify appropriate mitigation measures to remove or reduce negative interactions. For the purposes of this EIA Registration document, Indigenous traditional activities practiced on Crown, publicly-owned, or certain private lands will be considered.

The local assessment area (LAA) for traditional land and resource use is limited to the footprint where ground disturbance will be taking place (i.e., the PDA).

5.11.2 Existing Conditions

Based on a review of available literature, the following is a high-level summary of traditional land and resource use in the Project area.

5.11.2.1 Historical Background

Archeology confirms the presence of Indigenous campsites in New Brunswick as far back as 11,000 years. The Wolastoqiyik and Mi'kmaq people who reside in New Brunswick have stewarded and occupied this land for millennia. Given the rural nature of the PDA and its proximity to Grand Lake and other waterbodies, the general vicinity of the Project has likely been used by Indigenous people for centuries at a minimum (Stantec 2013).

Areas of New Brunswick were colonized by Europeans during the 17th century, and various rural communities near the PDA were developed to support the economic drivers that have made up New Brunswick's natural resource based economy. Many of these communities to this day are focused on supplying resources and labour to natural resource industries, including forestry (Stantec 2013).

The Project lies within traditional Wolastoqey and Mi'gmaq territories. It is known that Indigenous people had camps along Grand Lake and would travel up the Salmon River to and beyond what is currently known as the Village of Chipman. The rivers that flow from Grand Lake were also trading routes, where Indigenous people traded fish, potatoes, and various weaved goods such as baskets (Perley, Turnbull, and Allen 2000). The PDA is 45 kilometers north of the Jemseg Archaeological site, a site of significant Wolastoqiyik historical significance (Blair 2015). During colonial times, in the years after 1792, the Wolastoqey held a small amount of farmland along the banks of Grand Lake (Davidson 2019).

The Wolastoqiyik and Mi'gmaq people lived off of the land, using traditional means to feed their families through hunting, trapping, fishing, and gathering. These efforts were largely focused around river systems, as major rivers were primary travel routes. Wolastoqiyik and Mi'gmaq people used both major and minor rivers and streams throughout New Brunswick to access and trade ford, trade resources, and to communicate and share information (Stantec 2013).

5.11.2.2 First Nation Community Context

The entire province of New Brunswick is subject to the Peace and Friendship Treaties signed by the British with the Wolastoqey (Maliseet), Mi'kmaq, and Peskotomuhkati (Passamaquoddy) Nations in 1752 and renewed in specific agreements thereafter. New Brunswick's First Nations assert Aboriginal and treaty rights through these Peace and Friendship Treaties, and those rights are protected under Section 35(1) of the Constitution Act, 1982. In addition, the Supreme Court of Canada has held in several important decisions that the Crown (both federal and provincial) has a duty to consult with potentially affected First Nations in respect of decisions made by the Crown that might affect these Aboriginal or treaty rights, including those that might relate to their current use of the land and resources for traditional purposes. The Province of New Brunswick has a duty to consult policy which is administered by the New Brunswick Department of Aboriginal Affairs (GNB 2011).

Today, there are 15 officially recognized First Nations communities within the province of New Brunswick. They consist of six Wolastoqey Nation communities and nine Mi'kmaq Nation communities. In addition the Peskotomuhkati people are working towards official recognition of their nation in Canada. Wolastoqey communities and their traditional territory are generally located along the Wolastoq (St. John River) valley, while the Mi'kmaq communities are predominantly located along the northern and eastern coastal regions of the province and the Peskotomuhkati in the southwest portion of New Brunswick In addition, the New Brunswick Aboriginal Peoples Council (NBAPC) represents non-status Indigenous people living in New Brunswick. Therefore, all 16 communities and their respective organizations, plus the NBAPC, will be informed of the proposed project and offered an opportunity for early engagement. Each community or organization can decide if they would like to participate further in engagement and consultation on the proposed project.

There may be traditional practices such as hunting, fishing, trapping, ceremonial, and gathering purposes. Though, these activities are going to be extremely limited within the Village of Chipman itself, and the lands adjacent to the PDA. Practices such as hunting and trapping are prohibited in municipalities by federal legislation for safety reasons. It is possible that other ceremonial activities may take place within the Village, and fishing activities may take place along the Salmon River and within Grand Lake. Hunting, gathering, and trapping may also take place in the more forested areas surrounding the Village of Chipman, where there are less restrictions on these activities.

An Indigenous Knowledge (IK) study has not been completed for the Project; furthermore, specific and documented details on how and where traditional activities have been or are taking place may exist, but they are normally held confidential by First Nations. This knowledge is both valuable and private to the rights holders (land users), and as such there is an expectation that this knowledge should not be freely available for the purposes of development of traditional territories. As such, information presented within this section has been collected from reliable secondary sources. However, data collected for other field disciplines (e.g., wildlife and wildlife habitats, vegetation and wetlands, fish and fish habitat, and heritage resources) will also be used to inform the availability of land and resources that could be used for traditional purposes within the Project site.

5.11.2.3 Indigenous Population Demographics

The 2016 Census (Statistics Canada 2017) is the latest Census available and it identified that approximately 4% of the New Brunswick population self-identifies as having an Indigenous or Aboriginal identity, or the equivalent of 29,385 persons. The total population of registered status First Nation band members in New Brunswick was 17,005, with a total of 9,805 residing on-reserve, as reported by Indigenous and Northern Affairs Canada (INAC 2022 and **Table 5-13**). It is noted that the totals from the Census and from Indigenous and Northern Affairs Canada may differ slightly.

Table 5-13: New Brunswick First Nation Total Registered Population and Registered Population On-Reserve

First Nation Community	2022 Registered Population	2022 On-reserve Population
Wolastoqey (Maliseet) First Nations in New Brunswick		
Welamoktok (Oromocto) First Nation	824	339
Sitansisk (St. Mary's) First Nation	2,087	899
Pilick (Kingsclear) First Nation	1,064	738
Wotstak (Woodstock) First Nation	1,165	293
Neqotkuk (Tobique) First Nation	2,588	1,589
Matawaskiye (Madawaska Maliseet) First Nation	379	162
Wolastoqey First Nations Sub-total	**8,107**	**4,073**
Mi'kmaq First Nations in New Brunswick		
Ugpi'ganjig (Eel River Bar) First Nation	815	346
Oinpegitjoig (Pabineau) First Nation	353	102
Esgenoopetitj First Nation (formerly Burnt Church)	1,940	1,330
Metepenagiag First Nation (formerly Red Bank)	707	435
Natoaganeg (Eel Ground) First Nation	1,083	580
L'nui Menikuk (Indian Island) First Nation	213	111
Elsipogtog First Nation (formerly Big Cove)	3,524	2,714
Tjipogtotjg (Buctouche) First Nation	124	79
Amlamgog (Fort Folly) First Nation	139	35
Mi'kmaq First Nations Sub-total	**8,898**	**5,732**
Total First Nation Population in New Brunswick	**17,005**	**9,805**

Source: INAC (2022)

The closest Indigenous communities to the PDA are Welamoktok (Oromocto) First Nation, at 58 km in a straight line from the project site, with Sitansisk (Saint Mary's) First Nation slightly further away to the southeast, at 64 km from the PDA.

5.11.3 Assessment of Potential Interactions between the Project and Traditional Land and Resource Use

The assessment of potential interaction between the Project and traditional land and resource use by Indigenous persons is provided in this section.

5.11.3.1 Potential Interactions

In general, potential interactions between the Project and traditional land and resource use are associated with any Project activity that could result in change in the amount of land or water available to Indigenous persons for practicing traditional activities that would restrict access to an area, or limit an area's use for traditional practices or Project activities. Project activities such as site access may affect traditional land and resource use in the following ways.

- As the PIDs are currently private property, access for traditional land uses such as hunting and gathering are already limited.
- During construction, most of the PDA may be cleared of remaining vegetation (except for areas remaining as buffers), and as such, natural resources that may be present on site (e.g., plants, wildlife, medicines) will no longer be available for harvesting or use. Outside the PDA, it is not expected that Project-related effects would interfere with the practice of traditional activities.

5.11.3.2 Mitigation

It is important to note that traditional land and resource use is also connected to other VCs. The discussion of the potential interactions between the Project and other VCs (i.e. surface water; fish and fish habitat; vegetation and wetlands; wildlife and wildlife habitat; and, heritage resources), and their associated mitigation measures are applicable to this section. In addition, the following mitigation measures should be employed to avoid or reduce the potential environmental effects of the Project on traditional land and resource use at the PDA:

- Minimize the size of any areas of ground disturbance on the Project site to that which is necessary to accomplish the Project objectives while minimizing environmental disturbance to the extent possible;
- Maintain natural vegetation along watercourses and in wetlands (if present), as well as along the property boundaries, to minimize effects on natural resources and to provide a buffer for reducing effects of the Project that could cause sensory disturbance to wildlife (i.e., noise, dust);
- Conduct engagement with First Nations, if so desired, to exchange information and address question and concerns associated with the Project; and
- Avoid known or identified archaeological sites, and follow the procedure if archaeological objects are accidently encountered as well as contacting and updating First Nations.

5.11.3.3 Characterization of Potential Interactions Following Mitigation

The majority of interactions between the Project and traditional land and resource use can be considered temporary and can be mitigated effectively.

Ground disturbances are limited, though the PDA consists of an area that is 14 ha in size, which will not return to its original state after construction is complete and the project is operational. The Project will unavoidably result in a permanent loss of vegetation and potential displacement of species used for traditional purposes due to both, altered habitat or sensory disturbance, in addition to loss of access to the PDA by First Nations if they chose to use it.

It is anticipated that engagement with the Indigenous communities, if so desired, will provide opportunities for these Indigenous groups to share information, ask questions, and discuss concerns about unanticipated interactions between the Project and traditional land and resource use.

5.11.4 Summary

Although access to the PDA for practicing traditional activities will be lost, the Project is not anticipated to result in a permanent loss of access by Indigenous communities to practice traditional land and resource use activities in the areas surrounding the Village of Chipman.

The Project is anticipated to reduce some access to the general area in the immediate vicinity of the PDA, as the PDA will consist of private residences, which will limit ceremony or gathering activities, though these activities will not be limited in the surrounding area. The subdivision, once complete, may also have green space where specific low-impact ceremonial activities may take place.

In light of the above, and in consideration of the Project planning and mitigation to be employed to reduce or minimize environmental impacts, the potential interactions between the Project and traditional land and resource use are not expected to be substantive.

6.0 Effects of the Environment on the Project

The effects of the environment on the Project are discussed in this section.

6.1 Scope of VC

Effects of the environment on the Project are those effects related to risks of natural hazards and influences of the natural environment that might affect the normal conduct of the Project or cause damage to infrastructure as part of it. Potential effects of the environment on any project are a function of project or infrastructure design in the context of its receiving environment, and ultimately how the project is affected by the natural environment. These effects may arise from physical conditions, land forms, and site characteristics or other attributes of the environment which may act on the project such that the project components, schedule, and/or costs could be substantively and adversely changed.

Based on the nature of the undertaking, and in consideration of the relatively short period of time during which the Project will be undertaken, the following environmental attributes have been selected for consideration in this assessment:

- severe weather events, including wind, precipitation, floods, hail, electrical storms, and tornadoes;
- seismic activity; and
- forest fires resulting from causes other than the Project.

Since the Project will be executed over a relatively short period from initial lot and house construction to the sale of the properties, consideration of long-term climate and climate change effects is not warranted.

6.2 Existing Conditions

6.2.1 Severe Weather Events

Extreme precipitation and storms can occur in New Brunswick throughout the year, but tend to be more common and severe during the winter. Winter storms generally bring high winds and a combination of snow and rain, especially in low lying areas.

Extreme rainfall events occur when 50 mm or more rain falls over a 24-hour period. ECCC issues a rainfall warning when this is forecast to occur. Extreme rainfall event data collected for three of New Brunswick's cities indicate that in the 2000s, Fredericton and Moncton had more extreme rainfall events than any other decade on record, while Saint John had the highest number of events during the 1960s. The trends were different in all three communities (NBDELG 2022e). In New Brunswick, river valleys and flood plains can pose a risk because of ice jams, harsh weather and the floods of annual spring thaw. Flooding in New Brunswick is rather common, especially along the Saint John River (ECCC 2017).

Significant ice storms have affected New Brunswick twice in the past 10 years. The December 2013 ice storm saw the southern region hardest hit (Atlantic Security Group Inc. 2014); however, in January 2017, a significant ice storm affected eastern and northeastern New Brunswick extending from the Acadian Peninsula to the New Brunswick-Nova Scotia border. According to NB Power, between 50 and 100 mm of ice built up on trees and power equipment in the Acadian Peninsula. Ice buildup led to significant damage to NB Power equipment and transmission/distribution infrastructure, as well as impassable roads, wide-spread power outages, and health emergencies (GNB 2017).

Electrical storms, or thunderstorms, which are more frequent in New Brunswick than the rest of Atlantic Canada, occur on average 10 to 20 times a year (NAV Canada 2001). Generally, only one of these storms (per year) is extreme enough to produce hail. Thunderstorms can produce extremes of rain, wind, hail and lightning; however, most of these storms are relatively short-lived.

Tornadoes are rare in New Brunswick, but can occur. Across Canada, tornadoes occur most frequently in two areas - from southern Alberta across southern Saskatchewan and southern Manitoba to northwestern Ontario, and from southern Ontario across southern Quebec to New Brunswick. These areas are extensions of tornado-active areas in the United States, though separated by an area of low frequency caused by the stabilizing influence of the relatively cool Great Lakes (Western University 2022).

6.2.2 Seismicity

Seismic activity is dictated by the local geology of an area and the movement of tectonic plates comprising the Earth’s crust. Natural Resources Canada monitors seismic activity throughout Canada and identifies areas of known seismic activity in order to document, record, and prepare for seismic events that may occur. The Project area is located in the Northern Appalachians Seismic Zone, which includes most of New Brunswick and extends into the northeastern United States, as far south as Boston, Massachusetts. Historical seismic data recorded throughout this zone has identified clusters of earthquake activity. However, historical seismic activity is considered low (Natural Resources Canada 2018). Earthquakes in New Brunswick generally cluster in three regions: the Central Highlands (near Miramichi) region, the Moncton region, and the Passamaquoddy Bay region in the southeastern corner of the province.

The largest recorded earthquake ever recorded in New Brunswick was a magnitude 5.7 (on the Richter scale) event on January 9, 1982, located in the north-central Miramichi Highlands. Aftershocks following this earthquake reached magnitude 5.1 and 5.4. Between 1855 and 1937, other moderate earthquakes in these three regions, ranged from 4.5 to 6.0 (Basham and Adams 1984). The maximum credible earthquake magnitude for the northern Appalachians region is estimated to be magnitude 7.0, based on historical earthquake data and regional tectonics (Adams and Halchuk 2003). It is noted that there is potential for large earthquakes of up to an estimated magnitude 7.5 along fault zones in the St. Lawrence River region. However, any such events in this region would be close to 400 km from the Project site, and therefore the amplitude of ground motions at the Project site would be low due to attenuation over a large distance.

Earthquakes are not unknown in southern New Brunswick, and several earthquakes have been recorded in the vicinity. A search of earthquake records within 50 km of the PDA area showed approximately 70 events from 1986 to 2022 ranging from magnitudes up to 3.3, the closest of these being approximately 4 km to the east, a magnitude 2.8 earthquake near the Ridge Road and Bronson Settlement Road intersection. The largest magnitude event recorded within 50 km of the Project was a magnitude 3.3 earthquake on May 9, 1986 located in Doaktown, approximately 45 km northeast of the Project (Natural Resources Canada 2021).

In summary, a review of historical earthquake records and regional tectonics indicates that the Project is situated in a region of low to moderate seismicity.

6.2.3 Forest Fires

The Fire Weather Index is a component of the Canadian Forest Fire Weather Index System. The index provides a numeric rating of fire intensity, and is the general index of fire danger throughout the forested areas of Canada (Natural Resources Canada 2022a).

The mean Fire Weather Index in New Brunswick for the month of July (i.e., normally the driest month of the year), when risk of forest fire is typically greatest, was mostly 0-5, as shown in **Figure 6-1**, which is the lowest rating on the scale of possible fire risk. This risk is based on Fire Weather Normals data, representing the average value of a fire weather code or index over the 30-year period from 1981 to 2010 (Natural Resources Canada 2022a).

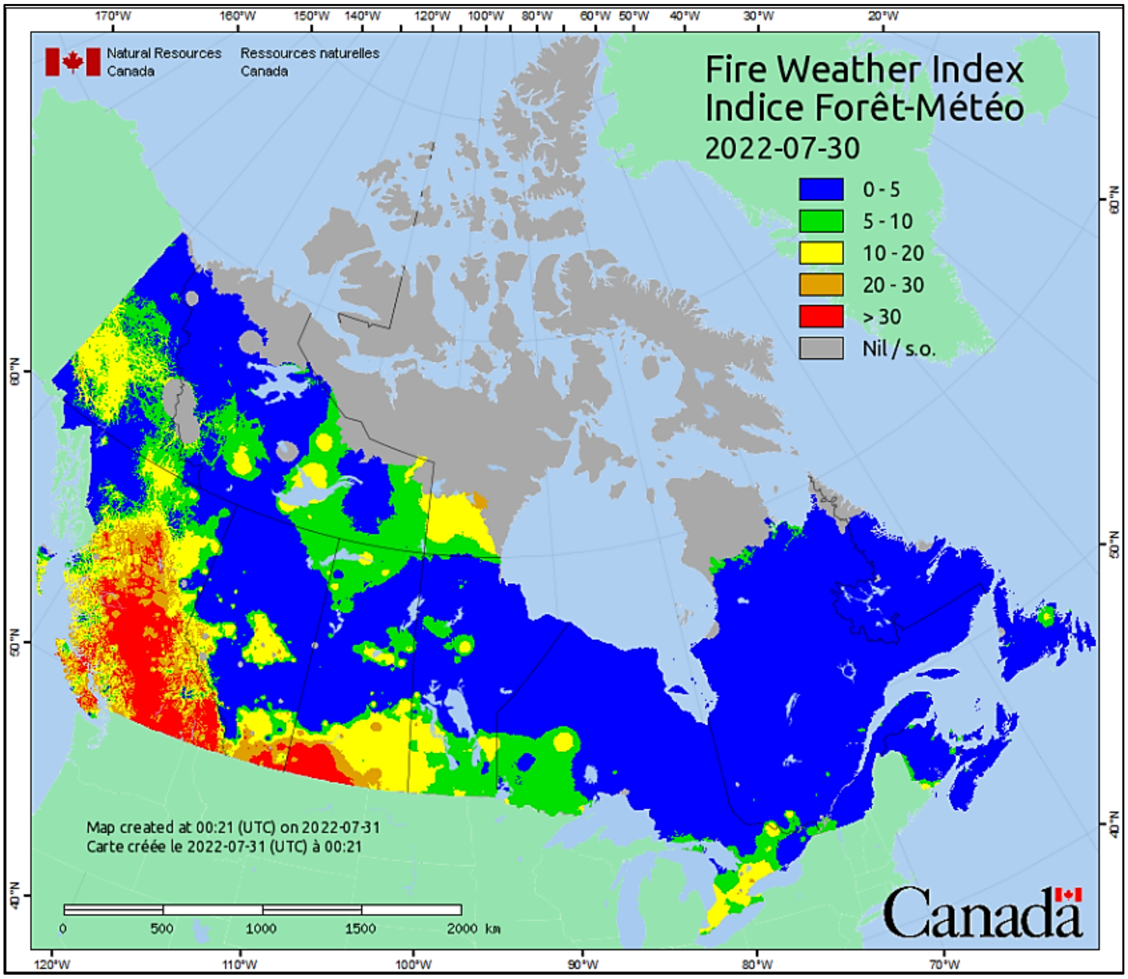


Figure 6-1: Natural Resources Canada Fire Weather Index

6.3 Assessment of Potential Interactions between the Environment and the Project

As a factor of safety, and a matter of responsible engineering practice, the design and materials to be chosen for construction of the Project should be selected so that the Project will withstand environmental stressors that could occur from various natural and environmental phenomena (e.g., extreme storms, increased precipitation and other factors arising from climate change, and others). The EIA has been carried out in parallel to Project design, and the results of the EIA have informed the design of the Project such that any potential concerns are addressed and the potential for significant adverse effects of the environment on the Project is minimized.

The Project will be constructed to meet all applicable building, safety and industry codes and standards.

The engineering design of the Project should consider and incorporate potential future changes in the forces of nature that could affect its operation or integrity (e.g., climate change), and Project components and infrastructure should be designed and built to adapt to or withstand these effects.

Design requirements address issues associated with environmental extremes including:

- wind loads;
- storm water drainage from rain storms and floods;
- weight of snow and ice, and associated water;
- earthquake loads; and,
- erosion protection of slopes, embankments, ditches and open drains.

6.3.1 Potential Interactions

6.3.1.1 Effects of Extreme Weather on the Project

To assess the environmental effects of extreme weather on the Project, current climate must be considered. Current climate conditions have been established by compiling relevant historical data and establishing a climatological background for the Project area.

Recent climate trends (1981-2010 averages and extremes) have been assessed to determine the likelihood, and effect, of severe and extreme weather events on the Project so that they may be accounted for in both the engineering design, as well as timelines of various Project components. The most relevant extreme weather events that could potentially have effects on the Project include:

- heavy precipitation events; and
- extreme storms accompanied by heavy and/or freezing precipitation, thunderstorms, and strong winds; and increased incidence of flooding and erosion.

Each of these effects must be considered in terms of how they may adversely affect the Project if they are not accounted for in the planning and execution of the Project. The environmental attributes described have the potential to affect the Project in several ways, including but not limited to:

- Delays in carrying out Project activities as a result of severe weather;
- A reduction in visibility and an inability to manoeuvre heavy equipment;
- Changes to the ability of workers to access the work site; and
- Damage to heavy equipment and site infrastructure.

Extreme snowfall can also affect winter Project activities by causing delays in the movement of materials in and out of the construction site, and resulting in additional effort for snow clearing and removal. This additional effort, however, would not substantially change the Project schedule.

Extreme snowfall contributing to unusual flooding during snowmelt and extreme rainfall events could also potentially lead to flooding and erosion. Heavy rain, snowfall and/or freezing rain events could also cause an interruption to services, such as communications or electricity.

Some effects, such as damage to infrastructure, can also result in consequential effects on the environment. These types of environmental effects are addressed as accidents, malfunctions, and unplanned events in **Section 7.0**.

6.3.1.2 Effects of Seismic Activity on the Project

The Project is geographically situated within an identified seismic zone where historical earthquake activity has been identified (Northern Appalachian Seismic Zone). There are historical records of one magnitude 5.7 earthquake in the Miramichi Highlands region (Natural Resources Canada 2021). The maximum credible earthquake magnitude for the Northern Appalachians Seismic Zone is estimated to be magnitude 7.0, based on historical earthquake data and regional tectonics (Adams and Halchuk 2003). It is noted that there is potential for large earthquakes of up to an estimated magnitude 7.5 along fault zones in the St. Lawrence River region. Any such events in this region, however, would be over 200 km from the Project, and therefore, the amplitude of ground motions at the PDA would be low due to attenuation over a large distance.

Although the level of historical seismic activity near the Project is considered to be low to moderate, past occurrence of seismic activity in an area is not necessarily an indicator that a significant seismic event could or could not occur in the near future.

Based on the low frequency of recorded earthquakes in the region, and, therefore, low probability that a major seismic event would occur in the immediate vicinity of the Project during the Project’s lifespan, major Project damage or interruption to activities due to earthquakes during any phase of the Project is considered to be low.

6.3.1.3 Effects of Forest Fires on the Project

With respect to the effects of forest fires on the Project, Project-related equipment and vehicles could be damaged by extreme heat. Smoke generated by forest fires could adversely affect project personnel resulting from reduced air quality. The Project is situated within a sparsely developed region in central New Brunswick where forest fires are not uncommon.

Aerial imagery indicates that the forests surrounding the PDA area have been subject to varying degrees of harvest and silviculture related to forest harvest practices. Fire behaviour normals mapping (Natural Resources Canada 2022b) indicates that the mean rate of spread of fire in the Project area is between one and three metres per minute. The rate of spread is based on several factors including fuel type, forest health, and crown base height. The mean rate of spread for the Project area is the second lowest on the scale used by Natural Resources Canada.

In the event that a forest fire encroaches on the PDA, New Brunswick has a forest fire control program in place to identify and control fires, minimizing the potential magnitude and extent of any forest fire, and their potential consequential effects on the Project. Local and provincial emergency response crews will provide for rapid detection and response to any identified fire threat. This includes fires that could start within the Project site perimeter as well as fires approaching from outside the area (i.e., forest fires).

6.3.2 Mitigation

Mitigation strategies for minimizing the likelihood of a significant adverse effect of the environment on the Project are inherent in: the planning process being conducted, the application of engineering design codes and standards, construction practices, and monitoring. To address these environmental effects, proactive design, planning, and maintenance are required in consideration of the potential normal and extreme conditions that might be encountered throughout the life of the Project.

6.3.2.1 Mitigating Effects of Extreme Weather on the Project

The following mitigation measures should be implemented to prevent effects of extreme weather on the Project.

- The materials specified for the Project will be in compliance with the applicable standards and codes (e.g., National Building Code) and will maintain structural integrity at the anticipated minimum and ambient temperatures near the PDA to prevent damage to Project infrastructure that could pose a substantial health and safety risk, could delay the Project schedule and milestones, or could not be technically or economically repaired.
- Disruption of Project activities and delays to the Project schedule should be avoided by scheduling weather dependent tasks for periods when the weather conditions are favourable. A disruption allowance should be considered in Project and operational scheduling.
- Extreme precipitation events are an expected work condition and the Project schedule allows for weather conditions typical for the southeastern New Brunswick region. Site water management

features and erosion and sediment control structures should be in place early in the Project to manage potential increased site run-off from precipitation events that could occur.

- Erosion as a result of extreme precipitation and potential flooding is not anticipated to have a substantive adverse effect on the Project due to standard mitigation measures that should be implemented (e.g., management of site water, use of erosion and sedimentation control structures, and construction methods that stabilize erodible soils as early as possible after the ground has been disturbed). Following construction, exposed soils should be stabilized, roadways and laydown areas should use suitable gravel bases and/or sub-bases to prevent erosion, and exposed areas should be vegetated where possible to prevent surface erosion.

As described above, environmental stressors potentially associated with climate change and severe weather would be more than adequately addressed by engineering design to comply with building codes and standards that incorporate factors of safety to account for these changes, and careful materials selection for Project-related infrastructure. The National Building Code of Canada provides for factors of safety to account for possible extreme weather (including allowances for future increased frequency and/or severity of these storms that could arise from climate change), and will form the basis of the design and construction of the Project-related infrastructure.

6.3.2.2 Mitigating Effects of Seismic Activity on the Project

The Project and related infrastructure will be designed to the applicable standard in consideration of the maximum credible earthquake magnitude for the region. The National Building Code of Canada provides for sufficient factors of safety to account for seismic activity in active seismic zones in Canada, and will form the basis of the design and construction of site infrastructure. The intent of these and other design standards is to maintain the integrity of the facilities based on the level of risk for an earthquake in the area of a magnitude up to the maximum credible earthquake. Therefore, seismicity is not considered to have the potential to substantively damage project infrastructure or components during all phases of the Project, due to planned design mitigation and the application of the National Building Code of Canada and other applicable codes, standards, and guidelines.

6.3.2.3 Mitigating Effects of Forest Fires on the Project

Petroleum products and flammable substances that may be required by contractors will be stored within secondary containment to reduce likelihood of spills and potential ignition.

Through integrated and coordinated emergency response capabilities at the local and provincial levels, personnel will mobilize away from the Project site if forest fires are affecting the local area, and will only return under clear and safe conditions, as determined by emergency response agencies in the province.

6.3.3 Characterization of Potential Interactions Following Mitigation

The potential effects of the environment on all Project phases should be considered in the planning and design of the Project and in the scheduling of Project activities to limit delays, prevent damage to infrastructure and the environment, and to maximize the safety of staff. Compliance with detailed design engineering completed for the Project should account for weather extremes, seismicity, and forest fire threats, through built-in factors of safety to prevent undue damage to infrastructure and equipment or schedule delays from such events or occurrences. Although it is possible, for the Project to experience extreme environmental conditions during its lifecycle, a substantive delay (e.g., a delay for more than one season) is not anticipated.

Therefore, the effects of the environment are not expected to adversely affect the Project in a manner that cannot be planned for or accommodated through design and other mitigation and adaptive management strategies. As a result, the effects of the environment on the Project are not expected to be substantive.

6.4 Summary

As a matter of generally accepted engineering practice, responsible and viable engineering designs tend to consistently overestimate and account for possible forces of the environment, and thus inherently incorporate several factors of safety to ensure that a project is designed to be safe and reliable throughout its lifetime.

Environmental management is an inherent consideration in the best management practices of the design and associated Project risk management. Environmental stressors, such as those that could arise as a result of severe weather, seismic events, or other factors (e.g., fires), would more than adequately be addressed by good planning, materials selection, best practices, and scheduling foresight. The Project schedule should provide allowances so as to not adversely be affected by a potential delay caused by effects of the environment. While there is potential for natural forces to affect the Project, it is not likely to have a substantive effect due to planned mitigation and design.

7.0 Accidents, Malfunctions and Unplanned Events

This section identifies the potential accidents, malfunctions, and unplanned events that could occur as part of the Project. The assessment focuses on events that are considered credible, based on the Project description and the experience of the EIA team in assessing similar projects.

7.1 Approach

The general approach to assessing the potential environmental interactions of the selected potential accident, malfunction, or unplanned event scenarios involves the following:

- Describing the potential accident, malfunction, or unplanned event;
- Considering if the potential accident, malfunction, or unplanned event could occur during the life of the Project, and during which activity(ies);
- Determining with which valued component(s) (VCs) the potential accident, malfunction, or unplanned event may interact;
- Describing the Project planning, safeguards, and mitigation established or proposed to minimize the potential for such occurrences to happen;
- Considering the contingency or emergency response procedures applicable to the event; and
- In consideration of the above, assessing the potential interactions of accidents, malfunctions, and unplanned events on related VCs following mitigation.

Spatial and temporal boundaries for considering residual environmental effects of potential accidents, malfunctions, and unplanned events that may arise as a result of the Project are the same as those for each VC to which they apply, presented in **Section 4.2** of this document.

7.2 Description of Potential Credible Accidents, Malfunctions, and Unplanned Events

Based on the nature of the Project, general knowledge of the environment within which the Project is located, as well as the experience of the Proponent and the EIA team, the following credible accidents, malfunctions, and unplanned events have been selected for this assessment and are described in greater detail in the following sections:

Failure of Erosion and Sediment Control Measure: Erosion and sediment control (ESC) measures prevent exposed soil from mobilizing and entering undisturbed areas as a result of rainfall or spring runoff. A failure of an ESC measure could result in mass wasting of soil or siltation of receiving watercourses.

Vehicle Accident: A vehicle accident is possible at the Project site or while Project-related vehicles are in transit on provincial roads. A vehicle accident includes a collision with other vehicles, pedestrians, wildlife, or structures/objects, and potentially cause damage to property or pose a risk to the health and safety of workers, the public, or wildlife. A fire or fuel spill could also occur as a consequence of a vehicle collision, compounding the initial effects by potentially threatening the atmospheric environment, the acoustic environment, surface water, groundwater, fish and fish habitat, and wildlife and wildlife habitat.

Accidental Release of a Hazardous Material: An accidental release of fuel used in vehicles or equipment on-site may occur during construction activities, refuelling of machinery or trucks as a result of human error or equipment malfunction, potentially affecting surface water, groundwater, fish and fish habitat, wildlife and wildlife habitat, vegetation, and wetlands.

Discovery of a Heritage Resource: Previously undiscovered archaeological resources (i.e., artifacts) could be uncovered during excavation as well as from other intrusive activities on the site. Based on the bedrock geology (i.e., sedimentary formations of the Cumberland Formations) underlying the Project site, there is potential that palaeontological resources (i.e., fossils) could be present in the bedrock.

7.3 Potential Interactions between Accidents, Malfunctions, and Unplanned Events and Related Valued Components

Based on the nature of the above credible events and the EIA team's knowledge of their potential to interact with the environment, the VCs with a reasonable potential to interact with these potential accidents, malfunctions, or unplanned events are identified in **Table 7-1**.

Table 7-1: Potential Interactions of Accidents, Malfunctions, and Unplanned Events with Valued Components

Accident, Malfunction, or Unplanned Event	Atmospheric Environment	Acoustic Environment	Groundwater	Surface Water	Fish and Fish Habitat	Vegetation and Wetlands	Wildlife and Wildlife Habitat	Socioeconomic Environment	Heritage Resources	Traditional Land and Resource Use
Failure of Erosion and Sediment Control Measure				✓	✓	✓	✓			✓
Vehicle Accident	✓	✓	✓	✓	✓	✓	✓	✓		✓
Accidental Release of a Hazardous Material	✓	✓	✓	✓	✓	✓	✓	✓		✓
Discovery of a Heritage Resource									✓	

Legend: ✓ indicates a potential interaction

Those accidents, malfunctions, or unplanned events that may result in an interaction with a specific VC are identified with a checkmark in the table above, and are therefore carried for further assessment below.

Accidents, malfunctions, or unplanned events that are not identified with a checkmark in the table above are not expected to result in an interaction with a specific VC or VCs, and are thus not discussed further.

7.3.1 Failure of Erosion and Sediment Control Measure

Erosion and sediment control (ESC) measures prevent erosion of surface soils and the resulting surface runoff from directly entering surface water bodies. Failure of ESC measures could be a result of the measures being insufficient to manage a given runoff event (e.g., rainfall or spring runoff exceeding capacity) or the implementation was poorly constructed.

A failure of an ESC measure could primarily affect fish and fish habitat. The discharge of runoff containing sediment to watercourses during storm events or spring runoff could result in the degradation of adjacent surface water bodies, wetlands, and fish and fish habitat which those environments support. The effects on fish and fish habitat could include a temporary reduction in water quality due to increased sediment load. If the release were to occur during spawning periods, spawning beds could be negatively affected as sediment may cover the gravel beds and suffocate the eggs. Aquatic organisms may be adversely affected by a sediment release, potentially reducing the fish's food supply. Consequential environmental effects could result to surface water, vegetation and wetlands, and wildlife and wildlife habitat.

In addition, a failure of an ESC measure could affect traditional land and resource use as a consequential environmental effect. Indigenous communities that may practice traditional activities near the PDA could be affected if the fish and fish habitat affected by an ESC failure were being used for traditional purposes.

7.3.1.1 Mitigation

Key mitigation to prevent a failure of erosion or sediment control measures includes:

- Additional siltation and erosion prevention devices should be on-site and readily deployable in the event of sudden/heavy precipitation and/or a runoff event;
- Construction of the ESC measures using quality materials and sound and proven construction practices in accordance with industry best practices;
- Periodic inspection and maintenance (as required) of the ESC measures, particularly following each precipitation event; and
- An Environmental Management Plan should be developed for extreme rainfall or spring runoff events including:

- monitoring of surface runoff conditions during heavy rainfall/spring runoff and operational observations to evaluate the need for improvements in surface runoff control,
- cover should be applied to highly erodible areas,
- clean-out of check dams should be conducted, and
- provision of a stockpile of sediment and erosion control materials.

Note that approaches may vary depending upon season.

7.3.1.2 Potential Interactions Following Mitigation

The installation, maintenance, and monitoring of erosion and sediment control structures is a routine activity on construction sites and industrial operations, and is well understood by site managers and construction personnel. With daily visual monitoring of erosion and sediment control devices, conducting maintenance of them as necessary, periodically removing accumulated sediment, and active water management on-site, the risk of a failure of erosion and sediment control measures occurring is expected to be very low. With the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of a failure of erosion and sedimentation control measures with surface water, fish and fish habitat, vegetation and wetlands, wildlife and wildlife habitat, and traditional land and resources during all phases of the Project are not expected to be substantive.

7.3.2 Vehicle Accident

A vehicle accident could affect the socioeconomic environment, the atmospheric environment, the acoustic environment, groundwater, surface water, fish and fish habitat, vegetation and wetlands, wildlife and wildlife habitat, and/or traditional land and resource use.

Vehicles will be active across the construction sites for the entirety of the Project duration as well on provincial roads during mobilization and demobilization activities or moving to and from different parts of the wellfield. Vehicle collisions have the potential to pose a risk to human health and safety and other property such as Project infrastructure or private property. This could have an adverse effect on the socioeconomic environment.

Consequential environmental effects of a vehicle accident could occur on the atmospheric environment, as fires or fuel spills arising from a vehicle accident could result in a temporary and localized reduction in air quality. The resulting noise from a vehicle accident as well as from emergency response vehicles could cause an interaction with the acoustic environment. Fuel spills resulting from a vehicle accident could adversely affect surface water, groundwater, or fish and fish habitat, as surface or groundwater resources may become contaminated by fuel, potentially threatening potable water supplies, and fish and fish habitat. If natural resources affected by a vehicle fuel spill or accident are used for traditional purposes by Indigenous persons, a consequential environmental effect could also occur to traditional land and resource use. Finally, a vehicle accident could have a direct effect on wildlife in the event of vehicle-to-wildlife collision, and an indirect effect in the event of a fuel spill or fire resulting from a vehicle collision.

7.3.2.1 Mitigation

Key mitigation to prevent a vehicle accident should include:

- Roads should be designed to ensure they will accommodate vehicles and equipment planned for the Project;
- Select a preferred transportation route off-site to optimize safety by using roads that are designed to accommodate the vehicle weights that will be associated with the Project;
- Vehicles travelling to and from the Project site will adhere to posted speed limits, weight restrictions, and other traffic safety rules, and drivers will adjust their speed to conditions accordingly;
- Drivers will also heed wildlife warning signs and reduce speed in areas identified as posing a potential risk of wildlife collision;
- Pedestrian zones should be identified to allow workers access throughout the work area on foot if needed; and
- A communications plan should be established to engage with local communities potentially affected by Project-related traffic.

7.3.2.2 Potential Interactions Following Mitigation

Though a vehicle accident may occur with any project, particular attention should be paid to conducting Project operations in a careful and safe manner so as to reduce the risk of a serious vehicle accident. With the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of a vehicle accident with the socioeconomic environment, the atmospheric environment, the acoustic environment, groundwater, surface water, fish and fish habitat, vegetation and wetlands, wildlife and wildlife habitat, and/or traditional land and resource use.

7.3.3 Accidental Release of a Hazardous Material

The accidental release of a hazardous material through spills could affect primarily groundwater, surface water, and fish and fish habitat, with consequential environmental effects possible to the atmospheric environment, vegetation and wetlands, wildlife and wildlife habitat, socioeconomic environment, and traditional land and resource use.

As vehicles and mobile equipment used on-site will need to be refuelled for their continued operation, fuels should be brought on-site either by mobile tankers operated by approved refuelling contractors or for small equipment in approved fuel storage containers less than 40 L. Refuelling activities should be carried out in a designated area (at least 30 m away from watercourses or wetlands) using defined procedures to prevent the occurrence of a spill.

An accidental spill of hydrocarbons or other substances may contaminate air, soils, or groundwater and, through runoff, contaminate watercourses. Contaminants may adversely affect both terrestrial and aquatic habitats and their species, including migratory birds. Loss of petroleum hydrocarbons, hazardous materials, or other substances may volatilize and adversely affect ambient air quality on a temporary and localized basis.

Chemical and fuel spills may enter a watercourse directly, potentially affecting water quality and fish and their habitat, with the extent of effects depending upon the nature of the material and the quantity released. The effects could range from a small localized spill, which is contained and remediated quickly, to a large release of a highly soluble material that affects the receiving watercourse. Possible negative effects to fish and fish habitat could include direct mortality of fish and aquatic organisms, degradation of surface water quality, and potential injury or death of wildlife in the event of exposure. If natural resources affected by a spill are used for traditional purposes by Indigenous persons, a consequential environmental effect of a spill could also occur to traditional land and resource use.

Effects on vegetation and wetlands from an accidental hazardous materials release include a physical harm or death of vegetation species, a reduction or loss of wetland function as a habitat for fish and wildlife, and accretion of contaminants in wetland sediments. Contaminants are less likely to move through a wetland system at the same rate as riparian systems due to the generally lower mobility of water and sediments. Contaminants may build up in the sediments and be released into the ecosystem over time, rather than being flushed out over a season as with a riparian system.

7.3.3.1 Mitigation

Key mitigation to prevent an accidental release of a hazardous material includes:

- Fuels should be brought on-site either by mobile tankers operated by approved refuelling contractors or in approved fuel storage containers less than 40 L. Refuelling activities will be carried out in an area at least 30 m away from watercourses or wetlands using defined procedures to prevent the occurrence of a spill. An Environmental Management Plan will be developed for substances anticipated to be brought on-site during the construction activities;
- When possible, fuelling operations will be conducted in designated areas located at a minimum distance of 30 m from wetlands, surface water bodies, or preferential pathways;
- Vehicle maintenance, including the changing of oil and lubricants, should not be permitted on-site;
- Releases potentially caused by motor vehicle accidents are addressed initially by local emergency response agencies and directed by the NBDELG. Subsequently, site contractors will contain the spill and remove contaminated soils and sediment for disposal;
- Emergency spill kits should be available on-site; and

- Small spills can typically be cleaned up effectively with minimal long-term impacts, and larger spills are not likely to occur based on limited quantities of hydrocarbons anticipated to be present on-site during construction and reclamation.

7.3.3.2 Potential Interactions Following Mitigation

With no planned storage of liquid hazardous materials on-site and careful implementation of best practices during refuelling of equipment, the risk of spills resulting during construction or reclamation activities for the Project is expected to be low. The risk of contamination from spills and leaks will be reduced further by preventive measures, contingency planning and spill response and mitigation. With the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of an accidental release of a hazardous material with the atmospheric environment, water resources, fish and fish habitat, vegetation and wetlands, wildlife and wildlife habitat, and traditional land and resource use during all phases of the Project are not expected to be substantive.

7.3.4 Discovery of a Heritage Resource

The discovery of a heritage resource would interact with the heritage resources VC.

Any ground breaking or earth moving activity has the potential to uncover previously undiscovered heritage resources. Archaeological resources (i.e., artifacts) tend to be found in surficial soils and when discovered, whereas palaeontological resources (i.e., fossils) tend to be found in bedrock. Little excavation is planned for the Project aside from a shallow excavations for groundwater well and sanitary sewer infrastructure installation.

The discovery of these resources can provide valuable information about human activity or use in the distant past (in the case of artifacts), or the presence of wildlife and vegetation in earlier eras (in the case of fossils).

With respect to the Project, it is possible that previously undiscovered heritage resources in the form of artifacts could be found in the surficial soils (including topsoil and overburden) during the Project activities. Moreover, it is possible that fossils could be found in the sedimentary rock underlying the Project.

7.3.4.1 Mitigation

Key mitigation measures to minimize the potential for the discovery of a heritage resource include:

- Minimize the extent of disturbance of the Project site by planning as small a disturbance area as possible;
- Planned avoidance of known areas of elevated archaeological potential, to the extent practical; and
- Contingency and emergency response procedures should be developed and implemented.

In the event that an archaeological or cultural resource or artifact is discovered during the Project, the following procedure should be followed:

- Work will be immediately stopped, and the area will be marked to prevent further disturbance. An exclusion zone of 100 m surrounding the find will be established;
- The Site Manager will immediately contact the Archaeology and Heritage Branch (AHB) of the New Brunswick Department of Tourism, Heritage and Culture (NBDTHC) to notify them of the discovery and establish a mitigation plan;
- Notify affected First Nations of the discovery in a manner consistent with the directions of AHB;
- No additional work will be permitted at the site until approval has been received from the appropriate regulatory agency to resume the work;
- If bones or human remains are found, work in the area must cease, and the RCMP shall be immediately notified;
- No one shall disturb, move or conceal any uncovered human remains; and
- If the discovered resources are related to Indigenous culture, the New Brunswick Department of Aboriginal Affairs will be contacted to determine how best to proceed with respect to repatriation of the resources.

7.3.4.2 Potential Interactions Following Mitigation

Given the low archaeological potential of most of the Project site and its historically disturbed nature (previous forest harvesting), the potential to encounter previously undiscovered heritage resource during construction and operation of the Project is believed to be very low. With the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of a discovery of a heritage resource on heritage resources are not expected to be substantive.

7.3.5 Overall Summary

In light of the above, and with the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of all credible accidents, malfunctions, or unplanned events on all VCs are not expected to be substantive.

8.0 Consultation and Engagement

In accordance with the EIA Regulation, direct communication with stakeholders (local residents, elected officials, businesses, etc.) is required. The planned approach to public and stakeholder notification as well as Indigenous consultation in respect of the EIA review of the Project is described in this section.

8.1 Overall Approach

Residents within 500 m of the Project should be made aware of the proposed construction activities through direct written communications (i.e., letter). In addition, interested residents should be given the option to review the EIA document available to download on the NBDELG's website.

Direct written communication should include the following:

- Brief description of the proposed Project;
- Description of the Project location;
- Map showing the location of the Project components;
- Status of the Provincial Regulatory Approval process; and
- Contact information from a CHA or Dillon representative who can be contacted for further information.

Given that the Project activities will be conducted on privately owned land and will be occurring largely in isolated, forested areas generally away from residential properties, a broad public, stakeholder, and Indigenous engagement program is not believed to be warranted for this limited scale Project. Engagement activities should be focused on consultation with the landowner and any immediate adjacent landowners within 500 m of the PDA.

In the event that any questions or concerns are raised about the Project during the EIA review period, they should be documented, responded to, and reported to the NBDELG in a summary report on engagement efforts within 60 days of registration of the Project.

8.2 Future Activities

In accordance with the EIA Guide (NBDELG 2018a), CHA should provide a summary report documenting the engagement efforts and feedback received during the first 45 days following submission of the EIA Registration document to the NBDELG. The report should be submitted to NBDELG for review within 60 days following registration of the Project, so that the information can be considered in the course of decision-making in respect of the Project.

9.0 Other Information

9.1 Project Related Documents

This EIA Registration document includes other relevant documents as **Appendices A** to **G** of this document. Other than this EIA Registration document and the appended information, there are currently no additional Project-related documents that are publicly accessible.

9.2 Approval of the Undertaking

Following completion of the EIA review for the Project and the receipt of a Certificate of Determination, a number of other authorizations, approvals, permits, licenses, or leases may be required from provincial or federal agencies. Refer to **Section 1.4** of this document for more information in this regard.

9.3 Signature

This document is submitted on behalf of the Chipman Housing Authority Inc. (CHA).

Mike Turnbull (Mar 10, 2023 16:31 AST)

Chipman Housing Authority Inc.

March 10, 2023

Date of Signature

10.0 Closing

This report was prepared by Dillon Consulting Limited (Dillon) on behalf of the Chipman Housing Authority Inc. Dillon has used the degree of care and skill ordinarily exercised under similar circumstances at the time the work was performed by reputable members of the environmental consulting profession practicing in Canada. Dillon assumes no responsibility for conditions which were beyond its scope of work. There is no warranty expressed or implied by Dillon.

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This report has been prepared by a team of Dillon professionals on behalf of the Chipman Housing Authority Inc.

Respectfully submitted,

DILLON CONSULTING LIMITED

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Appendix A

Preliminary Groundwater Assessment and WSSA Application

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March 31, 2022

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Attention: Mike Turnbull, P.Eng., MBA

Forest Avenue Conceptual Development

Introduction

Dillon Consulting Limited (Dillon) was retained by J.D. Irving Ltd. (JDI) to complete a groundwater assessment in relation to the Forest Avenue Development project to be completed at the properties identified by Property Identification (PID) Nos. 45082526 and 45080470 (herein, "the subject property") in Chipman, New Brunswick

The following sections of this report detail a project description, methodologies, results of the hydrogeological assessments, as well as conclusions and recommendations. Copies of the Water Well Driller's report from the wells are provided in **Attachment A**. Laboratory analytical certificates are presented in **Attachment B**. Aquifer Test analysis reports are provided in **Attachment C**. The statements made in this report are subject to and are to be read in conjunction with the limitations included in the disclaimer presented in **Attachment D**.

Project Description

Purpose/Rationale

It is understood that the subject property is to be developed to accommodate housing for workers at JDI operations in the Chipman area. Based on current assumptions, the development is projected to include 76 single-family dwellings, which will include a mix of modular homes and slab-on-grade bungalows. Each dwelling will be serviced by its own individual water well.

The purpose is to assess the potential that the underlying aquifer could provide a suitable, sustainable, (i.e., in terms of quality and quantity) water source for the development.

Property Description

The subject property is located in a vacant/residential area of Chipman and the site is situated on the parcels of land identified by PID Nos. 45082526 and 45080470. The site is currently vegetated/forested lands and encompasses an area of approximately 35 acres. The site is bound to the north by the Chipman Forest Avenue School; to the south by a rail line, followed by residential/forested lands; to the west by residential properties; and, to the east by vacant/forested lands.

The nearest residential property, relative to the approximate center of the site, would be approximately 300 m to the south.

Proposed Development

Based on current assumptions, the development is projected to include 76 single-family dwellings, which will include a mix of modular homes and slab-on-grade bungalows. Each dwelling will be serviced by its own individual water well. The proposed development is to include a storm-water retention pond as well as a green-space park. Sewer water will be collected and piped to the municipal treatment system.

Estimated Water Demand

Estimated water demand calculations for the proposed development were completed in consideration of the proposed development design as well as the *Atlantic Canada Water & Wastewater Association Atlantic Canada Water Supply Design Guidelines (Draft 2, March 2000)*. Further details regarding the estimated water demand are provided below in **Table 1**.

Table 1 - Estimated Water Demand

Information/Assumption	
76 separate units, assuming 4 person per unit:	Total No. of People = 304 people
Assume 350 L per day per person:	Total Daily Water Demand = 106,400 L per Day
76 units:	Total Daily Water Demand Per Lot = 1,400 L per Day

Current Groundwater Usage

Groundwater usage at the site would not currently be expected per se; however, the Forest Avenue School (approximately 300m north of proposed development) is technically situated on the property identified by PID No. 45082526. The nearest residential property, relative to the approximate center of the site, would be approximately 300 m to the south. Residential properties in the area of the site, and throughout Chipman, source their water supplies with private water wells.

The subject property is not located within a wellfield protection area under the New Brunswick Wellfield Protection Program or a designated watershed under the New Brunswick Watershed Protection Area Designation Order.

Geology, Hydrogeology, Topography, and Drainage

Based on the Geological Survey of Canada's Surficial Geology Map of New Brunswick (Rampton, 1984), the native surficial geology in the area of the site consists of Late Wisconsinan/Early Holocene lacustrine and marine sediments, which includes sands, silts with minor clays and gravels, generally 1 to 10 m thick. Based on geological classifications from the Water Well Driller's Reports during the drilling program, overburden materials were encountered, to a maximum depth of 6 m, and generally consisted of clays with some sands.

Based on the Department of Natural Resources and Energy Bedrock Geology Map of New Brunswick (NBDNRE, 2000), regional bedrock in the Chipman area is identified as the late carboniferous-aged Pictou Group which consists of sandstone, mudstone, siltstone, and some shales. Based on geological classifications from the Water Well Driller's Reports during the drilling program, bedrock was generally encountered at a depth of 6 m and consisted of sandstone and siltsone.

Additional geological information can be found in the Water Well Driller's Reports presented in **Attachment A**.

The subject property is generally flat and based on available aerial mapping and topography data regional groundwater/surface water drainage conditions are anticipated to flow to the west towards the Salmon River, which is located approximately 800 m west of the site. Based on GeoSNB mapping, a provincially significant wetland is located approximately 400m northeast of the proposed development.

Climate Conditions

The nearest Environment Canada weather station to the subject property is the Coles Island (Climate ID: 810JAE0) station located approximately 30 km south of the subject site. The most recent climate data, released by Environment Canada, for the Coles Island station is presented in **Tables 2**, **3** and **4**. A summary of the average daily temperatures by month between 1981 and 2004 is found in **Table 2**, while monthly precipitation total averages between 1981 and 2004 are found in **Table 3**. Monthly averages of days with precipitation are displayed in **Table 4**.

Table 2 - Average Daily Temperature per Month (1981-2004)

Temp (°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average	*-8.7*	-8	-2.1	4.4	11.1	16.2	*19.1*	18.7	14.2	8	2.2	-4.9	5.8

Table 3 - Average Monthly Precipitation (1980-2004)

Precip.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	42.4	27.6	56.7	65.5	94.5	73.8	84.2	71.6	88.1	109.3	79.4	54.7	847.7
Snowfall (cm)	53.1	47.6	45	21.6	1.3	0	0	0	0	1	15.3	46.4	231.3
Precipitation (mm)	95.5	75.2	101.6	87.1	95.8	73.8	84.2	71.6	88.1	110.3	94.7	101.1	1079

Table 4 - Average Number of Days with Precipitation per Month (1980-2004)

Amount of Precip.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
>= 0.2 mm	13.9	11.7	13.9	14.9	15.1	13.5	13.4	11.9	13.2	14.8	15.3	14.7	166.1
>= 5 mm	6	5.3	6.6	6.2	6.3	4.5	4.6	4.5	4.4	5.9	6.1	6.6	66.8
>= 10 mm	3.5	2.5	3.5	2.9	2.8	2.1	2.5	2.3	2.7	3.9	3.4	3.5	35.6
>= 25 mm	0.67	0.35	0.76	0.29	0.67	0.35	0.65	0.53	1.1	1.1	0.44	0.78	7.7

The warmest months are generally from June to August, with July being the warmest month with an average daily temperature of 19.1 C. The coldest months are typically between December and February, January being the coldest with an average daily temperature of -8.7 C.

Over the data set, monthly averages yielded an annual average of 1079 mm of precipitation, with 847.7 mm of rain and 231.3 cm of snow falling per year. Generally, the Chipman area saw 166 days per year with precipitation between 1980 and 2004. The highest monthly average of precipitation was observed in October with 110.3 mm, while the lowest was observed in August with 71.6 mm.

Based on the climate data, the most surficial recharge to nearby underlying aquifers in the Chipman area is expected to occur between October and November, while the least amount of recharged would be expected to occur in August (high temperatures, low precipitation) or February (low precipitation, frozen ground conditions). As the water exploration program and hydrogeological testing were completed in a non-recharge season, in general, conservatism was added to the assessment.

Water Exploration Program and Hydrogeological Assessment

Scope

The water exploration program included the following components:

- The installation of three 150 mm diameter test wells (Well 1, Well 2, Well 3);
- A step-drawdown test (pumping well of Well 2);
- A 72 hour constant-rate pumping test (pumping well of Well 2);
- A 4 hour constant-rate pumping test (pumping well of Well 1); and
- A water quality sampling program.

Methodology

Test Well Drilling

On February 22, 2022, the three test wells were installed under the supervision of Dillon personnel. E.R. Steeves Ltd. (ER Steeves) was commissioned to drill the test wells.

The test wells were drilled using an air rotary drill rig in the areas of interest to assess preliminary yield and to observe geological conditions. Observed stratigraphy during the drilling activities was generally consistent between wells. In general, the test wells were installed with steel casing installed to a sufficient depth into competent bedrock, and then the open borehole was advanced to a sufficient depth where water bearing fractures were encountered to provide sufficient water yield for the testing.

Upon completion of each test well, each well was developed via air lift for approximately 1-2 hours. Air lifting is completed by pushing compressed air through the drill rods and bit at the bottom of the wells to push water and debris/drilling cuttings from the bottom of the well to the ground surface. This process is used to remove rock debris and sediment from the well following well installation, and is used to provide a preliminary estimate of water yield from the well.

The test wells remain in place and were used throughout the hydraulic testing. Well construction details and preliminary yield estimates following development of the test wells are provided below in **Table 5**.

Table 5 - Test Well Construction Details

Well Construction	Well 1	Well 2	Well 3
150 mm Steel Casing	0 to 11.6 mbgs	0 to 11.6 mbgs	0 to 11.6 mbgs
150 mm Open Bedrock Borehole	11.6 to 61 mbgs (Subsequently caved in to a depth of 44 mbgs)	11.6 to 61 mbgs	11.6 to 67.1 mbgs
Preliminary Estimated Well Yield (L/min)	9.1 L/min (2 igpm)	9.1 L/min (2 igpm)	159.1 L/min (35 igpm)
Observed Water Bearing Fracture Depth	36.6 and 50.3 mbgs	36.6 and 50.3 mbgs	21.3 mbgs

Water Elevation Monitoring

During the step-drawdown tests, pumping tests, and recovery periods following the pumping periods, changes in water levels were recorded in each of the test well. Relative changes in water elevations were measured using Solinst® brand electronic pressure transducers (dataloggers).

Step-Drawdown Test (Well #2)

The step-drawdown test on Well #2 commenced at around 1200 on February 28, 2022. The water pump and water discharge line was installed by ER Steeves. A gate valve was installed along the discharge line to regulate water flow from the pump. Relative water level observed in real-time during the test and an analog flowmeter was installed along the discharge line to monitor flow rate and volume during the testing. Various pumping intervals (approximately 15-30 minute durations) were completed with discharge rates varying from 2.3 L/min (0.5 igpm) to 54.5 L/min (12 igpm). The step-test was completed at around 1615 on February 28, 2022.

72 Hour Constant-Rate Pumping Test (Well #2)

The 72 hour constant-rate pumping test on Well #2 commenced at around 1815 on February 28, 2022. Based on the results of the step-test, the intent was to pump from Well #2 at approximately 45 L/min (10 igpm).

Between the evening hours of February 28 and the early morning hours of March 1, various equipment issues were encountered (i.e., generator shutting off due to cold temperatures). As a result, only brief periods (approximately 60 minutes) of sustained pumping were observed.

Between approximately 0700 on March 1 and 1000 on March 3, water was discharged from Well 2 at roughly 40.9 L/min (9 igpm). Around 0600 March 2 and 1945 March 2 the pump turned off due to issues with the generator.

4 Hour Constant-Rate Pumping Test (Well #1)

A 4 hour constant-rate pumping test commenced with Well #1 as the pumping well at 1200 on March 3. The discharge rate was roughly 22.7 L/min (5 igpm) and the test was completed at roughly 1600 March 3.

Laboratory Analytical Program

Analytical samples were collected from Well #1 and Well #2 during the pumping periods. Select samples were submitted for analysis of methyl tertiary-butyl ether (MtBE), benzene, toluene, ethylbenzene, xylene (BTEX), petroleum hydrocarbons (PHCs), general chemistry, metals, and for microbiology analysis (i.e., total coliforms, and E.coli). The samples were collected, preserved as directed by the laboratory, and submitted to Research and Productivity Council Inc. (RPC) in Fredericton, NB, for analysis. RPC is accredited by the Standards Council of Canada (SCC) for each of the analytical methods utilized and have in-house QA/QC programs to govern samples analysis and analytical data quality assurance. The analytical certificates are presented in **Attachment B**. The laboratory analytical program is summarized below in **Table 6**.

Table 6 - Laboratory Analytical Program

Parameters	Well #1	Well #2
Microbial Analysis	1	2
General Chemistry/Metals	1	2
MtBE, BTEX and PHCs	0	1

Results

Step-Drawdown Test (Well #2)

Relative water level elevations made during the step-drawdown test on Well #2 are presented on **Figure 1**.

Figure 1 - Step-Test (Well #2) Relative Water Level Data

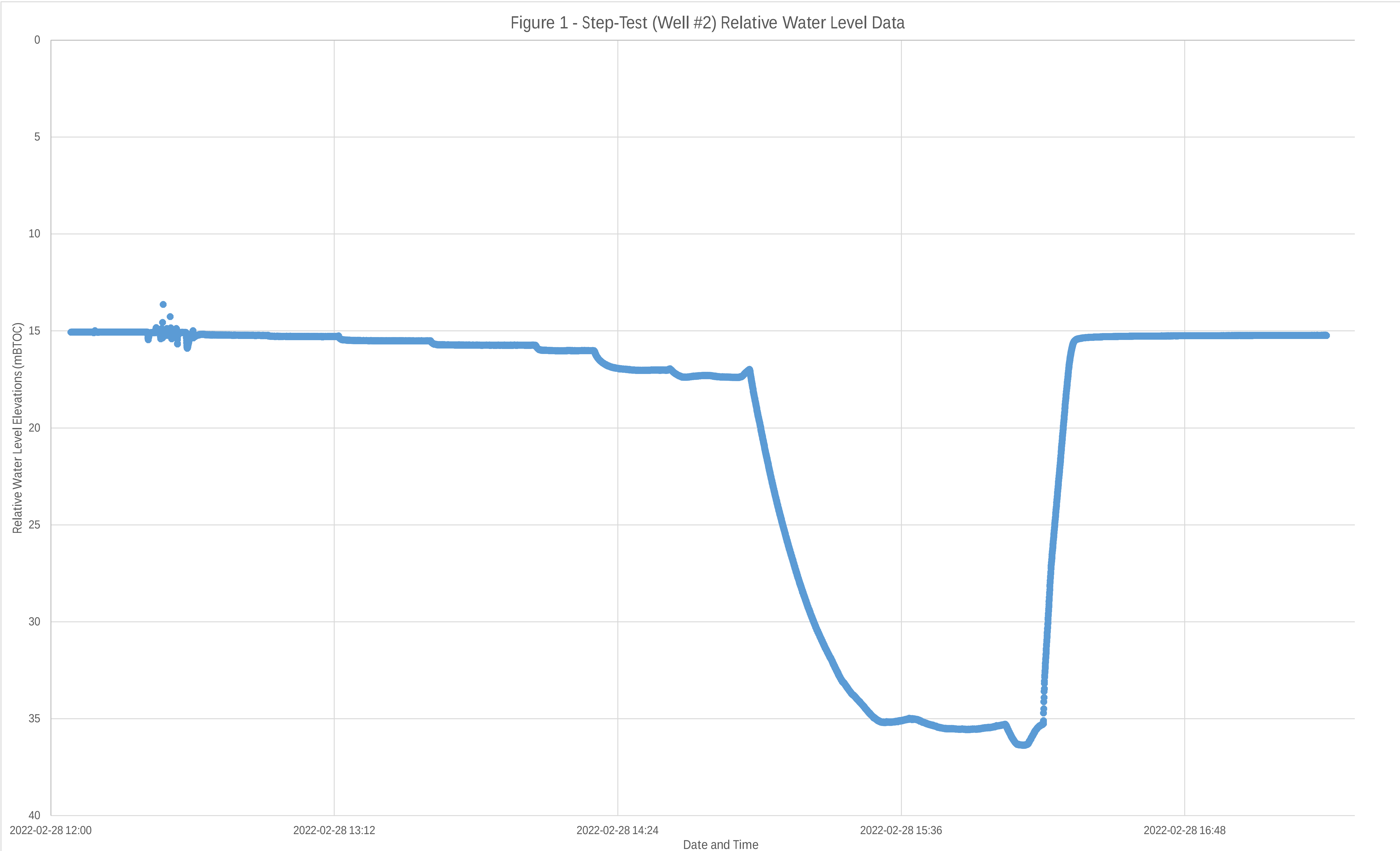

Figure 1 - Step-Test (Well #2) Relative Water Level Data
Relative Water Level Elevations (mBTOC)
0
5
10
15
20
25
30
35
40
2022-02-28 12:00
2022-02-28 13:12
2022-02-28 14:24
2022-02-28 15:36
2022-02-28 16:48
Date and Time

Various pumping intervals (approximately 15-30 minute durations) were completed with discharge rates varying from 2.3 L/min (0.5 igpm) to 54.5 L/min (12 igpm). Notable drawdowns were observed from 1200 to 1500 with the discharge rates being varied from 2.3 L/min (0.5 igpm) to 34.1 L/min (7.5 igpm), while a more pronounced drawdown is observed after 1500 when the pumping rate was increased to 43.2 L/min (9.5 igpm).

The pump was turned off at roughly 1615 on February 28 and a relatively quick (i.e., approximately 15 minutes) return to near static water level conditions in Well #2 was observed. Maximum drawdown observed in Well #2 during the step-test was approximately 20 m, and notable drawdowns in Well #1 and Well #3 were not observed during this test.

72 Hour Constant-Rate Pumping Test

Relative water level elevations made during the 72 hour pumping test on Well #2 are presented on **Figure 2**.

The 72 hour pumping test completed on Well #2 commenced at roughly 1800 on February 28 with a discharge rate of approximately 43.2 L/min (9.5 igpm). Within the first 11 hours of this period, the pump lost power due to electrical issues with the generator five times. During each of these drawdown and recovery periods associated with the stoppage in pumping, the maximum drawdowns observed were approximately 20 m and relatively quick (i.e., approximately 10 minute) returns to near static water level conditions are observed in Well #2.

Repairs/alterations were made to the electrical equipment a sustained pumping period commenced at around 0530 March 1 and was completed at 1000 on March 3. The discharge rate was approximately 43.2 L/min (9.5 igpm), and two brief periods of a stop in pumping due to equipment issues were experienced at 0600 March 2 and at 1930 on March 2.

Throughout the sustained pumping period, following the initial drawdown of approximately 20 m, the water level began to rise/recharge in the pumping well. This could possibly indicate that a positive boundary condition (for example, water flow from higher transmissivity area in the area of Well #3) had been met and that the aquifer could potentially sustain a discharge rate higher than 43.2 L/min (9.5 igpm).

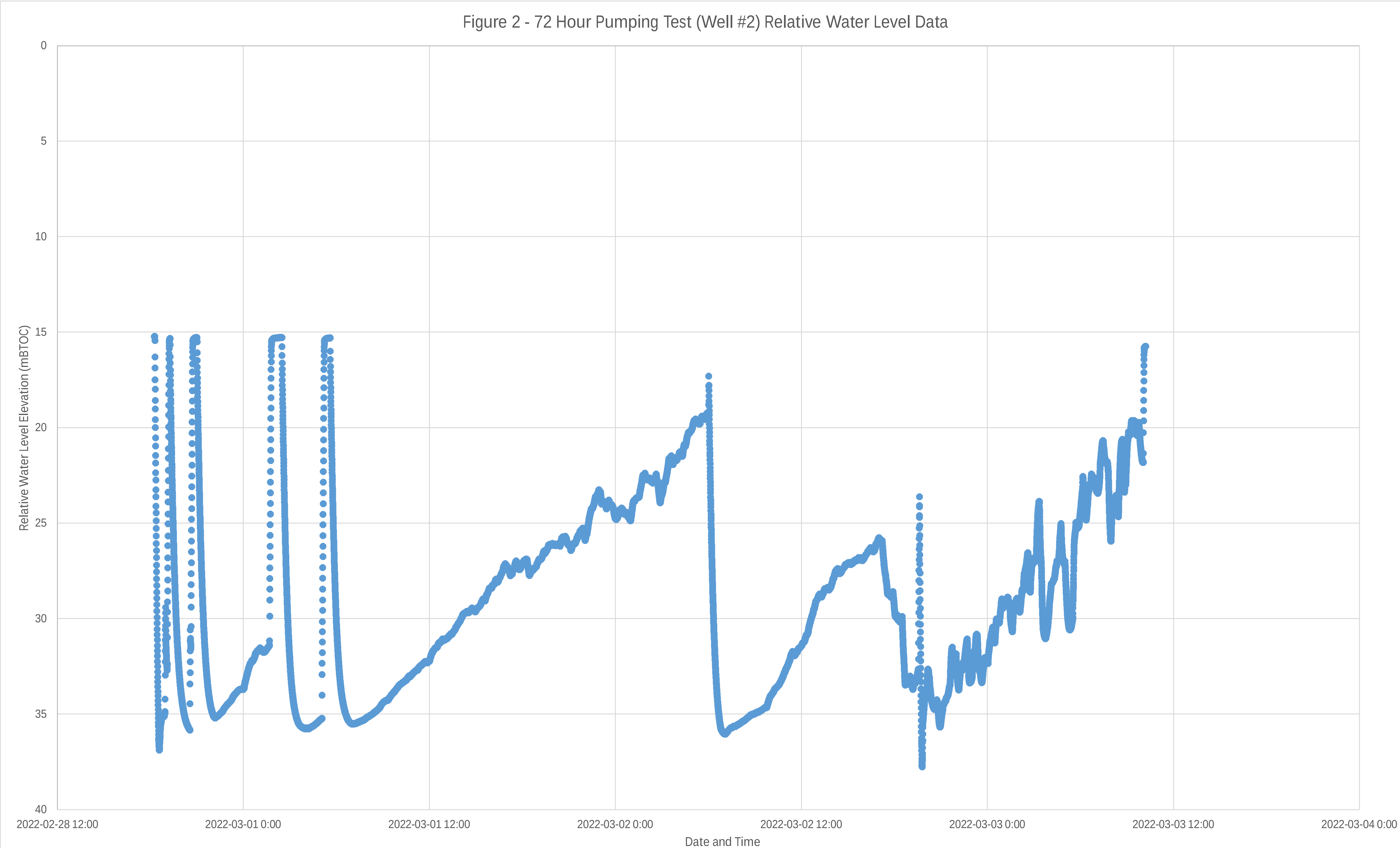

Figure 2 - 72 Hour Pumping Test (Well #2) Relative Water Level Data
Relative Water Level Elevation (mBTOC)
0
5
10
15
20
25
30
35
40
2022-02-28 12:00
2022-03-01 0:00
2022-03-01 12:00
2022-03-02 0:00
2022-03-02 12:00
2022-03-03 0:00
2022-03-03 12:00
2022-03-04 0:00
Date and Time

4 Hour Constant-Rate Pumping Test

Relative water level elevations made during the 4 hour pumping test on Well #1 are presented on **Figure 3**.

A 4 hour constant-rate pumping test commenced with Well #1 as the pumping well at 1200 on March 3. The discharge rate was roughly 22.7 L/min (5 igpm) and the test was completed at roughly 1600 March 3. Following the pump being turned on, a steady trend towards steady-state drawdown conditions was observed until a notable drawdown was observed following adjustment of the pumping rate. The maximum drawdown observed during this test was approximately 25 m. At the completion of the test, when comparing the recovery period to the recoveries observed in Well #2, a more gradual (i.e., approximately 30 minutes) recovery towards static water level conditions in Well #1 is observed.

Laboratory Analytical Program

Microbial Analysis

Analytical results for microbial analysis in groundwater are presented in **Table 7** and laboratory analytical certificates are presented in **Attachment B**.

Counts of total coliforms and E.Coli were not observed in the samples collected from Well #1 and Well #2, and therefore the samples met the Health Canada Drinking Water Quality (HCDWQ) guidelines.

MtBE, BTEX and PHCs

Analytical results for MtBE, BTEX and PHCs in groundwater are presented in **Table 8** and laboratory analytical certificates are presented in **Attachment B**.

Concentrations of MtBE, BTEX and PHCs were below the laboratory detection limits and were therefore below the applicable Atlantic RBCA Tier I RBSLs (residential, potable, coarse-grained).

General Chemistry and Metals

Analytical results for general chemistry and presented in **Table 9** and laboratory analytical certificates are presented in **Attachment B**.

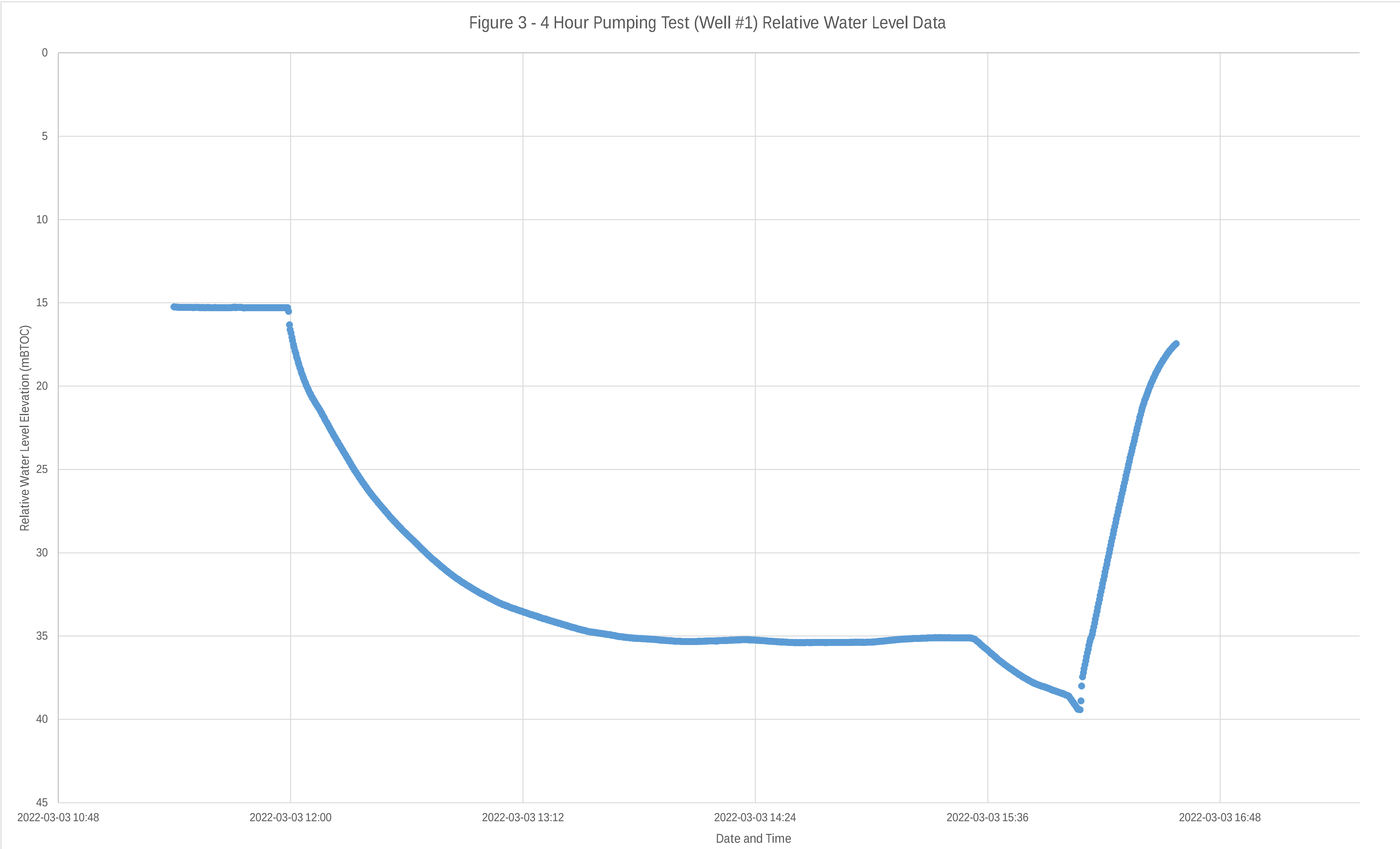

Figure 3 - 4 Hour Pumping Test (Well #1) Relative Water Level Data
Relative Water Level Elevation (mBTOC)
0
5
10
15
20
25
30
35
40
45
2022-03-03 10:48
2022-03-03 12:00
2022-03-03 13:12
2022-03-03 14:24
2022-03-03 15:36
2022-03-03 16:48
Date and Time

Table 7 - Microbial Analysis in Groundwater

			Location Code	Well 1		Well 2
			Date	2022-03-01	2022-03-03	2022-03-03
			Sample Type	Normal	Normal	Normal
	Unit	EQL	HC Drinking Water Quality Guidelines - MAC			
Biological						
Coliform	CFU/100mL		0	0	0	0
E. Coli	CFU/100mL		0	0	0	0

Environmental Standards
Health Canada, September 2020, HC Drinking Water Quality Guidelines - MAC

Table 8 - MtBE, BTEX and PHCs in Groundwater

			BTEX				Petroleum Hydrocarbons (PHCs)					Volatile Organic Compounds (VOCs)
			Benzene	Toluene	Ethylbenzene	Xylene Total	VPH (C6-C10 - BTEX)	EPH >C10-C16	EPH >C16-C21	EPH >C21-C32	Modified TPH (Tier 1)	Methyl tert-Butyl Ether (MTBE)
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL												
Atlantic PIRI Tier I RBSL - Residential Potable (Coarse) (Appendix 3)			0.005	0.024	0.0016	0.02					3.2	
HC Drinking Water Quality Guidelines - AO				0.024	0.0016	0.02						0.015
Location Code	Date	Sample Type										
Well 2	2022-03-03	Normal	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.02	<0.001

Environmental Standards
Atlantic RBCA, July 2021, Atlantic PIRI Tier I RBSL - Residential Potable (Coarse) (Appendix 3)
Health Canada, September 2020, HC Drinking Water Quality Guidelines - AO

Concentrations of aluminum and iron in the sample collected from Well #1 were found to be above operational and aesthetic-based HCDWQ guidelines. Concentrations of manganese in Well #1 were found to be above health-based HCDWQ guidelines.

Analytical results for general chemistry and metals in the samples collected from Well #2 were within the HCDWQ criteria.

In general, concentrations of select metals parameters in Well #1 were higher than the corresponding parameters in Well #2. This elevated concentrations could be attributed to the cave-in observed in Well #1 and the lesser duration of pumping when compared to Well #2.

The presence of aluminum, iron, and manganese are commonly found in groundwater throughout the Province of New Brunswick and the concentrations observed on the subject property are anticipated to be associated with naturally occurring groundwater conditions. Given that exceedances above health-based criteria were observed, it is recommended that water filtration/treatment systems be installed in the residences where these exceedances occur post-well development.

Aquifer Analysis

Following the pumping test, the relative water level data was compiled and reviewed. Various method of analysis were evaluated based upon the recovered data and the hydrogeological conditions. The following is a summary of hydrogeological conditions and assumptions applied to the conceptual site model with respect to data analysis:

- The aquifer is semi-confined and has an “apparent” infinite extent;
- The aquifer is homogeneous, isotropic, and has uniform thickness over the area of influence by pumping;
- The piezometric surface was horizontal prior to pumping;
- The test wells are partially penetrating;
- Water removed from storage is discharged instantaneously with decline in head; and
- The discharge volume is high relative to well storage, and therefore, well storage is negligible.

Applicable water level data from the pumping and recovery periods were input into the AquiferTestPro®. Estimates of hydraulic conductivity and aquifer transmissivity were estimated using the Theis solution for the pumping periods and the Hvorslev solution for the recovery periods. Further details regarding the hydraulic conductivity and transmissivity estimates from Well #1 and Well #2 are provided below in **Table 10**.

Table 10 - Hydraulic Conductivity and Transmissivity Estimates

Well ID	Hydraulic Conductivity (m/s)	Aquifer Transmissivity (m^2/s)
Well #1	1.9e-7	5.6e-6
Well #2	7.5e-7, 3.9e-6, 2.9e-6	1.8e-5, 9.5e-5, 7.1e-5
Well #2 - Average	2.5e-6	6.1e-5

The above estimates are consistent with published reference values for sandstone (Freeze and Cherry, 1979).

Using the above estimates, twenty-year safe well yield calculations ("Q20") were completed to estimate long-term safe pumping rates for the wells. The estimates were completed using the Farvolden equation:

$$Q20 = 0.683 * T * Ha * Sf$$

Where:

T = Aquifer Transmissivity [m^2/s]
Ha = Available Head (assumed to be the distance from SWL to Top of Aquifer, for Well 1 and Well 2 approximately 21.5 m) [m]
Sf = Unitless Safety Factor (0.7)

Using the above estimates and assumed values the Q20 for Well #1 was estimated to be 5.8e-5 m^3/s (4973 L/day), while the Well #2 was estimated to be 6.3e-4 m^3/s (54,175 L/day).

Discussion, Conclusions, and Recommendations

As the anticipated water demand for the proposed development exceed both of the estimated Q20 values for Well #1 and Well #2, the results of the assessment do not necessarily conclude that the aquifer can sustainably supply groundwater for the proposed development. However, as both of the Q20 estimates exceed the anticipated daily demand for a family of four on a per lot basis, it would be reasonable to conclude that Well #1 and Well #2 would provide a sustainable water source for an individual lot, or multiple lots, with respect to water quantity. Further, based on the observed recovery in the water level in Well #2 during the 72 hour pumping test, it would be reasonable to conclude that the aquifer could safely sustain an extraction higher than that of the pumping test (i.e., greater than 43.2 L/min, 9.5 igpm).

As a means to further evaluate capacity of the aquifer, it would be recommended to complete additional hydraulic testing with Well #3 serving as the pumping well. Given that the preliminary yield of Well #3 was over 10 times higher than those of Well #1 and Well #2, it would be reasonable to conclude that analysis conducted on Well #3 may present higher 20 year safe yield extraction rates. While the analysis on Well #1 and Well #2 does not indicate that those two wells, combined, provide safe extraction rates to sustain the entire development demand, it would be reasonable to assume that Well #1, Well #2, and Well #3, combined, may provide safe extractions to sustain the entire development demand.

Should water supply issues be encountered with individual water wells on each lot, given the higher preliminary estimated yield in Well #3, as a contingency plan, it would be reasonable to conclude Wells #1, #2 and #3 (or some combination thereof) could provide a sustainable water source as a communal system for the development if needed. Additionally, other mitigative measures, such as extending individual well depths for additional water storage or adding a storage tank, could be implemented for individual wells. Should a communal system be required, additional testing may be required.

Based on observations made during the test well drilling, it was concluded that groundwater storage and flow in the underlying sandstone aquifer is likely occurring primarily through fractures (i.e., no or limited secondary porosity). As such, it should be expected that further wells installed at the subject property would remain variable in terms of water quality and water quantity. This is further evident by the ranges observed in the preliminary well yields (i.e., Well #3 preliminary yield was 35 igpm, while Well #1 and Well #2 preliminary yields were 2 igpm) and the variation in the water quality data observed between Well #1 and Well #2.

Given the size of the property, this hydrogeological assessment needed to assess for variability across the site, as such, the test wells were separated by over 100 m. Therefore, the results of this assessment do not necessarily evaluate the potential for interference between wells installed on future adjacent lots (i.e., distances around 30 m). To assess for potential well interference, it would be recommended to complete short-term pumping tests on wells on adjacent lots. For example, at such time when the first three or four wells have been installed on adjacent properties, we would recommend then completing these tests to assess for potential indicators of well interference.

As evidence of well collapse was observed in Well #1, it should be noted that collapse may occur in future wells and that well liners or other mitigative measures or rehabilitation following collapse may be required.

Analytical results from Well #1 exhibited concentrations of metals above objective/aesthetic-based and health-based HCDWQ. Typically, per water well regulations, microbial analysis sampling is required on any water well installed for potable purposes. Given the exceedances observed in metals criteria, it is recommended that additional wells be sampled for analysis of general chemistry and metals as well. Given that exceedances above health-based criteria were observed, it is recommended that water filtration/treatment systems be installed in the residences where exceedances are observed in samples collected after the well has been developed to remove sediment created during the drilling process.

It is recommended that each installed well should be tested for quantity and quality as part of the installation process with storage and treatment added as necessary to meet the needs of each home.

It is understood that a stormwater retention pond is to be installed on the subject property. Per the neighbouring Province of Nova Scotia Groundwater under Direct Influence (GUDI) Surface Water Protocol, any well installed on the subject property will need be greater than 60 m from the pond.

Closure

We trust this meets your needs at this point. If you have questions or wish to discuss please contact the undersigned.

Yours truly,

DILLON CONSULTING LIMITED

DRAFT	**DRAFT**
Parrish Arnott, P.Geo. Hydrogeologist	Brennan Gourley, P.Eng. (NS) Environmental Engineer

Attachments:

- Attachment A – Water Well Driller's Reports
- Attachment B – Laboratory Analytical Certificates
- Attachment C – Aquifer Test Analysis Reports
- Attachment D – Disclaimer

Closure

We trust this meets your needs at this point. If you have questions or wish to discuss please contact the undersigned.

Yours truly,

DILLON CONSULTING LIMITED

DRAFT	**DRAFT**
Parrish Arnott, P.Geo. Hydrogeologist	Brennan Gourley, P.Eng. (NS) Environmental Engineer

Attachments:

- Attachment A – Water Well Driller's Reports
- Attachment B – Laboratory Analytical Certificates
- Attachment C – Aquifer Test Analysis Reports
- Attachment D – Disclaimer

Attachment A

Water Well Driller's Reports

New Brunswick Nouveau Brunswick

ENVIRONMENT & LOCAL GOVERNMENT

WATER WELL DRILLER'S REPORT 00041475

OFFICE USE ONLY
FIELD NO.
HEALTH CODE
LAB NO.
HEALTH OFFICE
EVENT NO.
SAMPLE RECEIVED DATE YR MO DAY
SAMPLE RECEIVED BY:

TESTING VOUCHER INFORMATION — **MANDATORY FOR WATER TEST**
SEE BACK FOR DETAILS **PLEASE PRINT**
INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF SAMPLING
FIRST NAME
LAST NAME
ADDRESS (MAIL RESULTS TO:)
CITY/TOWN/VILLAGE
PROV.
POSTAL CODE
DAYTIME PHONE
FAX NO.
TEL. NO.
SAMPLE COLLECTED YR MO DAY HR MIN AM PM

DO YOU NEED A SAMPLE FOR YOUR MORTGAGE?
SEE BACK FOR DETAILS
IF YOU WISH THE RESULTS TO BE RELEASED TO A MORTGAGE INSTITUTION PLEASE INCLUDE THE FOLLOWING CONTACT INFORMATION:
ATTENTION OF:
TEL NO.
FAX NO.
SIGNATURE OF WELL OWNER

P.I.D. NO. 4582526
WELL I.D. NO. 0064502

WELL OWNER INFORMATION
INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF DRILLING
FIRST NAME / LAST NAME: DILLON CONSULTING INC
ADDRESS: 1149 SMYTHE ST SUITE 200
CITY/TOWN/VILLAGE: FREDERICTON
PROVINCE: NB
POSTAL CODE: E3B 3H4
WELL LOCATION: SAME AS ABOVE ..... OR
CIVIC NUMBER STREET NAME: Forest Ave
CITY/TOWN/VILLAGE: Chipman
WELL PAID FOR BY PROVINCIAL DEPT. OF
WELL ON RESERVE? YES ☐ NO ☐
WELL ALREADY TAGGED? YES ☐ NO ☐
OLD WELL I.D.

WAS THE COST OF THIS WELL FINANCED BY NB HOUSING? YES ☐ NO ☐

WELL / WATER USE:
INDUSTRIAL ☐ ABANDONED ☐ DOMESTIC ☐
EXPLORATORY ☑ MUNICIPAL ☐ MONITORING ☐
HEAT PUMP ☐ OBSERVATION ☐ OTHER ☐

TYPE OF WORK COMPLETED: NEW WELL ☑ DEEPENED ☐
OTHER:

METHOD:
CABLE TOOL ☐ ROTARY ☑ OTHER

CASING INSTALLED:
LENGTH OF CASING ABOVE GROUND: 1 FT. 6 IN.
STEEL: 6 IN DIAM. FROM 0 FT. TO 38 FT.
PVC: IN DIAM. FROM FT. TO FT.
SLOTTED IN DIAM. FROM FT. TO FT.
SCREENS: TYPE: SLOT SIZE
IN DIAM. FROM FT. TO FT.
DRIVE SHOE: YES ☑ NO ☐

SETBACKS: SEE BACK FOR DETAILS
SEPTIC TANK (1) - FT.
SEPTIC TANK (2) - FT. FIELD (2) - FT. FIELD (1) - FT.
*RIGHT OF WAY OF ANY PUBLIC ROAD ☐ (1) 1000 ROAD (2)
CENTER OF ROAD ☐ (1) 1033 (2)
SETBACKS MEASURED (NEW CONSTRUCTION)
APPROXIMATE SETBACKS AS INDICATED BY HOMEOWNER ✓ (EXISTING CONST.)

FLOWING WELL? YES ☐ NO ☐ IF YES - RATE: igpm (approx.)

AQUIFER TEST: METHOD: AIR ☑ BAILER ☐ PUMP ☐
INITIAL WATER LEVEL: 220 FT BELOW TOP OF CASING
PUMPING RATE 35 igpm DURATION: 1 hrs. min.
FINAL WATER LEVEL: 30 FT. BELOW TOP OF CASING
ESTIMATED SAFE YIELD: 35 igpm

WELL GROUTED? YES ☐ NO ☑
FROM FT. TO FT. GROUT TYPE:
DRILLING FLUIDS USED: YES ☐ NO ☑
TYPE:

DRILLER'S LOG *

FROM (FT.)	TO (FT.)	COLOUR	ROCK TYPE
Ground Level	20	Brown	Sand + Clay
20	70	Grey + Blue	Sandstone
70	75	Dark Grey	Sandstone
75	125	Blue Grey	Sandstone
125	220	Brown + Red	Siltstone

IF INSUFFICIENT SPACE PLEASE USE ADDITIONAL SHEETS

TOTAL WELL DEPTH: 220 FT. DEPTH TO BEDROCK: 20 FT.
WATER BEARING 1 35 igpm AT 70 FT. 2 - igpm AT FT.
FRACTURE ZONES: 3 igpm AT FT. 4 igpm AT FT.

PUMP INSTALLATION: INSTALLED ☐ NOT INSTALLED ☑
PUMP INTAKE SETTING: 180 FT. BELOW TOP OF CASING (Recommended)
PUMP TYPE: SUBMERSIBLE ☑ JET ☐ TURBINE ☐
OTHER
WELL DISINFECTED? YES ☑ NO ☐
TYPE Bleach

DRILLER'S COMMENTS

DRILLING COMPANY: B & Steeves
COMPLETION DATE: 22 02 22 (YR. MO. DAY)
LICENSE NO. 100

G.P.S. (OPTIONAL)

I CERTIFY THAT THE WELL HEREIN DESCRIBED HAS BEEN CONSTRUCTED IN ACCORDANCE WITH THE WATER WELL REGULATION UNDER THE NEW BRUNSWICK CLEAN WATER ACT.

Signature of Driller: J. Steeves
Signature of Helper: Tom Walsh

WHITE - NBELG
BLUE - Homeowner / Voucher
YELLOW - Homeowner
PINK - Drilling Company

KEEP THIS REPORT WITH YOUR IMPORTANT DOCUMENTS

New Nouveau Brunswick

ENVIRONMENT & LOCAL GOVERNMENT

WATER WELL DRILLER'S REPORT

00046179

OFFICE USE ONLY

FIELD NO | HEALTH CODE | LAB NO | SAMPLE RECEIVED DATE (YR MO DAY)

HEALTH OFFICE | EVENT NO | SAMPLE RECEIVED BY

TESTING VOUCHER INFORMATION — **MANDATORY FOR WATER TEST**

SEE BACK FOR DETAILS **PLEASE PRINT**

INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF SAMPLING

FIRST NAME | LAST NAME

ADDRESS (MAIL RESULTS TO)

CITY/TOWN/VILLAGE | PROV | POSTAL CODE

DAYTIME PHONE | FAX NO

TEL NO | SAMPLE COLLECTED YR MO DAY HR MIN AM PM

DO YOU NEED A SAMPLE FOR YOUR MORTGAGE? **SEE BACK FOR DETAILS**

IF YOU WISH THE RESULTS TO BE RELEASED TO A MORTGAGE INSTITUTION PLEASE INCLUDE THE FOLLOWING CONTACT INFORMATION:

ATTENTION OF

TEL NO | FAX NO

SIGNATURE OF WELL OWNER

P.I.D. NO. 45825261

WELL I.D. NO. 00645011

WELL OWNER INFORMATION

INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF DRILLING

FIRST NAME / LAST NAME: DILLON CONSULTING INC

ADDRESS: 1 A9 SMYTHE ST SUITE 210

CITY/TOWN/VILLAGE: FREDERICTON PROVINCE: NB POSTAL CODE: E3B3H

WELL LOCATION. SAME AS ABOVE OR CIVIC NUMBER STREET NAME: Fk-t-A Ave

CITY/TOWN/VILLAGE: CY. Rhndwl

WELL PAID FOR BY PROVINCIAL DEPT OF

WELL ON RESERVE? YES ☐ NO ☑

WELL ALREADY TAGGED? YES ☐ NO ☑

OLD WELL ID

WAS THE COST OF THIS WELL FINANCED BY NB HOUSING? YES ☐ NO ☑

WELL / WATER USE:

INDUSTRIAL ☐ ABANDONED ☐ DOMESTIC ☐

EXPLORATORY ☑ MUNICIPAL ☐ MONITORING ☐

HEAT PUMP ☐ OBSERVATION ☐ OTHER ☐

TYPE OF WORK COMPLETED: NEW WELL ☑ DEEPENED ☐

OTHER

METHOD:

CABLE TOOL ☐ ROTARY ☑ OTHER

CASING INSTALLED:

LENGTH OF CASING ABOVE GROUND 1 FT 6 IN

STEEL 6 IN DIAM FROM 0 FT TO 38 FT

PVC IN DIAM FROM FT TO FT

SLOTTED IN DIAM FROM FT TO FT

SCREENS: TYPE SLOT SIZE

IN DIAM FROM FT TO FT

DRIVE SHOE YES ☑ NO ☐

SETBACKS: SEE BACK FOR DETAILS

SEPTIC TANK (1) – FT

SEPTIC TANK (2) – FT FIELD (2) – FT FIELD (1) – FT

*RIGHT OF WAY OF ANY PUBLIC ROAD ☐ (1) 550 ROAD (2)

CENTER OF ROAD ☐ (1) 883 (2)

SETBACKS MEASURED (NEW CONSTRUCTION)

APPROXIMATE SETBACKS AS INDICATED BY HOMEOWNER ✓ (EXISTING CONST.)

FLOWING WELL? YES ☐ NO ☑ IF YES-RATE igpm (approx)

AQUIFER TEST: METHOD AIR ☑ BAILER ☐ PUMP ☐

INITIAL WATER LEVEL: 200 FT BELOW TOP OF CASING

PUMPING RATE 2 igpm DURATION 1 hrs min

FINAL WATER LEVEL 25 FT. BELOW TOP OF CASING

ESTIMATED SAFE YIELD: 2 igpm

WELL GROUTED? YES ☐ NO ☑

FROM FT TO FT GROUT TYPE:

DRILLING FLUIDS USED: YES ☐ NO ☑

TYPE

DRILLER'S LOG*

FROM (FT)	TO (FT)	COLOUR	ROCK TYPE
GROUND LEVEL	20	Brown	clay
20	130	Grey & Brown	Sandstone
130	200	Brown	Silt stone

IF INSUFFICIENT SPACE PLEASE USE ADDITIONAL SHEETS

TOTAL WELL DEPTH: 200 FT DEPTH TO BEDROCK: 20 FT

WATER BEARING 1 1 igpm AT 120 FT 2 1 igpm AT 165 FT

FRACTURE ZONES 3 igpm AT FT 4 igpm AT FT

PUMP INSTALLATION: INSTALLED ☐ NOT INSTALLED ☑

PUMP INTAKE SETTING (Recommended) 160 FT BELOW TOP OF CASING

PUMP TYPE: SUBMERSIBLE ☑ JET ☐ TURBINE ☐

OTHER

WELL DISINFECTED? YES ☑ NO ☐

TYPE Bleach

DRILLER'S COMMENTS

DRILLING COMPANY: BR Sheaves

COMPLETION DATE: 2010 12 02 (YR MO DAY)

LICENSE NO. 1 10 0

G.P.S. (OPTIONAL)

I CERTIFY THAT THE WELL HEREIN DESCRIBED HAS BEEN CONSTRUCTED IN ACCORDANCE WITH THE WATER WELL REGULATION UNDER THE NEW BRUNSWICK CLEAN WATER ACT.

Signature of Driller: J. Sheaves

Signature of Helper: Tim walsh

WHITE - NB DENV
BLUE - Homeowner / Vouch
YELLOW - Homeowner
PINK - Drilling Company

KEEP THIS REPORT WITH YOU IMPORTANT DOCUMENTS

New Brunswick Nouveau

ENVIRONMENT & LOCAL GOVERNMENT

WATER WELL DRILLER'S REPORT

00046178

OFFICE USE ONLY

FIELD NO | HEALTH CODE | LAB NO | SAMPLE RECEIVED DATE (YR MO DAY)

HEALTH OFFICE | EVENT NO | SAMPLE RECEIVED BY

TESTING VOUCHER INFORMATION — **MANDATORY FOR WATER TEST**

SEE BACK FOR DETAILS **PLEASE PRINT**

INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF SAMPLING

FIRST NAME | LAST NAME

ADDRESS (MAIL RESULTS TO)

CITY/TOWN/VILLAGE | PROV | POSTAL CODE

DAYTIME PHONE | FAX NO

TEL NO | SAMPLE COLLECTED YR MO DAY HR MIN AM PM

DO YOU NEED A SAMPLE FOR YOUR MORTGAGE? **SEE BACK FOR DETAILS**

IF YOU WISH THE RESULTS TO BE RELEASED TO A MORTGAGE INSTITUTION PLEASE INCLUDE THE FOLLOWING CONTACT INFORMATION:

ATTENTION OF

TEL NO | FAX NO

SIGNATURE OF WELL OWNER

P.I.D. NO. 45825261

WELL I.D. NO. 06641124

WELL OWNER INFORMATION

INFORMATION INCLUDED HEREIN SHOULD BE THE WELL OWNER AT TIME OF DRILLING

FIRST NAME / LAST NAME: DILLON CONSULTING INC

ADDRESS: 1149 SMYTHE ST SUITE 200

CITY/TOWN/VILLAGE: FREDERICTON PROVINCE: NB POSTAL CODE: E3B 3H4

WELL LOCATION. SAME AS ABOVE OR CIVIC NUMBER STREET NAME: Forks St Ave

CITY/TOWN/VILLAGE: CHIPman WELL PAID FOR BY PROVINCIAL DEPT OF

WELL ON RESERVE? YES ☐ NO ☑ | WELL ALREADY TAGGED? YES ☐ NO ☑ | OLD WELL ID

WAS THE COST OF THIS WELL FINANCED BY NB HOUSING? YES ☐ NO ☑

WELL / WATER USE:

INDUSTRIAL ☐ ABANDONED ☐ DOMESTIC ☐

EXPLORATORY ☑ MUNICIPAL ☐ MONITORING ☐

HEAT PUMP ☐ OBSERVATION ☐ OTHER ☐

TYPE OF WORK COMPLETED: NEW WELL ☑ DEEPENED ☐

OTHER

METHOD:

CABLE TOOL ☐ ROTARY ☑ OTHER

CASING INSTALLED:

LENGTH OF CASING ABOVE GROUND 1 FT 6 IN

STEEL 6 IN DIAM FROM 0 FT TO 38 FT

PVC ____ IN DIAM FROM ____ FT TO ____ FT

SLOTTED ____ IN DIAM FROM ____ FT TO ____ FT

SCREENS: TYPE ____ SLOT SIZE ____

____ IN DIAM FROM ____ FT TO ____ FT

DRIVE SHOE YES ☑ NO ☐

SETBACKS: SEE BACK FOR DETAILS SEPTIC TANK (1) — FT

SEPTIC TANK (2) — FT FIELD (2) — FT FIELD (1) — FT

*RIGHT OF WAY OF ANY PUBLIC ROAD ☐ (1) 14/00 ROAD (2)

CENTER OF ROAD ☐ (1) 14/33 (2)

SETBACKS MEASURED ____ (NEW CONSTRUCTION)

APPROXIMATE SETBACKS AS INDICATED BY HOMEOWNER ✓ (EXISTING CONST.)

FLOWING WELL? YES ☐ NO ☑ IF YES-RATE ____ igpm (approx)

AQUIFER TEST: METHOD AIR ☑ BAILER ☐ PUMP ☐

INITIAL WATER LEVEL: 200 FT BELOW TOP OF CASING

PUMPING RATE 2 igpm DURATION 1 hrs ____ min

FINAL WATER LEVEL 35 FT. BELOW TOP OF CASING

ESTIMATED SAFE YIELD: 2 igpm

WELL GROUTED? YES ☐ NO ☑

FROM ____ FT TO ____ FT GROUT TYPE:

DRILLING FLUIDS USED: YES ☐ NO ☑

TYPE

DRILLER'S LOG*

FROM (FT)	TO (FT)	COLOUR	ROCK TYPE
GROUND LEVEL	15	Brown	Clay
15	125	Grey & Brown	Sandstone
125	200	Brown	Siltstone

IF INSUFFICIENT SPACE PLEASE USE ADDITIONAL SHEETS

TOTAL WELL DEPTH: 200 FT DEPTH TO BEDROCK: 15 FT

WATER BEARING 1 1 igpm AT 120 FT 2 1 igpm AT 160 FT

FRACTURE ZONES 3 ____ igpm AT ____ FT 4 ____ igpm AT ____ FT

PUMP INSTALLATION: INSTALLED ☐ NOT INSTALLED ☑

PUMP INTAKE SETTING. (Recommended) 120 FT BELOW TOP OF CASING

PUMP TYPE: SUBMERSIBLE ☑ JET ☐ TURBINE ☐

OTHER

WELL DISINFECTED? YES ☑ NO ☐

TYPE Bleach

DRILLER'S COMMENTS

DRILLING COMPANY: B R Steeves

COMPLETION DATE: 2016 02 16 (YR MO DAY) LICENSE NO. 100

G.P.S. (OPTIONAL)

I CERTIFY THAT THE WELL HEREIN DESCRIBED HAS BEEN CONSTRUCTED IN ACCORDANCE WITH THE WATER WELL REGULATION UNDER THE NEW BRUNSWICK CLEAN WATER ACT.

Signature of Driller: J. Steeves

Signature of Helper: Tom Walsh

WHITE - NB DENV

BLUE - Homeowner / Voucher

YELLOW - Homeowner

PINK - Drilling Company

KEEP THIS REPORT WITH YOUR IMPORTANT DOCUMENTS

Attachment B

Laboratory Analytical Certificates

Report ID: 432099-IAS
Report Date: 09-Mar-22
Date Received: 02-Mar-22

CERTIFICATE OF ANALYSIS

for
Dillon Consulting Ltd
1149 Smythe Street, Suite 200
Fredericton, NB E3B 3H4

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

Attention: Nathan Levesque
Project #: 22-3581
Location: Chipman

Analysis of Water

RPC Sample ID:			432099-1
Client Sample ID:			SA1
Date Sampled:			1-Mar-22
Analytes	**Units**	**RL**	
Sodium	mg/L	0.05	6.63
Potassium	mg/L	0.02	0.70
Calcium	mg/L	0.05	29.9
Magnesium	mg/L	0.01	3.91
Iron	mg/L	0.02	0.05
Manganese	mg/L	0.001	0.007
Copper	mg/L	0.001	< 0.001
Zinc	mg/L	0.001	< 0.001
Ammonia (as N)	mg/L	0.05	< 0.05
pH	units	-	7.4
Alkalinity (as $CaCO_3$)	mg/L	2	91
Chloride	mg/L	0.5	6.0
Sulfate	mg/L	1	12
Nitrate + Nitrite (as N)	mg/L	0.05	0.21
o-Phosphate (as P)	mg/L	0.01	< 0.01
r-Silica (as SiO_2)	mg/L	0.1	8.8
Carbon - Total Organic	mg/L	0.5	< 0.5
Turbidity	NTU	0.1	7.4
Conductivity	µS/cm	1	215
Calculated Parameters			
Bicarbonate (as $CaCO_3$)	mg/L	-	90.8
Carbonate (as $CaCO_3$)	mg/L	-	0.214
Hydroxide (as $CaCO_3$)	mg/L	-	0.013
Cation Sum	meq/L	-	2.12
Anion Sum	meq/L	-	2.25
Percent Difference	%	-	-2.97
Theoretical Conductivity	µS/cm	-	210
Hardness (as $CaCO_3$)	mg/L	0.2	90.8
Ion Sum	mg/L	-	124
Saturation pH (5°C)	units	-	8.2
Langelier Index (5°C)	-	-	-0.76

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

RL = Reporting Limit; Organic Carbon and ion chemistries for turbid samples are determined on filtered aliquots.

Matthew Norman
Senior Chemist
Inorganic Analytical Chemistry

Brannen Burhoe
Supervisor
Inorganic Analytical Services

Report ID: 432099-IAS
Report Date: 09-Mar-22
Date Received: 02-Mar-22

CERTIFICATE OF ANALYSIS

for
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www.rpc.ca

Attention: Nathan Levesque

Project #: 22-3581

Location: Chipman

Analysis of Metals in Water

RPC Sample ID:			432099-1
Client Sample ID:			SA1
Date Sampled:			1-Mar-22
Analytes	**Units**	**RL**	
Aluminum	µg/L	1	42
Antimony	µg/L	0.1	< 0.1
Arsenic	µg/L	1	< 1
Barium	µg/L	1	59
Beryllium	µg/L	0.1	< 0.1
Bismuth	µg/L	1	< 1
Boron	µg/L	1	14
Cadmium	µg/L	0.01	< 0.01
Calcium	µg/L	50	29900
Chromium	µg/L	1	< 1
Cobalt	µg/L	0.1	< 0.1
Copper	µg/L	1	< 1
Iron	µg/L	20	50
Lead	µg/L	0.1	< 0.1
Lithium	µg/L	0.1	3.8
Magnesium	µg/L	10	3910
Manganese	µg/L	1	7
Molybdenum	µg/L	0.1	0.7
Nickel	µg/L	1	3
Potassium	µg/L	20	700
Rubidium	µg/L	0.1	0.6
Selenium	µg/L	1	< 1
Silver	µg/L	0.1	< 0.1
Sodium	µg/L	50	6630
Strontium	µg/L	1	353
Tellurium	µg/L	0.1	< 0.1
Thallium	µg/L	0.1	< 0.1
Tin	µg/L	0.1	< 0.1
Uranium	µg/L	0.1	< 0.1
Vanadium	µg/L	1	< 1
Zinc	µg/L	1	< 1

Report ID: 432099-IAS
Report Date: 09-Mar-22
Date Received: 02-Mar-22

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Methods

Analyte	RPC SOP #	Method Reference	Method Principle
Ammonia	IAS-M47	APHA 4500-NH_3 G	Phenate Colourimetry
pH	IAS-M03	APHA 4500-H^+ B	pH Electrode - Electrometric
Alkalinity (as $CaCO_3$)	IAS-M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	IAS-M44	APHA 4500-CL E	Ferricyanide Colourimetry
Sulfate	IAS-M45	APHA 4500-SO_4 E	Turbidimetry
Nitrate + Nitrite (as N)	IAS-M48	APHA 4500-NO_3 H	Hydrazine Red., Derivitization, Colourimetry
o-Phosphate (as P)	IAS-M50	APHA 4500-P F	Molybdate/Ascorbic Acid Colourimetry
r-Silica (as SiO_2)	IAS-M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	IAS-M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	IAS-M06	APHA 2130 B	Nephelometry
Conductivity	IAS-M04	APHA 2510 B	Conductivity Meter - Electrode
Trace Metals	IAS-M01/IAS-M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

Report ID: 432344-OAS
Report Date: 07-Mar-22
Date Received: 04-Mar-22

CERTIFICATE OF ANALYSIS

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www.rpc.ca

Attention: Nathan Levesque
Project #: 22-3581
Location: Chipman

Hydrocarbon Analysis in Water (Atlantic MUST)

RPC Sample ID:			432344-1
Client Sample ID:			SA3
Date Sampled:			3-Mar-22
Matrix:			water
Analytes	Units	RL	
Benzene	mg/L	0.001	< 0.001
Toluene	mg/L	0.001	< 0.001
Ethylbenzene	mg/L	0.001	< 0.001
Xylenes	mg/L	0.001	< 0.001
VPH C6-C10 (Less BTEX)	mg/L	0.01	< 0.01
EPH >C10 - C16	mg/L	0.01	< 0.01
EPH >C16 - C21	mg/L	0.01	< 0.01
EPH >C21-C32	mg/L	0.01	< 0.01
Modified TPH Tier 1	mg/L	0.02	< 0.02
MTBE	mg/L	0.001	< 0.001
VPH Surrogate (IBB)	%		95
EPH Surrogate (IBB)	%		83
EPH Surrogate (C32)	%		104
Resemblance			ND
Return to Baseline at C32			Yes

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Angela Colford
Lab Supervisor
Organic Analytical Services

Steven Davenport
Senior Technician
Organic Analytical Services

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Method Summary

OAS-HC04: The Determination of Petroleum Hydrocarbons (Atlantic MUST) in Water(VPH)
OAS-HC04: Determination of Petroleum Hydrocarbons (Atlantic MUST) in Water (EPH)

Resemblance Legend

Resemblance Code	Resemblance	Resemblance Code	Resemblance
COMMENT	See General Report Comments	PAH	Possible PAHs Detected
FO	Fuel Oil Fraction	PG	Possible Gasoline Fraction
FO.LO	Fuel Oil and Lube Oil Fraction	PLO	Possible Lube Oil Fraction
G	Gasoline Fraction	PWFO	Possible Weathered Fuel Oil Fraction
LO	Lube Oil Fraction	PWG	Possible Weathered Gasoline Fraction
ND	Not Detected	TO	Transformer Oil
NR	No Resemblance (not-petrogenic in origin)	UP	Unknown Peaks
NRLR	No Resemblance in the lube oil range (>C21-C32).	WFO	Weathered Fuel Oil Fraction
OP	One Product (unidentified)	WG	Weathered Gasoline Fraction

General Report Comments

Return to Baseline: Samples are considered to have returned to baseline if the area from C32-C36 is less than 10% of the area from C10-C32.

Report ID: 432344-OAS
Report Date: 07-Mar-22
Date Received: 04-Mar-22

CERTIFICATE OF ANALYSIS

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Project #: 22-3581
Location: Chipman
QA/QC Report

RPC Sample ID:			BLANKD3146	BLANKD3149	SPIKED3144	SPIKED3147
Type:			EPH	VPH	EPH	VPH
Matrix:			water	water	water	water
Analytes	Units	RL			% Recovery	% Recovery
Benzene	mg/L	0.001	-	< 0.001	-	102%
Toluene	mg/L	0.001	-	< 0.001	-	102%
Ethylbenzene	mg/L	0.001	-	< 0.001	-	102%
Xylenes	mg/L	0.001	-	< 0.001	-	104%
VPH C6-C10 (Less BTEX)	mg/L	0.01	-	< 0.01	-	96%
EPH >C10 - C16	mg/L	0.01	< 0.01	-	-	-
EPH >C16 - C21	mg/L	0.01	< 0.01	-	-	-
EPH >C21-C32	mg/L	0.01	< 0.01	-	-	-
EPH >C10-C32	mg/L		-	-	91%	-
MTBE	mg/L	0.001	-	< 0.001	-	106%

RL = Reporting Limit

Report ID: 432344-OAS
Report Date: 07-Mar-22
Date Received: 04-Mar-22

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Project #: 22-3581

Summary of Date Analyzed

	VPH		EPH	
RPC Sample ID	**Extracted**	**Analyzed**	**Extracted**	**Analyzed**
432344-1	4-Mar-22	4-Mar-22	4-Mar-22	4-Mar-22

Report/Rapport: 432099-ML-W1
Date: 03-Mar-22
Date Received/Reçu: 02-Mar-22

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Attention: Nathan Levesque / Julie Greenlaw /
Trudy Ward / Dillon reports esdatlabs

Project/Job #: 22-3581

Client Location: Chipman

Microbiological Examination of Water/Qualité microbiologique de l'eau potable

RPC Sample ID/No. d'échantillon de RPC:				432099-1
Client Sample ID/ID d'échantillon du client:				SA1
Date collected/Date du prélèvement				1-Mar-22
Time sampled/Heure du prélèvement				3:00:00 PM
Analytes/Paramètre(s)	**Method/Méthode**	**Date Analyzed Date Analysé**	**Units Unités**	
Total Coliforms/Coliformes totaux	FFA10	2-Mar-22	MPN/100mL	0
E. coli	FFA10	2-Mar-22	MPN/100mL	0

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

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

Cathy Hay
Microbiology Supervisor
Applied and Experimental Bioscience

Adrienne Fortin
Microbiology Technician
Applied and Experimental Bioscience

Report/Rapport: 432344-ML-W1
Date: 07-Mar-22
Date Received/Reçu: 04-Mar-22

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Attention: Nathan Levesque / Julie Greenlaw / Trudy Ward / Dillon reports esdatlabs

Project/Job #: 22-3581

Client Location: Chipman

Microbiological Examination of Water/Qualité microbiologique de l'eau potable

RPC Sample ID/No. d'échantillon de RPC:				432344-1	432344-2
Client Sample ID/ID d'échantillon du client:				SA3	SA4
Date collected/Date du prélèvement				3-Mar-22	3-Mar-22
Time sampled/Heure du prélèvement				9:45:00 AM	3:30:00 PM
Analytes/Paramètre(s)	**Method/Méthode**	**Date Analyzed Date Analysé**	**Units Unités**		
Total Coliforms/Coliformes totaux	FFA10	4-Mar-22	MPN/100mL	0	0
E. coli	FFA10	4-Mar-22	MPN/100mL	0	0

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

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

Cathy Hay
Microbiology Supervisor
Applied and Experimental Bioscience

Adrienne Fortin
Microbiology Technician
Applied and Experimental Bioscience

Report ID: 432344-IAS
Report Date: 08-Mar-22
Date Received: 04-Mar-22

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Attention: Nathan Levesque
Project #: 22-3581
Location: Chipman

Analysis of Water

RPC Sample ID:			432344-1	432344-2
Client Sample ID:			SA3	SA4
Date Sampled:			3-Mar-22	3-Mar-22
Analytes	**Units**	**RL**		
Sodium	mg/L	0.05	5.82	125.
Potassium	mg/L	0.02	0.69	0.96
Calcium	mg/L	0.05	28.8	34.3
Magnesium	mg/L	0.01	4.00	2.81
Iron	mg/L	0.02	< 0.02	0.55
Manganese	mg/L	0.001	0.003	0.227
Copper	mg/L	0.001	< 0.001	< 0.001
Zinc	mg/L	0.001	< 0.001	0.002
Ammonia (as N)	mg/L	0.05	< 0.05	< 0.05
pH	units	-	7.7	8.2
Alkalinity (as $CaCO_3$)	mg/L	2	90	120
Chloride	mg/L	0.5	5.1	175
Sulfate	mg/L	1	11	8
Nitrate + Nitrite (as N)	mg/L	0.05	0.12	< 0.05
o-Phosphate (as P)	mg/L	0.01	< 0.01	< 0.01
r-Silica (as SiO_2)	mg/L	0.1	8.5	10.3
Carbon - Total Organic	mg/L	0.5	< 0.5	< 0.5
Turbidity	NTU	0.1	0.5	117.
Conductivity	µS/cm	1	212	777
Calculated Parameters				
Bicarbonate (as $CaCO_3$)	mg/L	-	89.6	118.
Carbonate (as $CaCO_3$)	mg/L	-	0.422	1.76
Hydroxide (as $CaCO_3$)	mg/L	-	0.025	0.079
Cation Sum	meq/L	-	2.04	7.44
Anion Sum	meq/L	-	2.18	7.50
Percent Difference	%	-	-3.39	-0.39
Theoretical Conductivity	µS/cm	-	202	734
Hardness (as $CaCO_3$)	mg/L	0.2	88.4	97.2
Ion Sum	mg/L	-	119	430
Saturation pH (5°C)	units	-	8.2	8.0
Langelier Index (5°C)	-	-	-0.48	0.15

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

RL = Reporting Limit; Organic Carbon and ion chemistries for turbid samples are determined on filtered aliquots.

Matthew Norman
Senior Chemist
Inorganic Analytical Chemistry

Brannen Burhoe
Supervisor
Inorganic Analytical Services

Report ID: 432344-IAS
Report Date: 08-Mar-22
Date Received: 04-Mar-22

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Attention: Nathan Levesque
Project #: 22-3581
Location: Chipman

Analysis of Metals in Water

RPC Sample ID:			432344-1	432344-2
Client Sample ID:			SA3	SA4
Date Sampled:			3-Mar-22	3-Mar-22
Analytes	**Units**	**RL**		
Aluminum	µg/L	1	18	354
Antimony	µg/L	0.1	< 0.1	0.1
Arsenic	µg/L	1	< 1	3
Barium	µg/L	1	59	223
Beryllium	µg/L	0.1	< 0.1	0.4
Bismuth	µg/L	1	< 1	< 1
Boron	µg/L	1	14	71
Cadmium	µg/L	0.01	< 0.01	0.10
Calcium	µg/L	50	28800	34300
Chromium	µg/L	1	< 1	< 1
Cobalt	µg/L	0.1	< 0.1	0.5
Copper	µg/L	1	< 1	< 1
Iron	µg/L	20	< 20	550
Lead	µg/L	0.1	< 0.1	0.2
Lithium	µg/L	0.1	3.4	53.0
Magnesium	µg/L	10	4000	2810
Manganese	µg/L	1	3	227
Molybdenum	µg/L	0.1	0.3	1.1
Nickel	µg/L	1	3	2
Potassium	µg/L	20	690	960
Rubidium	µg/L	0.1	0.6	1.3
Selenium	µg/L	1	< 1	< 1
Silver	µg/L	0.1	< 0.1	< 0.1
Sodium	µg/L	50	5820	125000
Strontium	µg/L	1	341	789
Tellurium	µg/L	0.1	< 0.1	< 0.1
Thallium	µg/L	0.1	< 0.1	< 0.1
Tin	µg/L	0.1	< 0.1	< 0.1
Uranium	µg/L	0.1	< 0.1	0.2
Vanadium	µg/L	1	< 1	< 1
Zinc	µg/L	1	< 1	2

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Methods

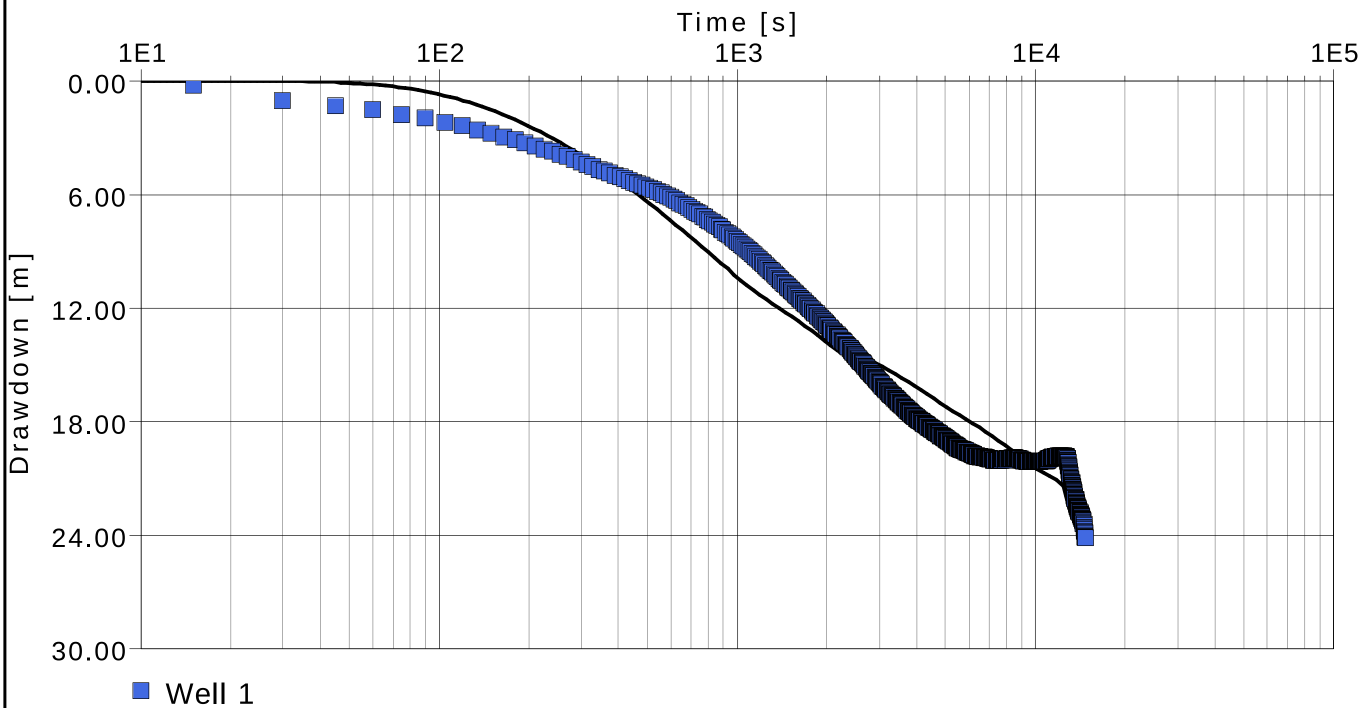
Analyte	RPC SOP #	Method Reference	Method Principle
Ammonia	IAS-M47	APHA 4500-NH_3 G	Phenate Colourimetry
pH	IAS-M03	APHA 4500-H^+ B	pH Electrode - Electrometric
Alkalinity (as $CaCO_3$)	IAS-M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	IAS-M44	APHA 4500-CL E	Ferricyanide Colourimetry
Sulfate	IAS-M45	APHA 4500-SO_4 E	Turbidimetry
Nitrate + Nitrite (as N)	IAS-M48	APHA 4500-NO_3 H	Hydrazine Red., Derivitization, Colourimetry
o-Phosphate (as P)	IAS-M50	APHA 4500-P F	Molybdate/Ascorbic Acid Colourimetry
r-Silica (as SiO_2)	IAS-M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	IAS-M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	IAS-M06	APHA 2130 B	Nephelometry
Conductivity	IAS-M04	APHA 2510 B	Conductivity Meter - Electrode
Trace Metals	IAS-M01/IAS-M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

Attachment C

Aquifer Test Analysis Reports

Dillon Consulting Limited 137 Chain Lake Drive, Suite 100 Halifax, NS B3S 1B3	**Pumping Test Analysis Report**
	Project: Forest Avenue Conceptual Devel.
	Number: 22-3581
	Client: J.D. Irving Ltd.

Location: Chipman, NB	Pumping Test: Well #1 - 6 Hr PT	Pumping Well: Well 1
Test Conducted by: NL		Test Date: 2022-03-03
Analysis Performed by: BCG	Well #1 - 6 Hr PT	Analysis Date: 2022-03-09
Aquifer Thickness: 24.40 m	Discharge: variable, average rate 0.00033213 [m³/s]	

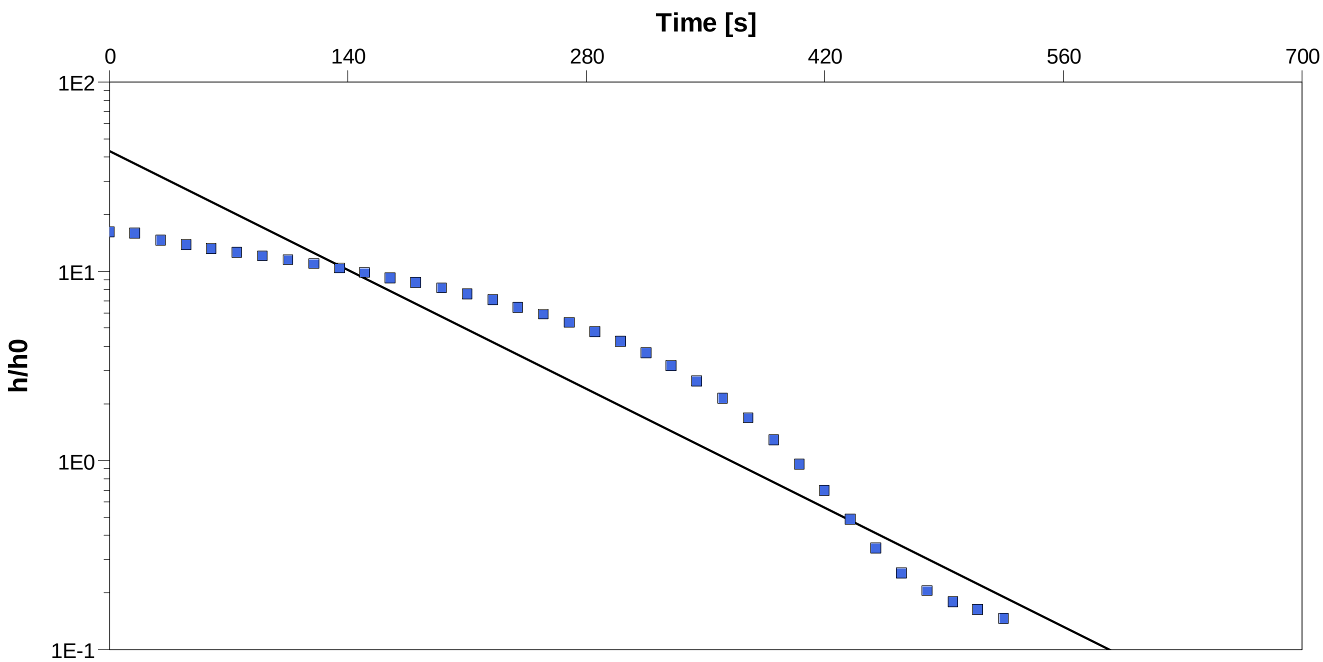


Calculation using Theis

Observation Well	Transmissivity [m²/s]	Hydraulic Conductivity [m/s]	Storage coefficient	Radial Distance to PW [m]	
Well 1	4.55×10^{-6}	1.86×10^{-7}	4.73×10^{-1}	0.08	

Dillon Consulting Limited 137 Chain Lake Drive, Suite 100 Halifax, NS B3S 1B3	**Slug Test Analysis Report** Project: Forest Avenue Conceptual Devel. Number: 22-3581 Client: J.D. Irving Ltd.

Location: Chipman, NB	Slug Test: Well #2 - S.T. #1	Test Well: Well #2
Test Conducted by: NL		Test Date: 2022-03-01
Analysis Performed by: BCG	Well #2 - S.T. #1	Analysis Date: 2022-03-09
Aquifer Thickness: 24.40 m		

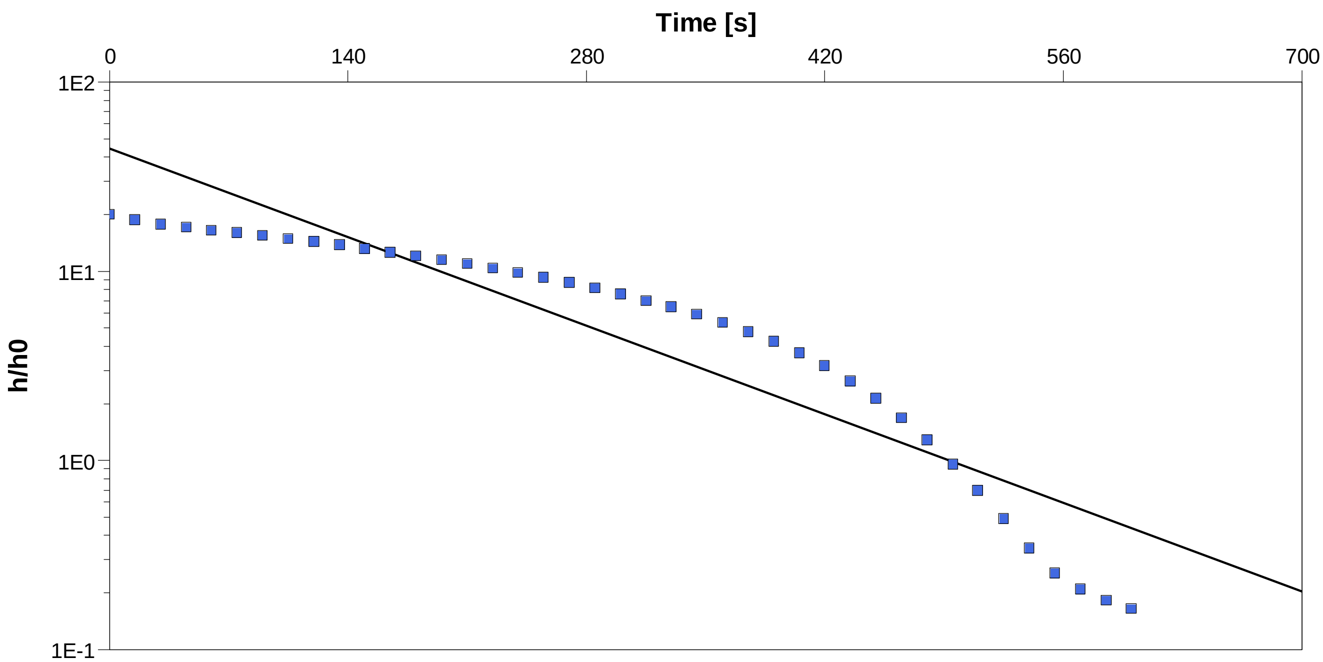


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
Well #2	3.94×10^{-6}	

Dillon Consulting Limited 137 Chain Lake Drive, Suite 100 Halifax, NS B3S 1B3	**Slug Test Analysis Report** Project: Forest Avenue Conceptual Devel. Number: 22-3581 Client: J.D. Irving Ltd.

Location: Chipman, NB	Slug Test: Well #2 - S.T. #2	Test Well: Well #2
Test Conducted by: NL		Test Date: 2022-03-01
Analysis Performed by: BCG	Well #2 - S.T. #2	Analysis Date: 2022-03-09
Aquifer Thickness: 24.40 m		

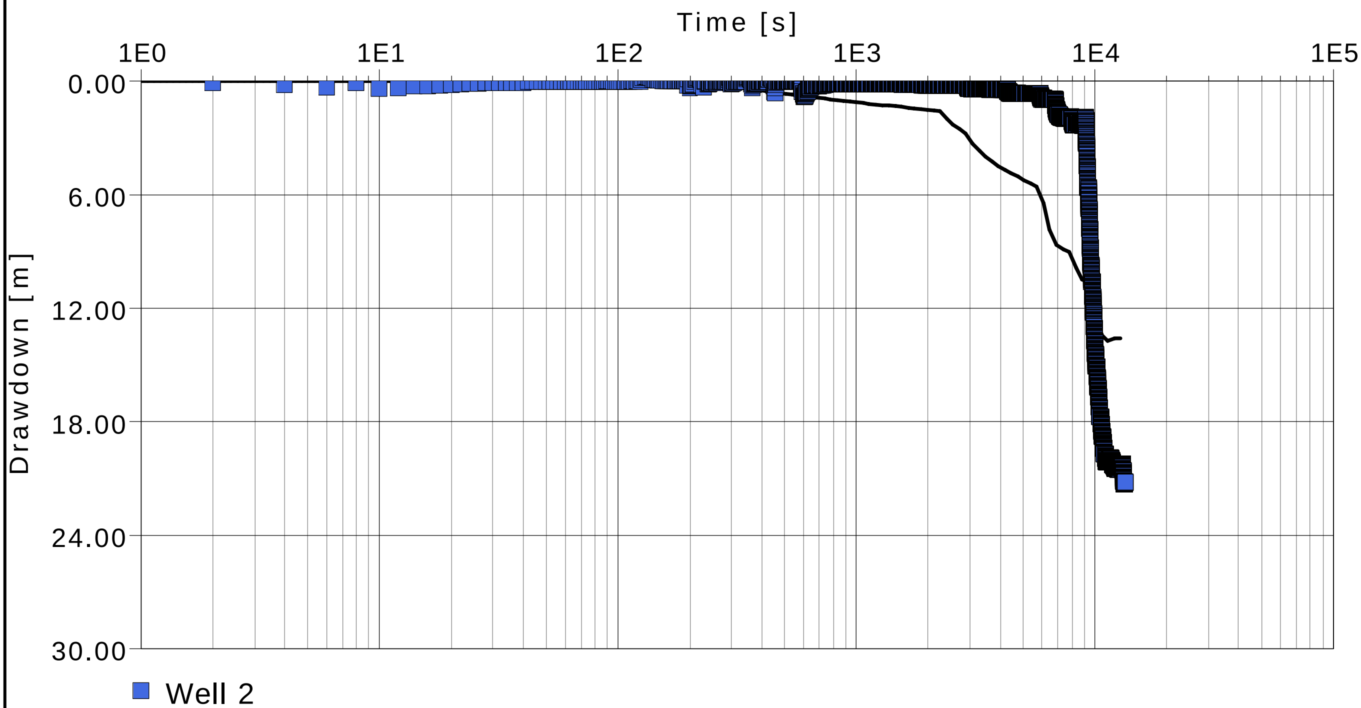


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
Well #2	2.93×10^{-6}	

Dillon Consulting Limited 137 Chain Lake Drive, Suite 100 Halifax, NS B3S 1B3	**Pumping Test Analysis Report** Project: Forest Avenue Conceptual Devel. Number: 22-3581 Client: J.D. Irving Ltd.

Location: Chpman, NB	Pumping Test: Well #2 - Step Test	Pumping Well: Well 2
Test Conducted by: NL		Test Date: 2022-02-28
Analysis Performed by: BCG	Well #2 - Step Test	Analysis Date: 2022-03-09
Aquifer Thickness: 24.40 m	Discharge: variable, average rate 0.00054523 [m³/s]	



Calculation using Theis

Observation Well	Transmissivity [m²/s]	Hydraulic Conductivity [m/s]	Storage coefficient	Radial Distance to PW [m]	
Well 2	1.82×10^{-5}	7.48×10^{-7}	9.90×10^{-1}	0.08	

Attachment D

Disclaimer

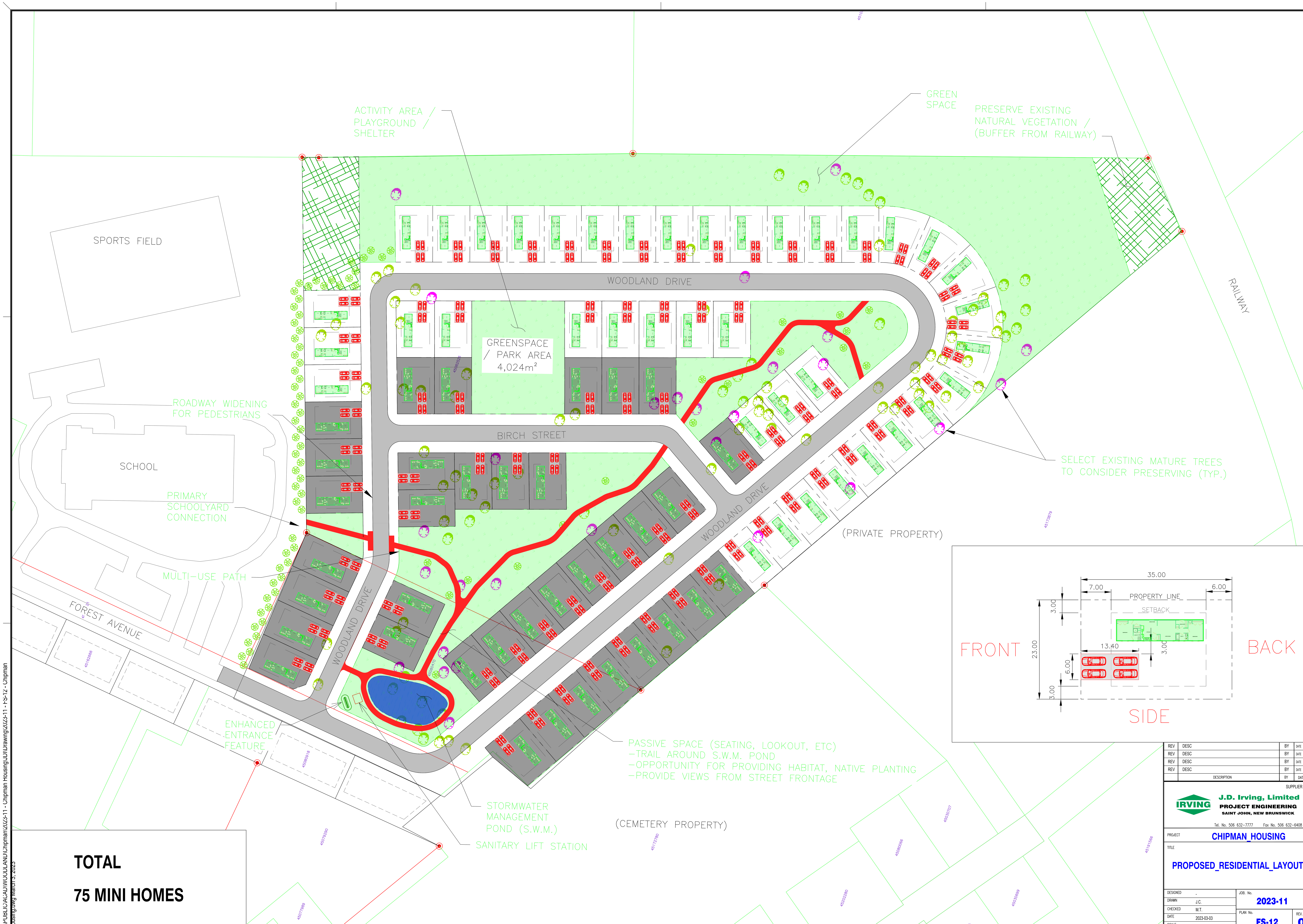
Disclaimer

Dillon Consulting Limited (Dillon) has used the degree of care and skill ordinarily exercised under similar circumstances at the time the work was performed by reputable members of the environmental consulting profession practicing in Canada. Dillon assumes no responsibility for conditions it was not authorized to investigate or which were beyond its scope of work. There is no warranty expressed or implied by Dilllon that the wok will discover all potential contamination since it may not be possible even with exhaustive sampling, testing, and analysis, to document all potential contamination on the site.

This report was prepared by Dillon for the sole benefit of J.D. Irving Limited. The material in it reflects Dillon's best judgment in light of the information available to Dillon at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Appendix B

Conceptual Subdivision Layout



TOTAL

75 MINI HOMES

REV	DESC	BY	DATE
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SUPPLIER

IRVING — J.D. Irving, Limited
PROJECT ENGINEERING
SAINT JOHN, NEW BRUNSWICK
Tel. No. 506 632-7777 Fax No. 506 632-6408

PROJECT: CHIPMAN_HOUSING

TITLE: PROPOSED_RESIDENTIAL_LAYOUT

DESIGNED	.	JOB. No.	2023-11
DRAWN	J.C.		
CHECKED	M.T.	PLAN No.	FS-12
DATE	2023-03-03	REV.	0
SCALE	.		

Mar 03, 2023 2:58pm A189805

24.2s (LMS Tech) ADT

Appendix C

AC CDC Report

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

DATA REPORT 7482: Chipman, NB

Prepared 4 November 2022
by C. Robicheau, Conservation Data Analyst

CONTENTS OF REPORT

Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (AC CDC; www.accdc.com) 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 AC CDC 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 AC CDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees.

Upon request and for a fee, the AC CDC 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 AC CDC 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
ChipmanNB_7482ob.xls	Rare or legally-protected Flora and Fauna in your study area
ChipmanNB_7482ob100km.xls	A list of Rare and legally protected Flora and Fauna within 100 km of your study area
ChipmanNB_7482msa.xls	Managed and Biologically Significant Areas in your study area

1.2 RESTRICTIONS

The AC CDC 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 AC CDC 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 AC CDC 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) AC CDC 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) AC CDC 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 AC CDC data response.

1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

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

Plants, Lichens, Ranking Methods, All other Inquiries	Sean Blaney	Senior Scientist / Executive Director	(506) 364-2658	sean.blaney@accdc.ca
Animals (Fauna)	John Klymko	Zoologist	(506) 364-2660	john.klymko@accdc.ca
Data Management, GIS	James Churchill	Conservation Data Analyst / Field Biologist		james.churchill@accdc.ca
Billing	Jean Breau	Financial Manager / Executive Assistant	(506) 364-2657	jean.breau@accdc.ca

Questions on the biology of Federal Species at Risk can be directed to AC CDC: (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.

New Brunswick. For information about rare taxa, protected areas, game animals, deer yards, old growth forests, archeological sites, fish habitat etc., or to determine if location-sensitive species (section 4.3) occur near your study site, please contact Hubert Askanas, Energy and Resource Development: (506) 453-5873.

Nova Scotia. For information about Species at Risk or general questions about Nova Scotia location-sensitive species please contact the Biodiversity Program at biodiversity@novascotia.ca. For questions about protected areas, game animals, deer yards, old growth forests, archeological sites, fish habitat etc., or to determine if location-sensitive species (section 4.3) occur near your study site please contact a Regional Biologist:

DIGB, ANNA, KING	Emma Vost	(902) 670-8187	Emma.Vost@novascotia.ca
SHEL, YARM	Sian Wilson	(902) 930-2978	Sian.Wilson@novascotia.ca
QUEE, LUNE	Peter Kydd	(902) 523-0969	Peter.Kydd@novascotia.ca
HALI, HANT	Shavonne Meyer	(902) 893-0816	Shavonne.Meyer@novascotia.ca
Central Region	Jolene Laverty	(902) 324-8953	Jolene.Laverty@novascotia.ca
COLC, CUMB	Kimberly George	(902) 890-1046	Kimberly.George@novascotia.ca
ANTI, GUYS	Harrison Moore	(902) 497-4119	Harrison.Moore@novascotia.ca
INVE, VICT	Maureen Cameron-MacMillan	(902) 295-2554	Maureen.Cameron-MacMillan@novascotia.ca
CAPE, RICH, PICT	Elizabeth Walsh	(902) 563-3370	Elizabeth.Walsh@novascotia.ca

Prince Edward Island. For information about rare taxa, protected areas, game animals, fish habitat etc., please contact Garry Gregory, PEI Department of Environment, Energy and Climate Action: (902) 569-7595.

2.0 RARE AND ENDANGERED SPECIES

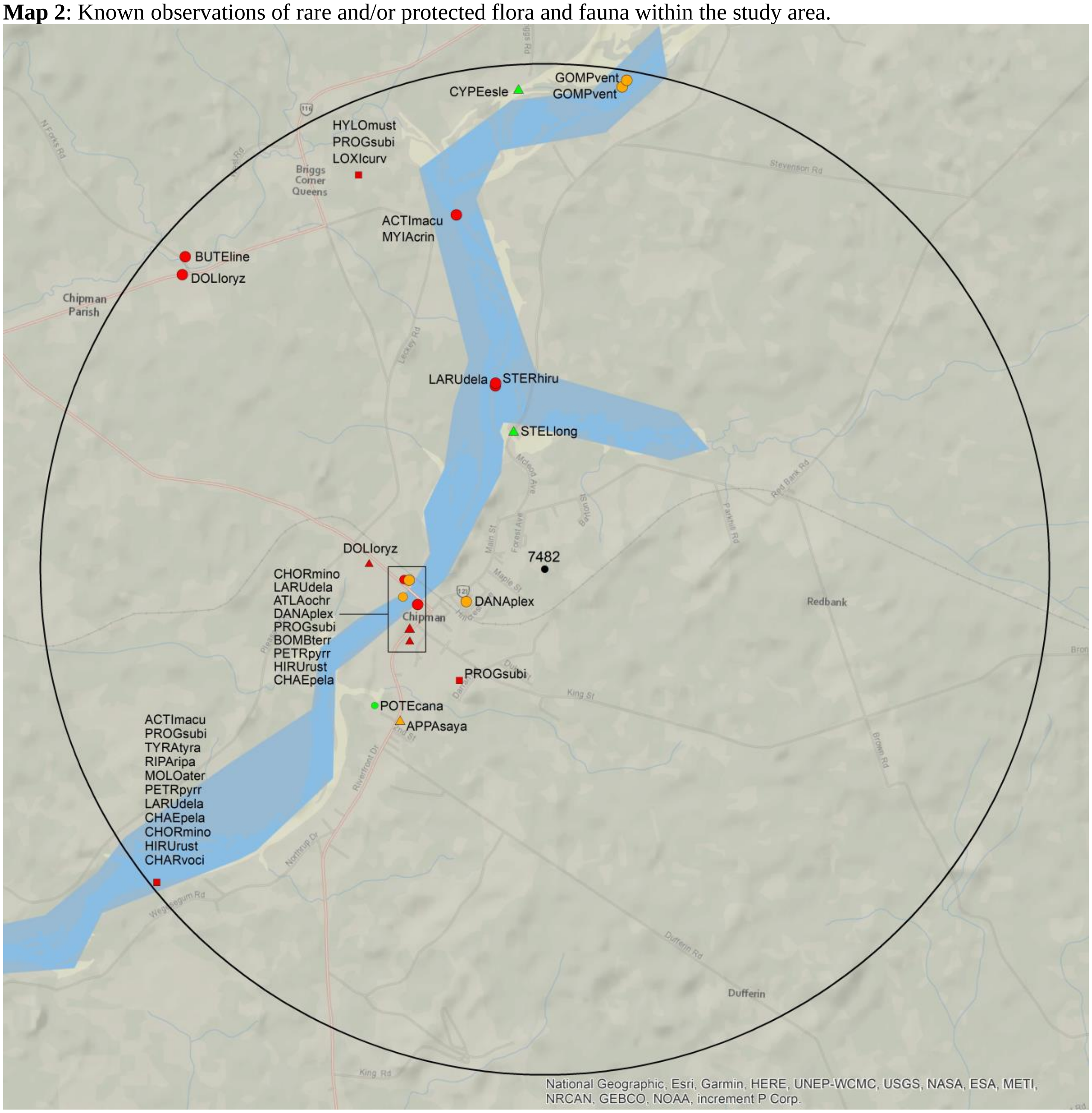
2.1 FLORA

The study area contains 3 records of 3 vascular and no records of nonvascular flora (Map 2 and attached: *ob.xls), excluding 'location-sensitive' species.

2.2 FAUNA

The study area contains 35 records of 17 vertebrate and 8 records of 5 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List), exlcuding 'location-sensitive species'. Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

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



RESOLUTION
- 4.7 within 50s of kilometers
- 4.0 within 10s of kilometers
- 3.7 within 5s of kilometers
- 3.0 within kilometers
- 2.7 within 500s of meters
- 2.0 within 100s of meters
- 1.7 within 10s of meters

HIGHER TAXON
- vertebrate fauna
- invertebrate fauna
- vascular flora
- nonvascular flora

3.0 SPECIAL AREAS

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

3.2 SIGNIFICANT AREAS
The GIS scan identified 2 biologically significant sites in the vicinity of the study area (Map 3 and attached file: *sa*.xls).

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

4.0 RARE SPECIES LISTS

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

4.1 FLORA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
P	*Potentilla canadensis*	Canada Cinquefoil				S1	1	2.2 ± 0.0
P	*Stellaria longifolia*	Long-leaved Starwort				S3	1	1.4 ± 1.0
P	*Cyperus esculentus var. leptostachyus*	Perennial Yellow Nutsedge				S3	1	4.8 ± 1.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened	Threatened	S1S2B	1	4.3 ± 7.0
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened		S2B	1	4.9 ± 7.0
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	4	1.5 ± 0.0
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Threatened	S2B	3	1.5 ± 0.0
A	*Dolichonyx oryzivorus*	Bobolink	Special Concern	Threatened	Threatened	S3B	2	1.7 ± 0.0
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S3B,S4M	3	1.4 ± 0.0
A	*Buteo lineatus*	Red-shouldered Hawk	Not At Risk			S1S2B	1	4.7 ± 0.0
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B,SUM	1	1.9 ± 0.0
A	*Progne subis*	Purple Martin				S1B	5	1.4 ± 7.0
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2B	3	1.5 ± 0.0
A	*Larus delawarensis*	Ring-billed Gull				S2S3B,S4N,S5M	3	1.3 ± 0.0
A	*Loxia curvirostra*	Red Crossbill				S3	1	4.3 ± 7.0
A	*Charadrius vociferus*	Killdeer				S3B	2	4.9 ± 7.0
A	*Myiarchus crinitus*	Great Crested Flycatcher				S3B	1	3.6 ± 0.0
A	*Molothrus ater*	Brown-headed Cowbird				S3B	1	4.9 ± 7.0
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B	1	4.9 ± 7.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S4M	2	3.6 ± 0.0
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Special Concern	S2S3?B	2	0.8 ± 0.0
I	*Gomphurus ventricosus*	Skillet Clubtail	Special Concern	Endangered	Endangered	S2	2	4.8 ± 0.0
I	*Bombus terricola*	Yellow-banded Bumble Bee	Special Concern	Special Concern		S4	1	1.4 ± 0.0
I	*Appalachina sayana sayana*	Spike-lip Crater Snail	Not At Risk			S3?	1	2.1 ± 1.0
I	*Atlanticoncha ochracea*	Tidewater Mucket				S3	2	1.4 ± 0.0

4.3 LOCATION SENSITIVE SPECIES

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

New Brunswick

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
Chrysemys picta picta	**Eastern Painted Turtle**	**Special Concern**		**YES**
Chelydra serpentina	Snapping Turtle	Special Concern	Special Concern	No
Glyptemys insculpta	**Wood Turtle**	**Threatened**	**Threatened**	**YES**
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 or bat species occurrence		[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 AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

# recs	CITATION
14	Erskine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
13	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
4	eBird. 2014. eBird Basic Dataset. Version: EBD_relNov-2014. Ithaca, New York. Nov 2014. Cornell Lab of Ornithology, 25036 recs.
4	Klymko, John. 2022. Atlantic Canada Conservation Data Centre zoological fieldwork 2021. Atlantic Canada Conservation Data Centre.
2	Benedict, B. Connell Herbarium Specimens (Data) . University New Brunswick, Fredericton. 2003.
2	Klymko, J.J.D. 2016. 2015 field data. Atlantic Canada Conservation Data Centre.
2	Sollows, M.C,. 2009. NBM Science Collections databases: molluscs. New Brunswick Museum, Saint John NB, download Jan. 2009, 6951 recs (2957 in Atlantic Canada).
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. https://doi.org/10.1037/arc0000014.
1	Blaney, C.S.; Mazerolle, D.M. 2012. Fieldwork 2012. Atlantic Canada Conservation Data Centre, 13,278 recs.
1	Bredin, K.A. 2001. WTF Project: Freshwater Mussel Fieldwork in Freshwater Species data. Atlantic Canada Conservation Data Centere, 101 recs.
1	Ducks Unlimited Canada (DUC). 2020. DUC owned properties in Atlantic Canada (v. DUC_Lands_Sept2020). DUC.
1	Erskine, A.J. 1999. Maritime Nest Records Scheme (MNRS) 1937-1999. Canadian Wildlife Service, Sackville, 313 recs.
1	iNaturalist. 2020. iNaturalist butterfly records selected for the Maritimes Butterfly Atlas. iNaturalist.
1	NatureServe Canada. 2019. iNaturalist Maritimes Butterfly Records. iNaturalist.org and iNaturalist.ca.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 45730 records of 153 vertebrate and 1818 records of 87 invertebrate fauna; 9022 records of 344 vascular and 1819 records of 211 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 (including “location-sensitive” species). 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	# recs	Distance (km)	Prov
A	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	S1	59	41.3 ± 1.0	NB
A	*Myotis septentrionalis*	Northern Myotis	Endangered	Endangered	Endangered	S1	22	30.0 ± 1.0	NB
A	*Perimyotis subflavus*	Tricolored Bat	Endangered	Endangered	Endangered	S1	17	53.6 ± 100.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Charadrius melodus melodus*	Piping Plover melodus subspecies	Endangered	Endangered	Endangered	S1B	77	60.4 ± 0.0	NB
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy population	Endangered	Endangered	Endangered	S2	1061	56.9 ± 50.0	NB
A	*Rallus elegans*	King Rail	Endangered	Endangered		SNA	6	86.2 ± 0.0	NB
A	*Melanerpes erythrocephalus*	Red-headed Woodpecker	Endangered	Threatened		SNA	2	89.9 ± 64.0	NB
A	*Empidonax virescens*	Acadian Flycatcher	Endangered	Endangered		SNA	3	68.0 ± 0.0	NB
A	*Protonotaria citrea*	Prothonotary Warbler	Endangered	Endangered		SNA	1	96.8 ± 0.0	NB
A	*Salmo salar pop. 7*	Atlantic Salmon - Outer Bay of Fundy population	Endangered		Endangered	SNR	418	12.3 ± 0.0	NB
A	*Rangifer tarandus pop. 2*	Caribou - Atlantic-Gasp├⌐sie population	Endangered	Endangered	Extirpated	SX	6	62.1 ± 1.0	NB
A	*Lanius ludovicianus*	Loggerhead Shrike	Endangered	Endangered		SXB	1	81.0 ± 0.0	NB
A	*Colinus virginianus*	Northern Bobwhite	Endangered	Endangered			4	59.8 ± 0.0	NB
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened	Threatened	S1B	61	49.0 ± 7.0	NB
A	*Asio flammeus*	Short-eared Owl	Threatened	Special Concern	Special Concern	S1S2B	17	59.2 ± 0.0	NB
A	*Ixobrychus exilis*	Least Bittern	Threatened	Threatened	Threatened	S1S2B	24	55.5 ± 7.0	NB
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened	Threatened	S1S2B	174	4.3 ± 7.0	NB
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Threatened	Threatened	Threatened	S2B	98	15.3 ± 0.0	NB
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Threatened	Threatened	S2B	10	68.2 ± 7.0	NB
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened		S2B	704	4.9 ± 7.0	NB
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2S3	2492	2.6 ± 0.0	NB
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	638	1.5 ± 0.0	NB
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened		Threatened	S3B,S3N	3	67.2 ± 1.0	NB
A	*Tringa flavipes*	Lesser Yellowlegs	Threatened			S3M	300	37.9 ± 0.0	NB
A	*Limosa haemastica*	Hudsonian Godwit	Threatened			S3M	3	92.8 ± 0.0	NB
A	*Anguilla rostrata*	American Eel	Threatened		Threatened	S4N	7023	6.5 ± 0.0	NB
A	*Coturnicops noveboracensis*	Yellow Rail	Special Concern	Special Concern	Special Concern	S1?B,SUM	3	43.0 ± 7.0	NB
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern population	Special Concern	Special Concern	Endangered	S1B,S1S2N,S2M	4	77.7 ± 0.0	NB
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Threatened	S2B	1291	1.5 ± 0.0	NB
A	*Salmo salar pop. 12*	Atlantic Salmon - Gaspe - Southern Gulf of St. Lawrence population	Special Concern		Special Concern	S2S3	1223	48.5 ± 1.0	NB
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Special Concern	S2S3B,S3M	228	17.6 ± 7.0	NB
A	*Bucephala islandica*	Barrow's Goldeneye	Special Concern	Special Concern	Special Concern	S2S3N,S3M	75	42.8 ± 0.0	NB
A	*Acipenser brevirostrum*	Shortnose Sturgeon	Special Concern	Special Concern	Special Concern	S3	11	43.6 ± 10.0	NB
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Special Concern	S3	40	10.5 ± 0.0	NB
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Special Concern	S3B	979	7.8 ± 0.0	NB
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S3B	760	5.7 ± 0.0	NB
A	*Dolichonyx oryzivorus*	Bobolink	Special Concern	Threatened	Threatened	S3B	1190	1.7 ± 0.0	NB
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern		S3B,S3S4N,SUM	346	7.9 ± 7.0	NB
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S3B,S4M	505	1.4 ± 0.0	NB
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern	Special Concern		S3M	8	67.6 ± 0.0	NB
A	*Podiceps auritus*	Horned Grebe	Special Concern	Special Concern	Special Concern	S3N	6	35.9 ± 219.0	NB
A	*Cardellina canadensis*	Canada Warbler	Special Concern	Threatened	Threatened	S3S4B	1121	5.2 ± 0.0	NB
A	*Phocoena phocoena*	Harbour Porpoise	Special Concern		Spec.Concern	S4	1	96.4 ± 0.0	NB
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern	Special Concern		S4	74	4.2 ± 1.0	NB
A	*Calidris subruficollis*	Buff-breasted Sandpiper	Special Concern	Special Concern		SNA	1	92.3 ± 0.0	NB
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S1?	4	90.2 ± 0.0	NB
A	*Fulica americana*	American Coot	Not At Risk			S1B	29	5.6 ± 0.0	NB
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Not At Risk	Special Concern	Endangered	S1B,S3M	150	45.7 ± 0.0	NB
A	*Bubo scandiacus*	Snowy Owl	Not At Risk			S1N,S2S3M	10	36.2 ± 1.0	NB
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1S2B	21	15.3 ± 0.0	NB
A	*Buteo lineatus*	Red-shouldered Hawk	Not At Risk			S1S2B	44	4.7 ± 0.0	NB
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S1S2B,SUM	7	80.7 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk			S2	7	80.8 ± 5.0	NB
A	*Chlidonias niger*	Black Tern	Not At Risk			S2B	346	25.1 ± 0.0	NB
A	*Podiceps grisegena*	Red-necked Grebe	Not At Risk			S2N,S3M	13	63.7 ± 0.0	NB
A	*Desmognathus fuscus pop. 2*	Northern Dusky Salamander - Quebec / New Brunswick population	Not At Risk			S3	59	65.1 ± 1.0	NB
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B,SUM	312	1.9 ± 0.0	NB
A	*Haliaeetus leucocephalus*	Bald Eagle	Not At Risk		Endangered	S4	1137	1.0 ± 0.0	NB
A	*Lynx canadensis*	Canada Lynx	Not At Risk		Endangered	S4	45	36.7 ± 10.0	NB
A	*Canis lupus*	Grey Wolf	Not At Risk		Extirpated	SX	2	58.8 ± 1.0	NB
A	*Puma concolor pop. 1*	Cougar - Eastern population	Data Deficient		Endangered	SU	134	27.0 ± 1.0	NB
A	*Calidris canutus rufa*	Red Knot rufa subspecies - Tierra del Fuego / Patagonia wintering population	E,SC	Endangered	Endangered	S2M	7	93.9 ± 0.0	NB
A	*Morone saxatilis*	Striped Bass	E,SC			S3S4B,S3S4N	8650	42.2 ± 0.0	NB
A	*Salmo salar*	Atlantic Salmon	E,T,SC			S2S3	1	49.5 ± 0.0	NB
A	*Thryothorus ludovicianus*	Carolina Wren				S1	16	61.7 ± 7.0	NB
A	*Salvelinus alpinus*	Arctic Char				S1	5	75.8 ± 1.0	NB
A	*Vireo flavifrons*	Yellow-throated Vireo				S1?B	11	47.0 ± 7.0	NB
A	*Tringa melanoleuca*	Greater Yellowlegs				S1?B,S4S5M	454	38.1 ± 0.0	NB
A	*Aythya americana*	Redhead				S1B	11	66.1 ± 7.0	NB
A	*Gallinula galeata*	Common Gallinule				S1B	21	50.0 ± 1.0	NB
A	*Grus canadensis*	Sandhill Crane				S1B	20	27.1 ± 7.0	NB
A	*Bartramia longicauda*	Upland Sandpiper				S1B	36	42.3 ± 0.0	NB
A	*Phalaropus tricolor*	Wilson's Phalarope				S1B	25	43.3 ± 0.0	NB
A	*Leucophaeus atricilla*	Laughing Gull				S1B	5	64.7 ± 1.0	NB
A	*Rissa tridactyla*	Black-legged Kittiwake				S1B	2	99.3 ± 0.0	NB
A	*Fratercula arctica*	Atlantic Puffin				S1B	2	93.6 ± 11.0	NB
A	*Progne subis*	Purple Martin				S1B	256	1.4 ± 7.0	NB
A	*Aythya marila*	Greater Scaup				S1B,S2N,S4M	28	44.2 ± 1.0	NB
A	*Oxyura jamaicensis*	Ruddy Duck				S1B,S2S3M	28	63.7 ± 0.0	NB
A	*Aythya affinis*	Lesser Scaup				S1B,S4M	104	43.3 ± 7.0	NB
A	*Eremophila alpestris*	Horned Lark				S1B,S4N,S5M	54	52.6 ± 7.0	NB
A	*Sterna paradisaea*	Arctic Tern				S1B,SUM	7	60.4 ± 0.0	NB
A	*Chroicocephalus ridibundus*	Black-headed Gull				S1N,S2M	9	64.7 ± 1.0	NB
A	*Branta bernicla*	Brant				S1N,S2S3M	11	49.2 ± 0.0	NB
A	*Calidris alba*	Sanderling				S1N,S3S4M	84	23.7 ± 0.0	NB
A	*Butorides virescens*	Green Heron				S1S2B	15	43.3 ± 7.0	NB
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1S2B	5	67.1 ± 0.0	NB
A	*Empidonax traillii*	Willow Flycatcher				S1S2B	111	10.7 ± 0.0	NB
A	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow				S1S2B	14	47.0 ± 7.0	NB
A	*Troglodytes aedon*	House Wren				S1S2B	25	47.0 ± 7.0	NB
A	*Calidris bairdii*	Baird's Sandpiper				S1S2M	6	74.8 ± 0.0	NB
A	*Melanitta americana*	American Scoter				S1S2N,S3M	63	58.0 ± 0.0	NB
A	*Microtus chrotorrhinus*	Rock Vole				S2?	5	93.8 ± 1.0	NB
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2B	587	1.5 ± 0.0	NB
A	*Cistothorus palustris*	Marsh Wren				S2B	213	43.3 ± 7.0	NB
A	*Mimus polyglottos*	Northern Mockingbird				S2B	126	43.0 ± 7.0	NB
A	*Pooecetes gramineus*	Vesper Sparrow				S2B	104	10.1 ± 0.0	NB
A	*Mareca strepera*	Gadwall				S2B,S3M	49	43.3 ± 7.0	NB
A	*Tringa solitaria*	Solitary Sandpiper				S2B,S4S5M	128	5.8 ± 0.0	NB
A	*Pinicola enucleator*	Pine Grosbeak				S2B,S4S5N,S4S5M	46	18.0 ± 7.0	NB
A	*Phalacrocorax carbo*	Great Cormorant				S2N	10	20.6 ± 0.0	NB
A	*Somateria spectabilis*	King Eider				S2N	1	98.6 ± 0.0	NB
A	*Larus hyperboreus*	Glaucous Gull				S2N	77	53.0 ± 0.0	NB

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A	*Melanitta deglandi*	White-winged Scoter				S2N,S4M	1	96.9 ± 0.0	NB
A	*Asio otus*	Long-eared Owl				S2S3	19	46.3 ± 0.0	NB
A	*Picoides dorsalis*	American Three-toed Woodpecker				S2S3	23	21.0 ± 1.0	NB
A	*Toxostoma rufum*	Brown Thrasher				S2S3B	73	13.4 ± 0.0	NB
A	*Icterus galbula*	Baltimore Oriole				S2S3B	285	18.0 ± 7.0	NB
A	*Somateria mollissima*	Common Eider				S2S3B,S2S3N,S4M	71	34.1 ± 0.0	NB
A	*Larus delawarensis*	Ring-billed Gull				S2S3B,S4N,S5M	297	1.3 ± 0.0	NB
A	*Pluvialis dominica*	American Golden-Plover				S2S3M	22	46.1 ± 221.0	NB
A	*Calcarius lapponicus*	Lapland Longspur				S2S3N,SUM	8	64.5 ± 0.0	NB
A	*Larus marinus*	Great Black-backed Gull				S3	155	18.9 ± 0.0	NB
A	*Picoides arcticus*	Black-backed Woodpecker				S3	104	14.5 ± 7.0	NB
A	*Loxia curvirostra*	Red Crossbill				S3	192	4.3 ± 7.0	NB
A	*Spinus pinus*	Pine Siskin				S3	392	10.7 ± 0.0	NB
A	*Prosopium cylindraceum*	Round Whitefish				S3	1	42.1 ± 0.0	NB
A	*Salvelinus namaycush*	Lake Trout				S3	1	91.3 ± 0.0	NB
A	*Sorex maritimensis*	Maritime Shrew				S3	20	67.3 ± 0.0	NB
A	*Spatula clypeata*	Northern Shoveler				S3B	275	25.1 ± 0.0	NB
A	*Charadrius vociferus*	Killdeer				S3B	733	4.9 ± 7.0	NB
A	*Tringa semipalmata*	Willet				S3B	123	12.3 ± 75.0	NB
A	*Cepphus grylle*	Black Guillemot				S3B	5	93.6 ± 11.0	NB
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	168	11.5 ± 0.0	NB
A	*Myiarchus crinitus*	Great Crested Flycatcher				S3B	375	3.6 ± 0.0	NB
A	*Piranga olivacea*	Scarlet Tanager				S3B	203	14.5 ± 7.0	NB
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S3B	964	5.9 ± 0.0	NB
A	*Passerina cyanea*	Indigo Bunting				S3B	102	12.2 ± 0.0	NB
A	*Molothrus ater*	Brown-headed Cowbird				S3B	341	4.9 ± 7.0	NB
A	*Setophaga tigrina*	Cape May Warbler				S3B,S4S5M	208	6.5 ± 0.0	NB
A	*Mergus serrator*	Red-breasted Merganser				S3B,S4S5N,S5M	99	20.6 ± 0.0	NB
A	*Anas acuta*	Northern Pintail				S3B,S5M	80	12.4 ± 7.0	NB
A	*Anser caerulescens*	Snow Goose				S3M	23	46.1 ± 221.0	NB
A	*Numenius phaeopus hudsonicus*	Whimbrel				S3M	9	38.1 ± 0.0	NB
A	*Arenaria interpres*	Ruddy Turnstone				S3M	52	34.1 ± 0.0	NB
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	245	34.0 ± 0.0	NB
A	*Calidris melanotos*	Pectoral Sandpiper				S3M	133	35.9 ± 219.0	NB
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	162	62.0 ± 0.0	NB
A	*Phalaropus fulicarius*	Red Phalarope				S3M	3	74.8 ± 0.0	NB
A	*Bucephala albeola*	Bufflehead				S3N	115	43.3 ± 2.0	NB
A	*Calidris maritima*	Purple Sandpiper				S3N	8	67.4 ± 0.0	NB
A	*Perisoreus canadensis*	Canada Jay				S3S4	516	5.1 ± 0.0	NB
A	*Poecile hudsonicus*	Boreal Chickadee				S3S4	331	14.7 ± 0.0	NB
A	*Eptesicus fuscus*	Big Brown Bat				S3S4	45	17.8 ± 0.0	NB
A	*Synaptomys cooperi*	Southern Bog Lemming				S3S4	106	46.6 ± 1.0	NB
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B	725	4.9 ± 7.0	NB
A	*Vireo gilvus*	Warbling Vireo				S3S4B	309	19.7 ± 0.0	NB
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S4M	970	3.6 ± 0.0	NB
A	*Melospiza lincolnii*	Lincoln's Sparrow				S3S4B,S4M	433	6.9 ± 7.0	NB
A	*Gallinago delicata*	Wilson's Snipe				S3S4B,S5M	1119	7.9 ± 7.0	NB
A	*Setophaga striata*	Blackpoll Warbler				S3S4B,S5M	53	26.3 ± 0.0	NB
A	*Pluvialis squatarola*	Black-bellied Plover				S3S4M	162	34.0 ± 0.0	NB
A	*Morus bassanus*	Northern Gannet				SHB	29	88.1 ± 7.0	NB
C	*Quercus macrocarpa - Acer rubrum / Onoclea sensibilis - Carex arcta Forest*	Bur Oak - Red Maple / Sensitive Fern - Northern Clustered Sedge Forest				S2	1	41.6 ± 0.0	NB

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C	*Acer saccharinum / Onoclea sensibilis - Lysimachia terrestris Forest*	Silver Maple / Sensitive Fern - Swamp Yellow Loosestrife Forest				S3	1	79.1 ± 0.0	NB
C	*Acer saccharum - Fraxinus americana / Polystichum acrostichoides Forest*	Sugar Maple - White Ash / Christmas Fern Forest				S3S4	1	80.6 ± 0.0	NB
I	*Bombus bohemicus*	Ashton Cuckoo Bumble Bee	Endangered	Endangered		S1	11	42.8 ± 5.0	NB
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Special Concern	S2S3?B	248	0.8 ± 0.0	NB
I	*Bombus affinis*	Rusty-patched Bumble Bee	Endangered	Endangered		SH	1	64.8 ± 5.0	NB
I	*Gomphurus ventricosus*	Skillet Clubtail	Special Concern	Endangered	Endangered	S2	99	4.8 ± 0.0	NB
I	*Cicindela marginipennis*	Cobblestone Tiger Beetle	Special Concern	Endangered	Endangered	S2S3	201	19.8 ± 0.0	NB
I	*Ophiogomphus howei*	Pygmy Snaketail	Special Concern	Special Concern	Special Concern	S2S3	29	5.9 ± 0.0	NB
I	*Alasmidonta varicosa*	Brook Floater	Special Concern	Special Concern	Special Concern	S3	44	46.7 ± 0.0	NB
I	*Lampsilis cariosa*	Yellow Lampmussel	Special Concern	Special Concern	Special Concern	S3	104	5.7 ± 0.0	NB
I	*Bombus terricola*	Yellow-banded Bumble Bee	Special Concern	Special Concern		S4	194	1.4 ± 0.0	NB
I	*Coccinella transversoguttata richardsoni*	Transverse Lady Beetle	Special Concern			SH	39	32.7 ± 2.0	NB
I	*Appalachina sayana sayana*	Spike-lip Crater Snail	Not At Risk			S3?	3	2.1 ± 1.0	NB
I	*Conotrachelus juglandis*	Butternut Curculio				S1	3	64.8 ± 0.0	NB
I	*Haematopota rara*	Shy Cleg				S1	1	69.0 ± 1.0	NB
I	*Corythucha juglandis*	a lace bug				S1	1	48.6 ± 0.0	NB
I	*Erora laeta*	Early Hairstreak				S1	8	65.2 ± 0.0	NB
I	*Catocala neogama*	The Bride Underwing				S1	1	73.0 ± 1.0	NB
I	*Somatochlora septentrionalis*	Muskeg Emerald				S1	1	98.8 ± 0.0	NB
I	*Leucorrhinia patricia*	Canada Whiteface				S1	10	98.4 ± 1.0	NB
I	*Polites origenes*	Crossline Skipper				S1?	8	55.3 ± 0.0	NB
I	*Icaricia saepiolus*	Greenish Blue				S1S2	4	60.7 ± 2.0	NB
I	*Pachydiplax longipennis*	Blue Dasher				S1S2	1	48.2 ± 0.0	NB
I	*Cicindela ancocisconensis*	Appalachian Tiger Beetle				S2	2	16.0 ± 0.0	NB
I	*Encyclops caeruleus*	Cerulean Long-horned Beetle				S2	1	66.9 ± 0.0	NB
I	*Scaphinotus viduus*	Bereft Snail-eating Beetle				S2	2	44.3 ± 13.0	NB
I	*Brachyleptura circumdata*	Dark-shouldered Long-horned Beetle				S2	6	44.7 ± 0.0	NB
I	*Satyrium calanus*	Banded Hairstreak				S2	25	47.0 ± 7.0	NB
I	*Satyrium calanus falacer*	Falacer Hairstreak				S2	1	63.0 ± 1.0	NB
I	*Strymon melinus*	Gray Hairstreak				S2	4	54.1 ± 0.0	NB
I	*Somatochlora brevicincta*	Quebec Emerald				S2	9	69.0 ± 0.0	NB
I	*Ophiogomphus colubrinus*	Boreal Snaketail				S2S3	37	46.1 ± 0.0	NB
I	*Sphaeroderus nitidicollis*	Polished Snail-eating Beetle				S3	1	44.7 ± 0.0	NB
I	*Orthosoma brunneum*	Moist Long-horned Beetle				S3	1	38.2 ± 5.0	NB
I	*Psyrassa unicolor*	Unicoloured Long-horned Beetle				S3	1	98.8 ± 0.0	NB
I	*Elaphrus americanus*	Boreal Elaphrus Beetle				S3	1	53.4 ± 0.0	NB
I	*Semanotus terminatus*	Light Long-horned Beetle				S3	1	73.4 ± 0.0	NB
I	*Desmocerus palliatus*	Elderberry Borer				S3	3	44.2 ± 0.0	NB
I	*Agonum crenistriatum*	Scalloped Harp Ground Beetle				S3	1	84.9 ± 1.0	NB
I	*Agonum consimile*	Consimile Ground Beetle				S3	1	84.9 ± 1.0	NB
I	*Agonum excavatum*	Excavated Harp Ground Beetle				S3	1	53.4 ± 0.0	NB
I	*Clivina americana*	America Pedunculate Ground Beetle				S3	1	53.4 ± 0.0	NB
I	*Olisthopus parmatus*	Tawny-bordered Harp Ground Beetle				S3	1	44.7 ± 0.0	NB
I	*Tachys scitulus*	Handsome Riverbank Ground Beetle				S3	1	53.4 ± 0.0	NB
I	*Amara pallipes*	Pale-footed Sun Beetle				S3	1	84.9 ± 1.0	NB

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I	*Carabus maeander*	Meander Ground Beetle				S3	1	84.9 ± 1.0	NB
I	*Carabus serratus*	Serrated Ground Beetle				S3	2	20.6 ± 0.0	NB
I	*Hippodamia parenthesis*	Parenthesis Lady Beetle				S3	14	20.5 ± 0.0	NB
I	*Stenocorus vittiger*	Shrub Long-horned Beetle				S3	1	53.4 ± 0.0	NB
I	*Badister neopulchellus*	Red-black Spotted Beetle				S3	1	53.4 ± 0.0	NB
I	*Calathus gregarius*	Gregarious Harp Ground Beetle				S3	1	89.4 ± 1.0	NB
I	*Gonotropis dorsalis*	Birch Fungus Weevil				S3	1	73.4 ± 0.0	NB
I	*Beckerus appressus*	Compressed Click Beetle				S3	1	83.9 ± 0.0	NB
I	*Saperda lateralis*	Red-edged Long-horned Beetle				S3	2	98.2 ± 0.0	NB
I	*Trachysida aspera*	Rough Flower Longhorn Beetle				S3	1	99.8 ± 0.0	NB
I	*Enoclerus muttkowskii*	Muttkowski's Checkered Beetle				S3	2	73.7 ± 0.0	NB
I	*Epargyreus clarus*	Silver-spotted Skipper				S3	10	20.5 ± 0.0	NB
I	*Hesperia sassacus*	Indian Skipper				S3	22	48.3 ± 1.0	NB
I	*Euphyes bimacula*	Two-spotted Skipper				S3	29	28.0 ± 0.0	NB
I	*Papilio brevicauda bretonensis*	Short-tailed Swallowtail				S3	3	98.1 ± 0.0	NB
I	*Tharsalea dospassosi*	Maritime Copper				S3	9	95.9 ± 0.0	NB
I	*Satyrium acadica*	Acadian Hairstreak				S3	24	40.5 ± 0.0	NB
I	*Callophrys eryphon*	Western Pine Elfin				S3	5	65.8 ± 7.0	NB
I	*Plebejus idas empetri*	Crowberry Blue				S3	3	91.7 ± 20.0	NB
I	*Argynnis aphrodite*	Aphrodite Fritillary				S3	26	40.5 ± 1.0	NB
I	*Boloria eunomia*	Bog Fritillary				S3	4	53.3 ± 0.0	NB
I	*Boloria bellona*	Meadow Fritillary				S3	71	35.5 ± 0.0	NB
I	*Boloria chariclea*	Arctic Fritillary				S3	2	46.8 ± 2.0	NB
I	*Nymphalis l-album*	Compton Tortoiseshell				S3	27	24.8 ± 0.0	NB
I	*Gomphurus vastus*	Cobra Clubtail				S3	124	21.7 ± 0.0	NB
I	*Celithemis martha*	Martha's Pennant				S3	1	89.2 ± 0.0	NB
I	*Ladona exusta*	White Corporal				S3	1	95.5 ± 0.0	NB
I	*Enallagma pictum*	Scarlet Bluet				S3	3	81.2 ± 0.0	NB
I	*Ischnura kellicotti*	Lilypad Forktail				S3	7	88.5 ± 0.0	NB
I	*Arigomphus furcifer*	Lilypad Clubtail				S3	22	17.2 ± 0.0	NB
I	*Alasmidonta undulata*	Triangle Floater				S3	51	26.4 ± 0.0	NB
I	*Atlanticoncha ochracea*	Tidewater Mucket				S3	162	1.4 ± 0.0	NB
I	*Striatura ferrea*	Black Striate Snail				S3	1	67.8 ± 1.0	NB
I	*Neohelix albolabris*	Whitelip Snail				S3	2	50.1 ± 0.0	NB
I	*Spurwinkia salsa*	Saltmarsh Hydrobe				S3	25	79.1 ± 0.0	NB
I	*Pantala hymenaea*	Spot-Winged Glider				S3B	5	73.4 ± 0.0	NB
I	*Collops vittatus*	Banded Soft-winged Flower Beetle				S3S4	1	71.9 ± 3.0	NB
I	*Hemicrepidius memnonius*	Memnon's Click Beetle				S3S4	3	98.8 ± 0.0	NB
I	*Bolitophagus corticola*	Corticolous Darkling Beetle				S3S4	1	98.8 ± 0.0	NB
I	*Bombus griseocollis*	Brown-belted Bumble Bee				S3S4	6	65.4 ± 0.0	NB
I	*Lanthus vernalis*	Southern Pygmy Clubtail				S3S4	1	46.0 ± 0.0	NB
I	*Somatochlora forcipata*	Forcipate Emerald				S3S4	16	45.8 ± 0.0	NB
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3S4	10	37.7 ± 0.0	NB
I	*Sphaerophoria pyrrhina*	Violaceous Globetail				SH	1	82.3 ± 5.0	NB
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered	Endangered	Endangered	SH	1	95.9 ± 1.0	NB
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened	Threatened		S1?	1	93.7 ± 5.0	NB
N	*Anzia colpodes*	Black-foam Lichen	Threatened	Threatened		S1S2	10	64.5 ± 0.0	NB
N	*Fuscopannaria leucosticta*	White-rimmed Shingle Lichen	Threatened			S2	107	38.9 ± 0.0	NB
N	*Peltigera hydrothyria*	Eastern Waterfan	Threatened	Threatened		S2S3	725	75.1 ± 0.0	NB
N	*Pectenia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Special Concern	S1	4	97.5 ± 0.0	NB
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	8	83.9 ± 0.0	NB

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N	*Arrhenopterum heterostichum*	One-sided Groove Moss				S1	1	99.1 ± 0.0	NB
N	*Imbribryum muehlenbeckii*	Muehlenbeck's Bryum Moss				S1	1	97.0 ± 1.0	NB
N	*Dicranoweisia crispula*	Mountain Thatch Moss				S1	1	93.7 ± 0.0	NB
N	*Didymodon rigidulus var. gracilis*	a moss				S1	1	96.6 ± 1.0	NB
N	*Sphagnum macrophyllum*	Sphagnum				S1	5	56.9 ± 0.0	NB
N	*Zygodon viridissimus var. viridissimus*	a Moss				S1	1	98.2 ± 0.0	NB
N	*Syntrichia ruralis*	a Moss				S1	1	60.6 ± 0.0	NB
N	*Sticta fuliginosa*	Peppered Moon Lichen				S1	1	88.6 ± 0.0	NB
N	*Cladonia straminea*	Reptilian Pixie-cup Lichen				S1	5	88.2 ± 1.0	NB
N	*Coccocarpia palmicola*	Salted Shell Lichen				S1	1	90.1 ± 1.0	NB
N	*Peltigera malacea*	Veinless Pelt Lichen				S1	1	90.0 ± 1.0	NB
N	*Bryoria bicolor*	Electrified Horsehair Lichen				S1	1	90.0 ± 1.0	NB
N	*Hygrobiella laxifolia*	Lax Notchwort				S1?	1	88.3 ± 1.0	NB
N	*Bartramia ithyphylla*	Straight-leaved Apple Moss				S1?	2	88.3 ± 0.0	NB
N	*Dichelyma falcatum*	a Moss				S1?	2	64.5 ± 10.0	NB
N	*Dicranum bonjeanii*	Bonjean's Broom Moss				S1?	1	65.9 ± 1.0	NB
N	*Dicranum condensatum*	Condensed Broom Moss				S1?	1	93.5 ± 0.0	NB
N	*Entodon brevisetus*	a Moss				S1?	1	28.4 ± 10.0	NB
N	*Oxyrrhynchium hians*	Light Beaked Moss				S1?	2	65.2 ± 1.0	NB
N	*Homomallium adnatum*	Adnate Hairy-gray Moss				S1?	4	28.4 ± 10.0	NB
N	*Plagiothecium latebricola*	Alder Silk Moss				S1?	1	95.8 ± 1.0	NB
N	*Rhytidium rugosum*	Wrinkle-leaved Moss				S1?	2	69.6 ± 0.0	NB
N	*Splachnum pensylvanicum*	Southern Dung Moss				S1?	1	39.7 ± 1.0	NB
N	*Heterodermia squamulosa*	Scaly Fringe Lichen				S1?	1	95.5 ± 0.0	NB
N	*Pertusaria propinqua*	a Lichen				S1?	2	90.0 ± 1.0	NB
N	*Rhizocarpon umbilicatum*	a Lichen				S1?	2	86.0 ± 1.0	NB
N	*Peltigera venosa*	Fan Pelt Lichen				S1?	2	81.3 ± 0.0	NB
N	*Cephaloziella spinigera*	Spiny Threadwort				S1S2	2	30.9 ± 0.0	NB
N	*Odontoschisma francisci*	Holt's Notchwort				S1S2	4	88.2 ± 1.0	NB
N	*Harpanthus flotovianus*	Great Mountain Flapwort				S1S2	2	81.2 ± 1.0	NB
N	*Pallavicinia lyellii*	Lyell's Ribbonwort				S1S2	3	28.4 ± 1.0	NB
N	*Radula tenax*	Tenacious Scalewort				S1S2	1	96.3 ± 0.0	NB
N	*Reboulia hemisphaerica*	Purple-margined Liverwort				S1S2	1	96.5 ± 0.0	NB
N	*Solenostoma obovatum*	Egg Flapwort				S1S2	2	87.4 ± 0.0	NB
N	*Brachythecium acuminatum*	Acuminate Ragged Moss				S1S2	5	39.8 ± 100.0	NB
N	*Ptychostomum salinum*	Saltmarsh Bryum				S1S2	1	95.8 ± 1.0	NB
N	*Pseudocampylium radicale*	Long-stalked Fine Wet Moss				S1S2	1	65.2 ± 1.0	NB
N	*Tortula obtusifolia*	a Moss				S1S2	1	95.2 ± 0.0	NB
N	*Distichium inclinatum*	Inclined Iris Moss				S1S2	5	96.6 ± 1.0	NB
N	*Ditrichum pallidum*	Pale Cow-hair Moss				S1S2	2	47.2 ± 1.0	NB
N	*Sphagnum platyphyllum*	Flat-leaved Peat Moss				S1S2	1	97.6 ± 1.0	NB
N	*Timmia norvegica*	a moss				S1S2	3	66.6 ± 0.0	NB
N	*Timmia norvegica var. excurrens*	a moss				S1S2	1	96.6 ± 0.0	NB
N	*Tortella humilis*	Small Crisp Moss				S1S2	7	81.2 ± 1.0	NB
N	*Pseudotaxiphyllum distichaceum*	a Moss				S1S2	1	66.7 ± 1.0	NB
N	*Hamatocaulis vernicosus*	a Moss				S1S2	1	94.2 ± 100.0	NB
N	*Umbilicaria vellea*	Grizzled Rocktripe Lichen				S1S2	1	96.2 ± 1.0	NB
N	*Pilophorus cereolus*	Powdered Matchstick Lichen				S1S2	1	93.9 ± 5.0	NB
N	*Peltigera scabrosa*	Greater Toad Pelt Lichen				S1S2	4	86.0 ± 1.0	NB
N	*Calypogeia neesiana*	Nees' Pouchwort				S1S3	1	81.2 ± 1.0	NB
N	*Fuscocephaloziopsis connivens*	Forcipated Pincerwort				S1S3	1	89.5 ± 0.0	NB
N	*Porella pinnata*	Pinnate Scalewort				S1S3	1	73.8 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
N	*Tritomaria scitula*	Mountain Notchwort				S1S3	1	94.8 ± 1.0	NB
N	*Amphidium mougeotii*	a Moss				S2	11	87.5 ± 1.0	NB
N	*Anomodon viticulosus*	a Moss				S2	5	47.0 ± 10.0	NB
N	*Cirriphyllum piliferum*	Hair-pointed Moss				S2	4	28.4 ± 1.0	NB
N	*Dicranella palustris*	Drooping-Leaved Fork Moss				S2	9	39.8 ± 100.0	NB
N	*Didymodon ferrugineus*	Rusty Beard Moss				S2	2	83.1 ± 1.0	NB
N	*Ditrichum flexicaule*	Flexible Cow-hair Moss				S2	1	87.5 ± 1.0	NB
N	*Anomodon tristis*	a Moss				S2	3	89.4 ± 10.0	NB
N	*Hygrohypnum bestii*	Best's Brook Moss				S2	5	62.7 ± 0.0	NB
N	*Isothecium myosuroides*	Slender Mouse-tail Moss				S2	1	87.5 ± 1.0	NB
N	*Meesia triquetra*	Three-ranked Cold Moss				S2	1	39.8 ± 100.0	NB
N	*Physcomitrium immersum*	a Moss				S2	7	65.2 ± 1.0	NB
N	*Platydictya jungermannioides*	False Willow Moss				S2	4	52.2 ± 15.0	NB
N	*Pohlia elongata*	Long-necked Nodding Moss				S2	11	83.6 ± 0.0	NB
N	*Seligeria calcarea*	Chalk Brittle Moss				S2	3	86.7 ± 0.0	NB
N	*Seligeria recurvata*	a Moss				S2	3	49.3 ± 1.0	NB
N	*Seligeria brevifolia*	a Moss				S2	4	98.0 ± 0.0	NB
N	*Sphagnum lindbergii*	Lindberg's Peat Moss				S2	1	96.2 ± 5.0	NB
N	*Sphagnum flexuosum*	Flexuous Peatmoss				S2	4	47.6 ± 0.0	NB
N	*Tayloria serrata*	Serrate Trumpet Moss				S2	8	39.3 ± 1.0	NB
N	*Tetrodontium brownianum*	Little Georgia				S2	10	89.4 ± 10.0	NB
N	*Thamnobryum alleghaniense*	a Moss				S2	23	65.6 ± 1.0	NB
N	*Ulota phyllantha*	a Moss				S2	4	96.3 ± 0.0	NB
N	*Anomobryum julaceum*	Slender Silver Moss				S2	5	65.2 ± 1.0	NB
N	*Cladonia macrophylla*	Fig-leaved Lichen				S2	3	91.8 ± 1.0	NB
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S2	3	36.8 ± 0.0	NB
N	*Leptogium milligranum*	Stretched Jellyskin Lichen				S2	1	67.1 ± 0.0	NB
N	*Nephroma laevigatum*	Mustard Kidney Lichen				S2	2	34.9 ± 0.0	NB
N	*Peltigera lepidophora*	Scaly Pelt Lichen				S2	4	69.1 ± 0.0	NB
N	*Anacamptodon splachnoides*	a Moss				S2?	1	86.6 ± 1.0	NB
N	*Andreaea rothii*	Dusky Rock Moss				S2?	5	88.3 ± 0.0	NB
N	*Anomodon minor*	Blunt-leaved Anomodon Moss				S2?	1	46.2 ± 1.0	NB
N	*Ptychostomum pallescens*	Tall Clustered Bryum				S2?	2	74.8 ± 100.0	NB
N	*Dichelyma capillaceum*	Hairlike Dichelyma Moss				S2?	1	28.3 ± 3.0	NB
N	*Hygrohypnum montanum*	a Moss				S2?	2	87.5 ± 1.0	NB
N	*Schistostega pennata*	Luminous Moss				S2?	5	39.0 ± 10.0	NB
N	*Seligeria diversifolia*	a Moss				S2?	2	38.8 ± 0.0	NB
N	*Sphagnum angermanicum*	a Peatmoss				S2?	1	26.7 ± 10.0	NB
N	*Trichodon cylindricus*	Cylindric Hairy-teeth Moss				S2?	2	49.3 ± 10.0	NB
N	*Plagiomnium rostratum*	Long-beaked Leafy Moss				S2?	5	67.0 ± 0.0	NB
N	*Ramalina labiosorediata*	Chalky Ramalina Lichen				S2?	1	96.7 ± 1.0	NB
N	*Collema leptaleum*	Crumpled Bat's Wing Lichen				S2?	9	66.9 ± 0.0	NB
N	*Imshaugia placorodia*	Eyed Starburst Lichen				S2?	7	56.4 ± 0.0	NB
N	*Nephroma arcticum*	Arctic Kidney Lichen				S2?	1	88.6 ± 1.0	NB
N	*Ptychostomum cernuum*	Swamp Bryum				S2S3	2	96.3 ± 0.0	NB
N	*Calliergonella cuspidata*	Common Large Wetland Moss				S2S3	3	40.6 ± 5.0	NB
N	*Drepanocladus polygamus*	Polygamous Hook Moss				S2S3	1	84.9 ± 0.0	NB
N	*Palustriella falcata*	Curled Hook Moss				S2S3	3	87.5 ± 0.0	NB
N	*Didymodon rigidulus*	Rigid Screw Moss				S2S3	9	93.9 ± 2.0	NB
N	*Ephemerum serratum*	a Moss				S2S3	3	60.5 ± 0.0	NB
N	*Isopterygiopsis pulchella*	Neat Silk Moss				S2S3	7	90.0 ± 1.0	NB
N	*Neckera complanata*	a Moss				S2S3	1	87.5 ± 1.0	NB
N	*Orthotrichum elegans*	Showy Bristle Moss				S2S3	2	74.3 ± 0.0	NB
N	*Pohlia proligera*	Cottony Nodding Moss				S2S3	9	52.2 ± 15.0	NB
N	*Codriophorus fascicularis*	Clustered Rock Moss				S2S3	3	87.7 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
N	*Bucklandiella affinis*	Lesser Rock Moss				S2S3	11	87.2 ± 1.0	NB
N	*Saelania glaucescens*	Blue Dew Moss				S2S3	2	93.7 ± 0.0	NB
N	*Scorpidium scorpioides*	Hooked Scorpion Moss				S2S3	3	92.9 ± 0.0	NB
N	*Seligeria campylopoda*	a Moss				S2S3	1	94.2 ± 100.0	NB
N	*Sphagnum centrale*	Central Peat Moss				S2S3	6	83.6 ± 0.0	NB
N	*Sphagnum subfulvum*	a Peatmoss				S2S3	2	98.4 ± 0.0	NB
N	*Taxiphyllum deplanatum*	Imbricate Yew-leaved Moss				S2S3	2	95.9 ± 1.0	NB
N	*Zygodon viridissimus*	a Moss				S2S3	2	95.9 ± 1.0	NB
N	*Schistidium agassizii*	Elf Bloom Moss				S2S3	3	83.4 ± 1.0	NB
N	*Loeskeobryum brevirostre*	a Moss				S2S3	11	69.3 ± 2.0	NB
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2S3	7	64.6 ± 0.0	NB
N	*Sphaerophorus globosus*	Northern Coral Lichen				S2S3	7	89.8 ± 0.0	NB
N	*Cetrariella delisei*	Snowbed Icelandmoss Lichen				S2S3	2	38.8 ± 0.0	NB
N	*Cladonia acuminata*	Scantily Clad Pixie Lichen				S2S3	2	95.9 ± 1.0	NB
N	*Cladonia ramulosa*	Bran Lichen				S2S3	4	92.2 ± 1.0	NB
N	*Cladonia sulphurina*	Greater Sulphur-cup Lichen				S2S3	6	83.8 ± 0.0	NB
N	*Parmeliopsis ambigua*	Green Starburst Lichen				S2S3	1	94.2 ± 1.0	NB
N	*Polychidium muscicola*	Eyed Mossthorns Woollybear Lichen				S2S3	9	75.5 ± 0.0	NB
N	*Hypnum curvifolium*	Curved-leaved Plait Moss				S3	6	87.7 ± 0.0	NB
N	*Tortella fragilis*	Fragile Twisted Moss				S3	2	58.1 ± 0.0	NB
N	*Schistidium maritimum*	a Moss				S3	5	96.3 ± 0.0	NB
N	*Hymenostylium recurvirostrum*	Curve-beak Beardless Moss				S3	4	96.7 ± 1.0	NB
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	6	55.6 ± 0.0	NB
N	*Solorina saccata*	Woodland Owl Lichen				S3	9	69.5 ± 0.0	NB
N	*Ahtiana aurescens*	Eastern Candlewax Lichen				S3	2	95.8 ± 0.0	NB
N	*Normandina pulchella*	Rimmed Elf-ear Lichen				S3	3	92.2 ± 1.0	NB
N	*Cladonia farinacea*	Farinose Pixie Lichen				S3	5	93.1 ± 1.0	NB
N	*Cladonia strepsilis*	Olive Cladonia Lichen				S3	1	71.8 ± 0.0	NB
N	*Hypotrachyna catawbiensis*	Powder-tipped Antler Lichen				S3	1	94.8 ± 0.0	NB
N	*Scytinium lichenoides*	Tattered Jellyskin Lichen				S3	16	69.1 ± 0.0	NB
N	*Nephroma bellum*	Naked Kidney Lichen				S3	3	84.1 ± 1.0	NB
N	*Peltigera degenii*	Lustrous Pelt Lichen				S3	13	74.5 ± 0.0	NB
N	*Leptogium laceroides*	Short-bearded Jellyskin Lichen				S3	7	49.0 ± 0.0	NB
N	*Peltigera membranacea*	Membranous Pelt Lichen				S3	48	64.6 ± 0.0	NB
N	*Cladonia botrytes*	Wooden Soldiers Lichen				S3	11	38.3 ± 0.0	NB
N	*Cladonia carneola*	Crowned Pixie-cup Lichen				S3	2	93.1 ± 1.0	NB
N	*Cladonia deformis*	Lesser Sulphur-cup Lichen				S3	8	81.0 ± 0.0	NB
N	*Aulacomnium androgynum*	Little Groove Moss				S3?	8	52.2 ± 15.0	NB
N	*Ptychostomum inclinatum*	Blunt-tooth Thread Moss				S3?	2	96.5 ± 0.0	NB
N	*Dicranella rufescens*	Red Forklet Moss				S3?	2	65.2 ± 4.0	NB
N	*Rhytidiadelphus loreus*	Lanky Moss				S3?	2	94.1 ± 0.0	NB
N	*Sphagnum lescurii*	a Peatmoss				S3?	5	83.3 ± 0.0	NB
N	*Sphagnum inundatum*	a Sphagnum				S3?	2	43.1 ± 0.0	NB
N	*Rostania occultata*	Crusted Tarpaper Lichen				S3?	1	80.4 ± 0.0	NB
N	*Scytinium subtile*	Appressed Jellyskin Lichen				S3?	10	58.0 ± 0.0	NB
N	*Peltigera neckeri*	Black-saddle Pelt Lichen				S3?	3	79.0 ± 0.0	NB
N	*Stereocaulon subcoralloides*	Coralloid Foam Lichen				S3?	1	96.7 ± 1.0	NB
N	*Barbula convoluta*	Lesser Bird's-claw Beard Moss				S3S4	2	40.9 ± 15.0	NB
N	*Brachytheciastrum velutinum*	Velvet Ragged Moss				S3S4	1	83.4 ± 1.0	NB
N	*Dicranella cerviculata*	a Moss				S3S4	2	85.1 ± 2.0	NB
N	*Dicranum majus*	Greater Broom Moss				S3S4	18	86.8 ± 0.0	NB
N	*Dicranum leioneuron*	a Dicranum Moss				S3S4	1	88.1 ± 0.0	NB

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N	*Encalypta ciliata*	Fringed Extinguisher Moss				S3S4	1	96.5 ± 0.0	NB
N	*Fissidens bryoides*	Lesser Pocket Moss				S3S4	4	75.2 ± 5.0	NB
N	*Elodium blandowii*	Blandow's Bog Moss				S3S4	1	95.3 ± 0.0	NB
N	*Heterocladium dimorphum*	Dimorphous Tangle Moss				S3S4	6	74.3 ± 0.0	NB
N	*Isopterygiopsis muelleriana*	a Moss				S3S4	15	86.8 ± 0.0	NB
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	3	87.5 ± 1.0	NB
N	*Orthotrichum speciosum*	Showy Bristle Moss				S3S4	5	76.0 ± 0.0	NB
N	*Physcomitrium pyriforme*	Pear-shaped Urn Moss				S3S4	6	55.6 ± 0.0	NB
N	*Pogonatum dentatum*	Mountain Hair Moss				S3S4	1	96.3 ± 0.0	NB
N	*Sphagnum torreyanum*	a Peatmoss				S3S4	1	89.3 ± 0.0	NB
N	*Sphagnum contortum*	Twisted Peat Moss				S3S4	1	92.6 ± 0.0	NB
N	*Sphagnum quinquefarium*	Five-ranked Peat Moss				S3S4	3	74.3 ± 0.0	NB
N	*Tetraphis geniculata*	Geniculate Four-tooth Moss				S3S4	8	40.9 ± 15.0	NB
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S3S4	1	99.3 ± 0.0	NB
N	*Weissia controversa*	Green-Cushioned Weissia				S3S4	3	78.7 ± 0.0	NB
N	*Abietinella abietina*	Wiry Fern Moss				S3S4	1	96.6 ± 0.0	NB
N	*Trichostomum tenuirostre*	Acid-Soil Moss				S3S4	3	87.7 ± 0.0	NB
N	*Rauiella scita*	Smaller Fern Moss				S3S4	1	94.0 ± 0.0	NB
N	*Pannaria rubiginosa*	Brown-eyed Shingle Lichen				S3S4	6	48.3 ± 0.0	NB
N	*Pseudocyphellaria holarctica*	Yellow Specklebelly Lichen				S3S4	91	14.5 ± 0.0	NB
N	*Ramalina thrausta*	Angelhair Ramalina Lichen				S3S4	11	86.0 ± 1.0	NB
N	*Hypogymnia vittata*	Slender Monk's Hood Lichen				S3S4	22	86.3 ± 1.0	NB
N	*Scytinium teretiusculum*	Curly Jellyskin Lichen				S3S4	3	66.7 ± 0.0	NB
N	*Montanelia panniformis*	Shingled Camouflage Lichen				S3S4	5	89.1 ± 1.0	NB
N	*Cladonia floerkeana*	Gritty British Soldiers Lichen				S3S4	5	71.8 ± 0.0	NB
N	*Cladonia parasitica*	Fence-rail Lichen				S3S4	1	48.5 ± 0.0	NB
N	*Xylopsora friesii*	a Lichen				S3S4	1	96.2 ± 1.0	NB
N	*Nephroma parile*	Powdery Kidney Lichen				S3S4	28	51.1 ± 0.0	NB
N	*Nephroma resupinatum*	a lichen				S3S4	1	86.3 ± 0.0	NB
N	*Protopannaria pezizoides*	Brown-gray Moss-shingle Lichen				S3S4	31	62.6 ± 0.0	NB
N	*Parmelia fertilis*	Fertile Shield Lichen				S3S4	1	77.0 ± 0.0	NB
N	*Usnea strigosa*	Bushy Beard Lichen				S3S4	9	82.7 ± 0.0	NB
N	*Fuscopannaria sorediata*	a Lichen				S3S4	1	82.1 ± 1.0	NB
N	*Stereocaulon condensatum*	Granular Soil Foam Lichen				S3S4	9	87.5 ± 0.0	NB
N	*Pannaria conoplea*	Mealy-rimmed Shingle Lichen				S3S4	10	36.8 ± 0.0	NB
N	*Physcia tenella*	Fringed Rosette Lichen				S3S4	2	81.4 ± 0.0	NB
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	10	69.8 ± 0.0	NB
N	*Peltigera neopolydactyla*	Undulating Pelt Lichen				S3S4	10	74.9 ± 0.0	NB
N	*Cladonia cariosa*	Lesser Ribbed Pixie Lichen				S3S4	3	96.3 ± 1.0	NB
N	*Hypocenomyce scalaris*	Common Clam Lichen				S3S4	1	96.7 ± 1.0	NB
N	*Leucodon brachypus*	a Moss				SH	10	72.2 ± 10.0	NB
N	*Orthotrichum gymnostomum*	a Moss				SH	1	72.3 ± 10.0	NB
N	*Splachnum luteum*	Yellow Collar Moss				SH	1	74.8 ± 100.0	NB
N	*Thelia hirtella*	a Moss				SH	1	39.8 ± 100.0	NB
N	*Cyrto-hypnum minutulum*	Tiny Cedar Moss				SH	3	25.3 ± 10.0	NB
P	*Juglans cinerea*	Butternut	Endangered	Endangered	Endangered	S1	258	30.5 ± 0.0	NB
P	*Symphyotrichum laurentianum*	Gulf of St Lawrence Aster	Threatened	Threatened	Endangered	S1	3	98.2 ± 0.0	NB
P	*Fraxinus nigra*	Black Ash	Threatened			S3S4	442	13.4 ± 0.0	NB
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Endangered	S1	23	72.7 ± 0.0	NB
P	*Lechea maritima var. subcylindrica*	Beach Pinweed	Special Concern	Special Concern	Special Concern	S2	35	98.7 ± 0.0	NB
P	*Symphyotrichum anticostense*	Anticosti Aster	Special Concern	Special Concern	Endangered	S3	4	80.1 ± 0.0	NB
P	*Symphyotrichum subulatum*	Bathurst Aster - Bathurst	Not At Risk		Endangered	S2	20	87.6 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
	(Bathurst pop)	pop.							
P	*Eriocaulon parkeri*	Parker's Pipewort	Not At Risk		Endangered	S3	156	81.5 ± 0.0	NB
P	*Pterospora andromedea*	Woodland Pinedrops			Endangered	S1	19	72.3 ± 0.0	NB
P	*Cryptotaenia canadensis*	Canada Honewort				S1	2	45.2 ± 1.0	NB
P	*Antennaria parlinii ssp. fallax*	Parlin's Pussytoes				S1	5	47.7 ± 1.0	NB
P	*Antennaria howellii ssp. petaloidea*	Pussy-Toes				S1	1	97.7 ± 1.0	NB
P	*Bidens discoidea*	Swamp Beggarticks				S1	5	6.5 ± 0.0	NB
P	*Bidens eatonii*	Eaton's Beggarticks				S1	9	82.2 ± 1.0	NB
P	*Pseudognaphalium obtusifolium*	Eastern Cudweed				S1	5	17.5 ± 0.0	NB
P	*Helianthus decapetalus*	Ten-rayed Sunflower				S1	14	75.7 ± 0.0	NB
P	*Hieracium paniculatum*	Panicled Hawkweed				S1	4	57.6 ± 0.0	NB
P	*Solidago multiradiata*	Multi-rayed Goldenrod				S1	19	97.1 ± 0.0	NB
P	*Barbarea orthoceras*	American Yellow Rocket				S1	1	51.9 ± 1.0	NB
P	*Cardamine parviflora*	Small-flowered Bittercress				S1	3	72.1 ± 0.0	NB
P	*Cardamine concatenata*	Cut-leaved Toothwort				S1	2	67.9 ± 0.0	NB
P	*Draba arabisans*	Rock Whitlow-Grass				S1	12	70.7 ± 1.0	NB
P	*Draba cana*	Lance-leaved Draba				S1	10	66.4 ± 0.0	NB
P	*Draba glabella*	Rock Whitlow-Grass				S1	10	87.5 ± 1.0	NB
P	*Chenopodiastrum simplex*	Maple-leaved Goosefoot				S1	13	60.8 ± 5.0	NB
P	*Blitum capitatum*	Strawberry-Blite				S1	3	33.8 ± 1.0	NB
P	*Suaeda rolandii*	Roland's Sea-Blite				S1	11	96.3 ± 0.0	NB
P	*Hypericum virginicum*	Virginia St. John's-wort				S1	2	89.2 ± 0.0	NB
P	*Hylodesmum glutinosum*	Large Tick-trefoil				S1	1	67.1 ± 0.0	NB
P	*Lespedeza capitata*	Round-headed Bush-clover				S1	11	29.7 ± 0.0	NB
P	*Pycnanthemum virginianum*	Virginia Mountain Mint				S1	4	66.0 ± 0.0	NB
P	*Polygonum douglasii*	Douglas Knotweed				S1	1	62.8 ± 0.0	NB
P	*Lysimachia quadrifolia*	Whorled Yellow Loosestrife				S1	14	59.1 ± 0.0	NB
P	*Primula laurentiana*	Laurentian Primrose				S1	14	89.7 ± 3.0	NB
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S1	1	88.4 ± 1.0	NB
P	*Crataegus jonesiae*	Jones' Hawthorn				S1	4	17.9 ± 1.0	NB
P	*Dryas integrifolia*	Entire-leaved Mountain Avens				S1	15	97.8 ± 0.0	NB
P	*Potentilla canadensis*	Canada Cinquefoil				S1	1	2.2 ± 0.0	NB
P	*Rubus flagellaris*	Northern Dewberry				S1	3	65.3 ± 0.0	NB
P	*Salix myrtillifolia*	Blueberry Willow				S1	25	98.8 ± 0.0	NB
P	*Saxifraga paniculata ssp. laestadii*	Laestadius' Saxifrage				S1	38	68.4 ± 0.0	NB
P	*Agalinis tenuifolia*	Slender Agalinis				S1	9	59.7 ± 0.0	NB
P	*Pedicularis canadensis*	Canada Lousewort				S1	2	72.3 ± 0.0	NB
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S1	9	66.7 ± 0.0	NB
P	*Carex atlantica ssp. atlantica*	Atlantic Sedge				S1	1	88.9 ± 0.0	NB
P	*Carex backii*	Rocky Mountain Sedge				S1	9	61.6 ± 0.0	NB
P	*Carex merritt-fernaldii*	Merritt Fernald's Sedge				S1	1	78.3 ± 0.0	NB
P	*Carex scirpoidea*	Scirpuslike Sedge				S1	6	68.5 ± 0.0	NB
P	*Carex sterilis*	Sterile Sedge				S1	2	45.7 ± 2.0	NB
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	13	56.5 ± 5.0	NB
P	*Carex saxatilis*	Russet Sedge				S1	12	80.4 ± 10.0	NB
P	*Cyperus diandrus*	Low Flatsedge				S1	12	63.2 ± 1.0	NB
P	*Eleocharis flavescens var. olivacea*	Bright-green Spikerush				S1	8	82.7 ± 0.0	NB
P	*Rhynchospora capillacea*	Slender Beakrush				S1	3	79.4 ± 0.0	NB
P	*Scirpus pendulus*	Hanging Bulrush				S1	6	35.8 ± 0.0	NB
P	*Sisyrinchium angustifolium*	Narrow-leaved Blue-eyed-grass				S1	2	82.1 ± 0.0	NB
P	*Juncus greenei*	Greene's Rush				S1	2	71.0 ± 10.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	*Juncus stygius ssp. americanus*	Moor Rush				S1	4	58.2 ± 0.0	NB
P	*Juncus subtilis*	Creeping Rush				S1	4	57.8 ± 5.0	NB
P	*Allium canadense*	Canada Garlic				S1	12	65.8 ± 0.0	NB
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S1	15	39.3 ± 0.0	NB
P	*Malaxis monophyllos var. brachypoda*	North American White Adder's-mouth				S1	9	48.2 ± 0.0	NB
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S1	10	48.2 ± 0.0	NB
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S1	12	52.0 ± 0.0	NB
P	*Spiranthes casei*	Case's Ladies'-Tresses				S1	6	72.4 ± 0.0	NB
P	*Bromus pubescens*	Hairy Wood Brome Grass				S1	8	41.4 ± 0.0	NB
P	*Calamagrostis stricta ssp. inexpansa*	Slim-stemmed Reed Grass				S1	1	47.2 ± 0.0	NB
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1	37	45.9 ± 0.0	NB
P	*Danthonia compressa*	Flattened Oat Grass				S1	5	62.8 ± 1.0	NB
P	*Dichanthelium xanthophysum*	Slender Panic Grass				S1	6	63.6 ± 0.0	NB
P	*Dichanthelium dichotomum*	Forked Panic Grass				S1	1	75.7 ± 1.0	NB
P	*Sporobolus compositus*	Rough Dropseed				S1	17	76.6 ± 0.0	NB
P	*Zizania aquatica var. brevis*	St. Lawrence Wild Rice				S1	23	82.6 ± 0.0	NB
P	*Potamogeton friesii*	Fries' Pondweed				S1	6	65.0 ± 5.0	NB
P	*Potamogeton nodosus*	Long-leaved Pondweed				S1	13	37.0 ± 8.0	NB
P	*Potamogeton strictifolius*	Straight-leaved Pondweed				S1	2	70.1 ± 2.0	NB
P	*Xyris difformis*	Bog Yellow-eyed-grass				S1	3	89.3 ± 0.0	NB
P	*Asplenium ruta-muraria var. cryptolepis*	Wallrue Spleenwort				S1	4	87.5 ± 1.0	NB
P	*Cystopteris laurentiana*	Laurentian Bladder Fern				S1	1	69.9 ± 1.0	NB
P	*Dryopteris clintoniana*	Clinton's Wood Fern				S1	1	85.2 ± 0.0	NB
P	*Dryopteris filix-mas ssp. brittonii*	Britton's Male Fern				S1	2	85.0 ± 1.0	NB
P	*Huperzia selago*	Northern Firmoss				S1	1	89.6 ± 1.0	NB
P	*Sceptridium oneidense*	Blunt-lobed Moonwort				S1	4	49.2 ± 5.0	NB
P	*Selaginella rupestris*	Rock Spikemoss				S1	16	62.7 ± 0.0	NB
P	*Cuscuta campestris*	Field Dodder				S1?	6	32.6 ± 5.0	NB
P	*Polygonum aviculare ssp. neglectum*	Narrow-leaved Knotweed				S1?	5	61.6 ± 0.0	NB
P	*Alisma subcordatum*	Southern Water Plantain				S1?	3	60.8 ± 0.0	NB
P	*Wolffia columbiana*	Columbian Watermeal				S1?	7	38.2 ± 0.0	NB
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S1S2	2	79.3 ± 0.0	NB
P	*Potamogeton bicupulatus*	Snailseed Pondweed				S1S2	2	95.6 ± 0.0	NB
P	*Eriophorum russeolum ssp. albidum*	Smooth-fruited Russet Cottongrass				S1S3	13	14.6 ± 0.0	NB
P	*Spiranthes cernua*	Nodding Ladies'-Tresses				S1S3	11	37.0 ± 0.0	NB
P	*Spiranthes arcisepala*	Appalachian Ladies'-tresses				S1S3	7	58.5 ± 0.0	NB
P	*Spiranthes incurva*	Sphinx Ladies'-tresses				S1S3	1	74.7 ± 0.0	NB
P	*Neottia bifolia*	Southern Twayblade			Endangered	S2	43	19.0 ± 0.0	NB
P	*Sanicula trifoliata*	Large-Fruited Sanicle				S2	1	71.0 ± 5.0	NB
P	*Sanicula odorata*	Clustered Sanicle				S2	1	81.2 ± 0.0	NB
P	*Hieracium robinsonii*	Robinson's Hawkweed				S2	15	82.8 ± 0.0	NB
P	*Betula minor*	Dwarf White Birch				S2	1	77.8 ± 0.0	NB
P	*Atriplex glabriuscula var. franktonii*	Frankton's Saltbush				S2	2	96.5 ± 1.0	NB
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2	2	25.3 ± 1.0	NB
P	*Viburnum dentatum*	Southern Arrow-Wood				S2	1	93.7 ± 0.0	NB
P	*Astragalus eucosmus*	Elegant Milk-vetch				S2	11	73.4 ± 0.0	NB
P	*Quercus macrocarpa*	Bur Oak				S2	174	20.4 ± 1.0	NB
P	*Nuphar x rubrodisca*	Red-disk Yellow Pond-lily				S2	15	27.3 ± 0.0	NB

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P	*Polygaloides paucifolia*	Fringed Milkwort				S2	17	27.8 ± 0.0	NB
P	*Persicaria amphibia var. emersa*	Long-root Smartweed				S2	51	16.3 ± 0.0	NB
P	*Anemone parviflora*	Small-flowered Anemone				S2	8	98.8 ± 0.0	NB
P	*Micranthes virginiensis*	Early Saxifrage				S2	14	72.4 ± 0.0	NB
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S2	6	57.4 ± 5.0	NB
P	*Viola canadensis*	Canada Violet				S2	1	79.5 ± 0.0	NB
P	*Carex cephaloidea*	Thin-leaved Sedge				S2	2	94.6 ± 0.0	NB
P	*Carex albicans var. emmonsii*	White-tinged Sedge				S2	9	34.6 ± 0.0	NB
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S2	69	24.1 ± 0.0	NB
P	*Schoenoplectiella smithii var. leviseta*	Smith's Bulrush				S2	60	75.7 ± 0.0	NB
P	*Galearis rotundifolia*	Small Round-leaved Orchid				S2	3	29.5 ± 0.0	NB
P	*Calypso bulbosa var. americana*	Calypso				S2	19	39.7 ± 0.0	NB
P	*Coeloglossum viride*	Long-bracted Frog Orchid				S2	11	73.9 ± 5.0	NB
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	8	56.5 ± 0.0	NB
P	*Platanthera huronensis*	Fragrant Green Orchid				S2	4	60.8 ± 0.0	NB
P	*Puccinellia nutkaensis*	Alaska Alkaligrass				S2	1	96.9 ± 10.0	NB
P	*Botrychium minganense*	Mingan Moonwort				S2	1	72.4 ± 0.0	NB
P	*Schizaea pusilla*	Little Curlygrass Fern				S2	5	88.4 ± 0.0	NB
P	*Coryphopteris simulata*	Bog Fern				S2	35	15.3 ± 0.0	NB
P	*Toxicodendron radicans var. radicans*	Eastern Poison Ivy				S2?	17	27.5 ± 1.0	NB
P	*Symphyotrichum novi-belgii var. crenifolium*	New York Aster				S2?	4	68.1 ± 1.0	NB
P	*Humulus lupulus var. lupuloides*	Common Hop				S2?	7	45.0 ± 1.0	NB
P	*Crataegus macrosperma*	Big-Fruit Hawthorn				S2?	2	90.4 ± 0.0	NB
P	*Rubus x recurvicaulis*	arching dewberry				S2?	6	33.8 ± 10.0	NB
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2S3	6	32.8 ± 0.0	NB
P	*Symphyotrichum racemosum*	Small White Aster				S2S3	11	16.7 ± 0.0	NB
P	*Alnus serrulata*	Smooth Alder				S2S3	12	35.7 ± 0.0	NB
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2S3	11	72.4 ± 0.0	NB
P	*Gentiana linearis*	Narrow-Leaved Gentian				S2S3	26	62.2 ± 0.0	NB
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	7	62.7 ± 0.0	NB
P	*Aphyllon uniflorum*	One-flowered Broomrape				S2S3	11	53.3 ± 1.0	NB
P	*Polygala senega*	Seneca Snakeroot				S2S3	2	94.0 ± 1.0	NB
P	*Persicaria careyi*	Carey's Smartweed				S2S3	13	8.3 ± 0.0	NB
P	*Hepatica americana*	Round-lobed Hepatica				S2S3	43	52.3 ± 1.0	NB
P	*Ranunculus sceleratus*	Cursed Buttercup				S2S3	3	62.5 ± 0.0	NB
P	*Rosa acicularis ssp. sayi*	Prickly Rose				S2S3	35	63.8 ± 0.0	NB
P	*Cephalanthus occidentalis*	Common Buttonbush				S2S3	22	34.7 ± 0.0	NB
P	*Galium obtusum*	Blunt-leaved Bedstraw				S2S3	11	45.3 ± 0.0	NB
P	*Euphrasia randii*	Rand's Eyebright				S2S3	4	93.1 ± 0.0	NB
P	*Dirca palustris*	Eastern Leatherwood				S2S3	17	38.0 ± 1.0	NB
P	*Phryma leptostachya*	American Lopseed				S2S3	4	77.5 ± 1.0	NB
P	*Verbena urticifolia*	White Vervain				S2S3	17	72.3 ± 2.0	NB
P	*Viola novae-angliae*	New England Violet				S2S3	7	53.7 ± 1.0	NB
P	*Carex rostrata*	Narrow-leaved Beaked Sedge				S2S3	4	72.3 ± 0.0	NB
P	*Carex vacillans*	Estuarine Sedge				S2S3	3	92.7 ± 1.0	NB
P	*Cyperus bipartitus*	Shining Flatsedge				S2S3	20	82.4 ± 0.0	NB
P	*Allium tricoccum*	Wild Leek				S2S3	19	53.0 ± 1.0	NB

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P	*Corallorhiza maculata var. occidentalis*	Spotted Coralroot				S2S3	22	57.8 ± 0.0	NB
P	*Corallorhiza maculata var. maculata*	Spotted Coralroot				S2S3	7	52.4 ± 0.0	NB
P	*Elymus canadensis*	Canada Wild Rye				S2S3	18	58.4 ± 1.0	NB
P	*Piptatheropsis canadensis*	Canada Ricegrass				S2S3	5	46.9 ± 10.0	NB
P	*Poa glauca*	Glaucous Blue Grass				S2S3	9	88.1 ± 0.0	NB
P	*Piptatheropsis pungens*	Slender Ricegrass				S2S3	10	66.1 ± 0.0	NB
P	*Potamogeton vaseyi*	Vasey's Pondweed				S2S3	3	94.6 ± 0.0	NB
P	*Isoetes tuckermanii ssp. acadiensis*	Acadian Quillwort				S2S3	5	81.6 ± 0.0	NB
P	*Panax trifolius*	Dwarf Ginseng				S3	48	30.6 ± 0.0	NB
P	*Artemisia campestris ssp. caudata*	Tall Wormwood				S3	146	16.9 ± 0.0	NB
P	*Artemisia campestris*	Field Wormwood				S3	5	38.2 ± 0.0	NB
P	*Nabalus racemosus*	Glaucous Rattlesnakeroot				S3	69	16.3 ± 0.0	NB
P	*Solidago racemosa*	Racemose Goldenrod				S3	14	75.9 ± 0.0	NB
P	*Tanacetum bipinnatum ssp. huronense*	Lake Huron Tansy				S3	26	39.5 ± 0.0	NB
P	*Ionactis linariifolia*	Flax-leaved Aster				S3	90	45.5 ± 0.0	NB
P	*Pseudognaphalium macounii*	Macoun's Cudweed				S3	9	46.6 ± 5.0	NB
P	*Impatiens pallida*	Pale Jewelweed				S3	2	66.5 ± 0.0	NB
P	*Turritis glabra*	Tower Mustard				S3	9	52.8 ± 0.0	NB
P	*Arabis pycnocarpa*	Cream-flowered Rockcress				S3	23	66.5 ± 0.0	NB
P	*Cardamine maxima*	Large Toothwort				S3	33	21.2 ± 0.0	NB
P	*Boechera stricta*	Drummond's Rockcress				S3	19	57.2 ± 0.0	NB
P	*Stellaria humifusa*	Saltmarsh Starwort				S3	4	88.0 ± 0.0	NB
P	*Stellaria longifolia*	Long-leaved Starwort				S3	8	1.4 ± 1.0	NB
P	*Oxybasis rubra*	Red Goosefoot				S3	4	96.6 ± 1.0	NB
P	*Hudsonia tomentosa*	Woolly Beach-heath				S3	33	70.8 ± 50.0	NB
P	*Cornus obliqua*	Silky Dogwood				S3	97	12.6 ± 0.0	NB
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S3	15	59.9 ± 0.0	NB
P	*Viburnum lentago*	Nannyberry				S3	1	87.0 ± 0.0	NB
P	*Rhodiola rosea*	Roseroot				S3	47	68.4 ± 0.0	NB
P	*Shepherdia canadensis*	Soapberry				S3	42	96.7 ± 0.0	NB
P	*Astragalus alpinus*	Alpine Milk-vetch				S3	1	76.0 ± 0.0	NB
P	*Astragalus alpinus var. brunetianus*	Alpine Milk-Vetch				S3	3	76.1 ± 0.0	NB
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S3	11	20.9 ± 0.0	NB
P	*Bartonia paniculata*	Branched Bartonia				S3	1	89.4 ± 0.0	NB
P	*Bartonia paniculata ssp. iodandra*	Branched Bartonia				S3	22	85.0 ± 0.0	NB
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	26	8.2 ± 0.0	NB
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S3	13	38.3 ± 0.0	NB
P	*Myriophyllum humile*	Low Water Milfoil				S3	6	42.6 ± 1.0	NB
P	*Myriophyllum quitense*	Andean Water Milfoil				S3	71	70.1 ± 0.0	NB
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	4	19.2 ± 0.0	NB
P	*Utricularia resupinata*	Inverted Bladderwort				S3	7	80.4 ± 1.0	NB
P	*Fraxinus pennsylvanica*	Red Ash				S3	144	8.6 ± 0.0	NB
P	*Rumex pallidus*	Seabeach Dock				S3	3	43.2 ± 1.0	NB
P	*Rumex occidentalis*	Western Dock				S3	1	71.4 ± 1.0	NB
P	*Podostemum ceratophyllum*	Horn-leaved Riverweed				S3	17	69.1 ± 1.0	NB
P	*Primula mistassinica*	Mistassini Primrose				S3	17	52.6 ± 0.0	NB
P	*Pyrola minor*	Lesser Pyrola				S3	11	52.9 ± 0.0	NB
P	*Anemone multifida*	Cut-leaved Anemone				S3	1	81.1 ± 0.0	NB
P	*Clematis occidentalis*	Purple Clematis				S3	31	16.4 ± 2.0	NB

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P	*Ranunculus flabellaris*	Yellow Water Buttercup				S3	17	43.7 ± 0.0	NB
P	*Amelanchier canadensis*	Canada Serviceberry				S3	16	41.9 ± 0.0	NB
P	*Crataegus scabrida*	Rough Hawthorn				S3	10	26.9 ± 1.0	NB
P	*Rubus occidentalis*	Black Raspberry				S3	25	39.5 ± 0.0	NB
P	*Salix candida*	Sage Willow				S3	2	95.7 ± 1.0	NB
P	*Salix myricoides*	Bayberry Willow				S3	11	17.4 ± 0.0	NB
P	*Salix nigra*	Black Willow				S3	181	12.6 ± 0.0	NB
P	*Salix interior*	Sandbar Willow				S3	37	37.8 ± 0.0	NB
P	*Comandra umbellata*	Bastard's Toadflax				S3	2	31.1 ± 10.0	NB
P	*Agalinis purpurea var. parviflora*	Small-flowered Purple False Foxglove				S3	22	51.9 ± 0.0	NB
P	*Castilleja septentrionalis*	Northeastern Paintbrush				S3	6	76.0 ± 0.0	NB
P	*Viola adunca*	Hooked Violet				S3	20	39.6 ± 1.0	NB
P	*Sagittaria montevidensis ssp. spongiosa*	Spongy Arrowhead				S3	117	67.6 ± 0.0	NB
P	*Symplocarpus foetidus*	Eastern Skunk Cabbage				S3	33	77.7 ± 5.0	NB
P	*Carex adusta*	Lesser Brown Sedge				S3	14	14.4 ± 1.0	NB
P	*Carex arcta*	Northern Clustered Sedge				S3	54	8.7 ± 0.0	NB
P	*Carex conoidea*	Field Sedge				S3	18	34.8 ± 0.0	NB
P	*Carex garberi*	Garber's Sedge				S3	18	63.1 ± 0.0	NB
P	*Carex granularis*	Limestone Meadow Sedge				S3	8	56.4 ± 5.0	NB
P	*Carex gynocrates*	Northern Bog Sedge				S3	1	62.8 ± 1.0	NB
P	*Carex hirtifolia*	Pubescent Sedge				S3	21	59.9 ± 5.0	NB
P	*Carex livida*	Livid Sedge				S3	1	91.2 ± 0.0	NB
P	*Carex ormostachya*	Necklace Spike Sedge				S3	13	46.2 ± 1.0	NB
P	*Carex plantaginea*	Plantain-Leaved Sedge				S3	5	79.4 ± 0.0	NB
P	*Carex rosea*	Rosy Sedge				S3	30	44.6 ± 0.0	NB
P	*Carex sprengelii*	Longbeak Sedge				S3	4	56.9 ± 0.0	NB
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S3	1	59.3 ± 10.0	NB
P	*Cyperus esculentus*	Perennial Yellow Nutsedge				S3	1	38.3 ± 0.0	NB
P	*Cyperus esculentus var. leptostachyus*	Perennial Yellow Nutsedge				S3	84	4.8 ± 1.0	NB
P	*Cyperus squarrosus*	Awned Flatsedge				S3	46	23.6 ± 0.0	NB
P	*Eriophorum gracile*	Slender Cottongrass				S3	9	43.2 ± 0.0	NB
P	*Blysmopsis rufa*	Red Bulrush				S3	21	95.5 ± 0.0	NB
P	*Elodea nuttallii*	Nuttall's Waterweed				S3	7	41.8 ± 0.0	NB
P	*Juncus vaseyi*	Vasey Rush				S3	21	68.0 ± 0.0	NB
P	*Najas gracillima*	Thread-Like Naiad				S3	3	43.0 ± 0.0	NB
P	*Cypripedium reginae*	Showy Lady's-Slipper				S3	12	58.4 ± 0.0	NB
P	*Goodyera oblongifolia*	Menzies' Rattlesnake-plantain				S3	1	66.2 ± 0.0	NB
P	*Neottia auriculata*	Auricled Twayblade				S3	8	84.4 ± 0.0	NB
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	52	22.1 ± 0.0	NB
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	34	14.8 ± 0.0	NB
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S3	23	60.0 ± 1.0	NB
P	*Agrostis mertensii*	Northern Bent Grass				S3	2	83.8 ± 0.0	NB
P	*Bromus latiglumis*	Broad-Glumed Brome				S3	29	47.7 ± 0.0	NB
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S3	11	57.2 ± 0.0	NB
P	*Leersia virginica*	White Cut Grass				S3	42	39.1 ± 0.0	NB
P	*Muhlenbergia richardsonis*	Mat Muhly				S3	9	77.8 ± 0.0	NB
P	*Schizachyrium scoparium*	Little Bluestem				S3	55	12.8 ± 0.0	NB
P	*Zizania aquatica*	Southern Wild Rice				S3	1	34.9 ± 0.0	NB
P	*Zizania aquatica var. aquatica*	Eastern Wild Rice				S3	12	33.4 ± 1.0	NB
P	*Adiantum pedatum*	Northern Maidenhair Fern				S3	17	52.4 ± 1.0	NB
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S3	15	68.4 ± 0.0	NB
P	*Anchistea virginica*	Virginia chain fern				S3	27	45.6 ± 0.0	NB
P	*Dryopteris goldieana*	Goldie's Woodfern				S3	11	65.5 ± 0.0	NB

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P	*Woodsia alpina*	Alpine Cliff Fern				S3	13	69.1 ± 0.0	NB
P	*Woodsia glabella*	Smooth Cliff Fern				S3	67	84.3 ± 0.0	NB
P	*Isoetes tuckermanii ssp. tuckermanii*	Tuckerman's Quillwort				S3	11	17.5 ± 0.0	NB
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3	21	20.7 ± 0.0	NB
P	*Huperzia appressa*	Mountain Firmoss				S3	35	87.5 ± 0.0	NB
P	*Sceptridium dissectum*	Dissected Moonwort				S3	25	39.9 ± 1.0	NB
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S3	14	52.3 ± 0.0	NB
P	*Botrychium simplex*	Least Moonwort				S3	15	20.3 ± 0.0	NB
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S3	4	67.1 ± 5.0	NB
P	*Selaginella selaginoides*	Low Spikemoss				S3	8	86.5 ± 5.0	NB
P	*Crataegus submollis*	Quebec Hawthorn				S3?	11	41.9 ± 1.0	NB
P	*Crataegus succulenta*	Fleshy Hawthorn				S3?	1	65.2 ± 5.0	NB
P	*Platanthera hookeri*	Hooker's Orchid				S3?	54	33.8 ± 2.0	NB
P	*Arnica lanceolata*	Lance-leaved Arnica				S3S4	32	58.1 ± 0.0	NB
P	*Bidens hyperborea*	Estuary Beggarticks				S3S4	143	67.6 ± 0.0	NB
P	*Solidago altissima*	Tall Goldenrod				S3S4	7	58.3 ± 1.0	NB
P	*Symphyotrichum boreale*	Boreal Aster				S3S4	7	58.1 ± 0.0	NB
P	*Betula pumila*	Bog Birch				S3S4	84	39.7 ± 0.0	NB
P	*Mertensia maritima*	Sea Lungwort				S3S4	4	91.6 ± 0.0	NB
P	*Subularia aquatica ssp. americana*	American Water Awlwort				S3S4	2	80.6 ± 0.0	NB
P	*Lobelia cardinalis*	Cardinal Flower				S3S4	8	60.9 ± 0.0	NB
P	*Callitriche hermaphroditica*	Northern Water-starwort				S3S4	8	55.8 ± 0.0	NB
P	*Viburnum edule*	Squashberry				S3S4	21	39.9 ± 0.0	NB
P	*Crassula aquatica*	Water Pygmyweed				S3S4	78	34.6 ± 0.0	NB
P	*Penthorum sedoides*	Ditch Stonecrop				S3S4	91	33.6 ± 1.0	NB
P	*Elatine americana*	American Waterwort				S3S4	32	41.8 ± 0.0	NB
P	*Hedysarum americanum*	Alpine Hedysarum				S3S4	2	83.4 ± 0.0	NB
P	*Fagus grandifolia*	American Beech				S3S4	261	8.0 ± 0.0	NB
P	*Geranium robertianum*	Herb Robert				S3S4	31	62.2 ± 1.0	NB
P	*Stachys hispida*	Smooth Hedge-Nettle				S3S4	12	45.3 ± 0.0	NB
P	*Stachys pilosa*	Hairy Hedge-Nettle				S3S4	23	32.3 ± 1.0	NB
P	*Teucrium canadense*	Canada Germander				S3S4	6	92.1 ± 5.0	NB
P	*Utricularia gibba*	Humped Bladderwort				S3S4	9	41.8 ± 0.0	NB
P	*Fraxinus americana*	White Ash				S3S4	205	11.2 ± 0.0	NB
P	*Epilobium strictum*	Downy Willowherb				S3S4	14	26.3 ± 0.0	NB
P	*Fallopia scandens*	Climbing False Buckwheat				S3S4	90	29.8 ± 0.0	NB
P	*Rumex persicarioides*	Peach-leaved Dock				S3S4	2	82.1 ± 1.0	NB
P	*Littorella americana*	American Shoreweed				S3S4	8	35.2 ± 0.0	NB
P	*Samolus parviflorus*	Seaside Brookweed				S3S4	112	68.1 ± 0.0	NB
P	*Thalictrum confine*	Northern Meadow-rue				S3S4	88	7.1 ± 0.0	NB
P	*Drymocallis arguta*	Tall Wood Beauty				S3S4	30	43.7 ± 0.0	NB
P	*Rosa palustris*	Swamp Rose				S3S4	17	6.4 ± 0.0	NB
P	*Rubus pensilvanicus*	Pennsylvania Blackberry				S3S4	27	8.9 ± 0.0	NB
P	*Sanguisorba canadensis*	Canada Burnet				S3S4	17	92.2 ± 0.0	NB
P	*Galium boreale*	Northern Bedstraw				S3S4	6	73.5 ± 0.0	NB
P	*Galium labradoricum*	Labrador Bedstraw				S3S4	2	32.5 ± 0.0	NB
P	*Salix pedicellaris*	Bog Willow				S3S4	68	29.4 ± 0.0	NB
P	*Geocaulon lividum*	Northern Comandra				S3S4	20	46.2 ± 0.0	NB
P	*Parnassia glauca*	Fen Grass-of-Parnassus				S3S4	10	64.0 ± 0.0	NB
P	*Agalinis neoscotica*	Nova Scotia Agalinis				S3S4	1	67.1 ± 0.0	NB
P	*Limosella australis*	Southern Mudwort				S3S4	128	67.6 ± 0.0	NB
P	*Ulmus americana*	White Elm				S3S4	212	8.0 ± 0.0	NB
P	*Boehmeria cylindrica*	Small-spike False-nettle				S3S4	12	42.9 ± 0.0	NB
P	*Juniperus horizontalis*	Creeping Juniper				S3S4	2	87.7 ± 1.0	NB
P	*Carex capillaris*	Hairlike Sedge				S3S4	17	67.4 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	*Carex eburnea*	Bristle-leaved Sedge				S3S4	20	17.8 ± 3.0	NB
P	*Carex exilis*	Coastal Sedge				S3S4	20	89.0 ± 0.0	NB
P	*Carex haydenii*	Hayden's Sedge				S3S4	86	8.1 ± 0.0	NB
P	*Carex lupulina*	Hop Sedge				S3S4	94	6.8 ± 0.0	NB
P	*Carex tenera*	Tender Sedge				S3S4	58	29.5 ± 0.0	NB
P	*Carex wiegandii*	Wiegand's Sedge				S3S4	203	6.4 ± 0.0	NB
P	*Carex recta*	Estuary Sedge				S3S4	7	46.0 ± 0.0	NB
P	*Carex atratiformis*	Scabrous Black Sedge				S3S4	3	73.3 ± 0.0	NB
P	*Cladium mariscoides*	Smooth Twigrush				S3S4	16	38.3 ± 0.0	NB
P	*Cyperus dentatus*	Toothed Flatsedge				S3S4	208	12.5 ± 0.0	NB
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S3S4	9	75.9 ± 0.0	NB
P	*Rhynchospora capitellata*	Small-headed Beakrush				S3S4	90	12.7 ± 1.0	NB
P	*Trichophorum clintonii*	Clinton's Clubrush				S3S4	112	51.4 ± 0.0	NB
P	*Bolboschoenus fluviatilis*	River Bulrush				S3S4	59	38.2 ± 0.0	NB
P	*Triglochin gaspensis*	Gasp├⌐ Arrowgrass				S3S4	36	82.9 ± 0.0	NB
P	*Lilium canadense*	Canada Lily				S3S4	163	8.0 ± 0.0	NB
P	*Triantha glutinosa*	Sticky False-Asphodel				S3S4	62	47.5 ± 0.0	NB
P	*Corallorhiza maculata*	Spotted Coralroot				S3S4	35	49.3 ± 1.0	NB
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	9	48.6 ± 1.0	NB
P	*Neottia cordata*	Heart-leaved Twayblade				S3S4	16	38.0 ± 0.0	NB
P	*Platanthera obtusata*	Blunt-leaved Orchid				S3S4	17	32.0 ± 1.0	NB
P	*Calamagrostis pickeringii*	Pickering's Reed Grass				S3S4	52	36.7 ± 0.0	NB
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S3S4	13	6.4 ± 0.0	NB
P	*Eragrostis pectinacea*	Tufted Love Grass				S3S4	17	47.1 ± 0.0	NB
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S3S4	4	91.8 ± 0.0	NB
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3S4	9	73.1 ± 0.0	NB
P	*Potamogeton richardsonii*	Richardson's Pondweed				S3S4	35	18.7 ± 0.0	NB
P	*Xyris montana*	Northern Yellow-Eyed-Grass				S3S4	183	14.6 ± 0.0	NB
P	*Cryptogramma stelleri*	Steller's Rockbrake				S3S4	9	69.5 ± 0.0	NB
P	*Asplenium viride*	Green Spleenwort				S3S4	19	77.0 ± 0.0	NB
P	*Dryopteris fragrans*	Fragrant Wood Fern				S3S4	91	11.1 ± 1.0	NB
P	*Equisetum palustre*	Marsh Horsetail				S3S4	11	43.0 ± 0.0	NB
P	*Polypodium appalachianum*	Appalachian Polypody				S3S4	37	58.5 ± 0.0	NB
P	*Celastrus scandens*	Climbing Bittersweet				SX	2	83.4 ± 1.0	NB
P	*Agalinis maritima*	Saltmarsh Agalinis				SX	2	95.7 ± 50.0	NB

5.1 SOURCE BIBLIOGRAPHY (100 km)

The recipient of these data shall acknowledge the AC CDC 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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12	Kouchibouguac National Park, Natural Resource Conservation Sec. 1988. The Resources of Kouchibouguac National Park. Beach, H. (ed.) , 90 recs.
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10	Tremblay, E. 2001. Kouchibouguacis River Freshwater Mussel Data. Parks Canada, Kouchibouguac NP, 45 recs.
10	Wisniowski, C. 2018. Optimizing wood turtle conservation in New Brunswick through collaboration, strategic planning, and landowner outreach. Nature Trust of New Brunswick, 10 records.
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9	Blaxley, Megan; Vinson, Neil. 2020. Peltigera hydrothyria records from a tributary of Lake Brook, Fundy National Park. Chapman-Lam, Colin J. (ed.) Fundy National Park, 9.
9	Bredin, K.A. 2001. WTF Project: Freshwater Mussel Fieldwork in Freshwater Species data. Atlantic Canada Conservation Data Centere, 101 recs.
9	Donell, R. 2008. Rare plant records from rare coastal plant project. Bouctouche Dune Irving Eco-centre. Pers. comm. to D.M. Mazerolle, 50 recs.
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8	Edsall, J. 2001. Lepidopteran records in New Brunswick, 1997-99. , Pers. comm. to K.A. Bredin. 91 recs.
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6	Chiasson, R. 2018. Breeding bird observations from NBWTF project. pers. comm. to S. Blaney.
6	Elward, D. 2017. 2015-2016 Freshwater Mussel Inventories in the Bouctouche Watershed. Southeastern Anglers Association, 6 recs.
6	Robinson, S.L. 2010. Fieldwork 2009 (dune ecology). Atlantic Canada Conservation Data Centre. Sackville NB, 408 recs.
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4	Canadian Wildlife Service, Dartmouth. 2010. Piping Plover censuses 2007-09, 304 recs.

# recs	CITATION
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4	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.
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4	Gravel, Mireille. 2010. Coordonnées des tortues des bois Salmon River Road, 2005. Kouchibouguac National Park, 4 recs.
4	Kennedy, Joseph. 2010. New Brunswick Peregrine records, 2010. New Brunswick Dept Natural Resources, 16 recs (11 active).
4	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.
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4	Moldowan, Patrick Chrysemys picta records from COSEWIC status report. pers. comm. 2021.
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3	Forbes, G. 2001. Bog Lemming, Phalarope records, NB. , Pers. comm. to K.A. Bredin. 6 recs.
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3	Layberry, R.A. 2012. Lepidopteran records for the Maritimes, 1974-2008. Layberry Collection, 1060 recs.
3	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.
3	Manthorne, A. 2019. Incidental aerial insectivore observations. Birds Canada.
3	Nash, Vicky. 2018. Hammond River Angling Association Wood Turtle observations. Hammond River Angling Association, 3 recs.
3	Nelson Poirier. 2009. Rare plant finds in the Exmoor & Lyttleton areas. Pers. comm. to S. Blaney. 4 recs, 4 recs.
3	Newell, R.E. 2008. Vascular Plants of Muzroll Lake. Pers. comm. to C.S. Blaney, 1 pg. 43 recs.
3	Simpson, D. Collection sites for Black Ash seed lots preserved at the National Tree Seed Centre in Fredericton NB. National Tree Seed Centre, Canadian Forest Service. 2016.
3	Toner, M. 2001. Lynx Records 1973-2000. NB Dept of Natural Resources, 29 recs.
3	Wallace, S. 2022. Email to Sean Blaney regarding NB DNRED Ranger Wood Turtle sightings from 2021. NB DNRED, 5 records.
2	Amirault, D.L. 2000. Piping Plover Surveys, 1983-2000. Canadian Wildlife Service, Sackville, unpublished data. 70 recs.
2	Anon. 2017. Export of Maritimes Butterfly records. Global Biodiversity Information Facility (GBIF).
2	Bagnell, B.A. 2003. Update to New Brunswick Rare Bryophyte Occurrences. B&B Botanical, Sussex, 5 recs.
2	Basquill, S.P., Porter, C. 2019. Bryophyte and lichen specimens submitted to the E.C. Smith Herbarium. NS Department of Lands and Forestry.
2	Belliveau, A.G. E.C. Smith Herbarium Specimen Database 2019. E.C. Smith Herbarium, Acadia University. 2019.
2	Brunelle, P.-M. 2005. Wood Turtle observations. Pers. comm. to S.H. Gerriets, 21 Sep. 3 recs, 3 recs.
2	Clayden, S.R.; Goltz, J.P. 2018. Emails to Sean Blaney on occurrence of Polygonum douglasii at Big Bluff, Kings Co., New Brunswick. pers. comm., 1 record.
2	DeMerchant, A. 2019. Bank Swallow colony observation. NB Department of Energy and Resource Development, Pers. comm. to J.L. Churchill.
2	Deseta, N. 2021. Email to John Klymko regarding Riparia riparia observations. Nashwaak Watershed Association Inc.
2	Donelle, R. 2007. Bouctouche Dune Rare Coastal Plant Data. Irving Eco-centre, la Dune du Bouctouche, 2 recs.
2	Edsall, J. 1992. Summer 1992 Report. New Brunswick Bird Info Line, 2 recs.
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2	Mazerolle, D. 2003. Assessment of Seaside Pinweed (Lechea maritima var. subcylindrica) in Southeastern New Brunswick. Irving Eco-centre, la Dune du Bouctouche, 18 recs.
2	McIntosh, W. 1904. Supplementary List of the Lepidoptera of New Brunswick. Bulletin of the Natural History Society of New Brunswick, 23: 355-357.
2	McLeod, D. & Saunders, J. 2004. Cypripedium reginae. Pers. comm. to C.S. Blaney. 4 recs, 4 recs.
2	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2014.
2	Nature Trust of New Brunswick. 2020. Nature Trust of New Brunswick 2020 staff observations of species occurence data. Nature Trust of New Brunswick, 133 records.
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2	Newell, R.E. 2005. E.C. Smith Digital Herbarium. E.C. Smith Herbarium, Irving Biodiversity Collection, Acadia University, Web site: http://luxor.acadiau.ca/library/Herbarium/project/. 582 recs.
2	Olsen, R. Herbarium Specimens. Nova Scotia Agricultural College, Truro. 2003.
2	Phillips, B. 2017. Emails to John Klymko regarding Eastern Waterfan (Peltigera hydrothyria) occurrences in Fundy National Park. Fundy Biosphere Reserve, 3 recs.
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2	Vinson, Neil. 2020. Email - additional Peltigera hydrothyria records, Fundy National Park. Chapman-Lam, Colin J. (ed.) Fundy National Park, 2.
2	Webster, R.P. Database of R.P. Webster butterfly collection. 2017.
1	Allen, Cory. 2021. Email to John Klymko regarding Glyptemys insculpta observation. Personal communication.
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	Basset, I.J. & Crompton, C.W. 1978. The Genus Suaeda (Chenopodiaceae) in Canada. Canadian Journal of Botany, 56: 581-591.
1	Bateman, M.C. 2001. Coastal Waterfowl Surveys Database, 1965-2001. Canadian Wildlife Service, Sackville, 667 recs.
1	Bishop, G. 2012. Field data from September 2012 Anticosti Aster collection trip. , 135 rec.
1	Blaney, C.S. 1999. Fieldwork 1999. Atlantic Canada Conservation Data Centre. Sackville NB, 292 recs.
1	Blaney, C.S. 2019. Atlantic Canada Conservation Data Centre Fieldwork 2019. Atlantic Canada Conservation Data Centre.
1	Blaney, C.S.; Spicer, C.D. 2001. Fieldwork 2001. Atlantic Canada Conservation Data Centre. Sackville NB, 981 recs.
1	Bouchard, A. Herbier Marie-Victorin. Universite de Montreal, Montreal QC. 1999.
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	Brunton, D.F. 2016. Record of Potamogeton vaseyi in Joslin Creek, NB. pers. comm., 1 record.
1	Buchanan, Jean. 2021. Email to Sean Blaney regarding Wood Turtle, Chipman, NB. pers. comm.
1	Clark, R. 2021. Email to S. Blaney, re: Wood Turtle observation from near Hunters Home, Queens Co., NB., May 20 2021. Rosemarie Clark <rsmr_clrk.luvsfam@hotmail.ca>, 1 record.
1	Clavette, A., and others. 2013. Peregrine Falcon nesting information from NatureNB listserv. NatureNB.
1	Clayden, S.R. 2020. Email regarding Blue Felt Lichen (Pectenia plumbea) occurrences in New Brunswick, from Stephen Clayden to Sean Blaney. pers. comm., 2 records.
1	Clayden, S.R. 2020. Email to Sean Blaney regarding Pilophorus cereus and P. fibula at Fidele Lake area, Charlotte County, NB. pers. comm., 2 records.
1	Collins, H. 2014. Email to John Klymko regarding CHELserp record from Miramichi watershed. Miramichi River Environmental Assessment Committee, 1 record.
1	Cormier, R. 2019. Wood Turtle observation. pers. comm. to J.L. Churchill.
1	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.
1	Daury, R.W. & Bateman, M.C. 1996. The Barrow's Goldeneye (Bucephala islandica) in the Atlantic Provinces and Maine. Canadian Wildlife Service, Sackville, 47pp.
1	Doucet, D.A. 2007. Fieldwork 2007: Insects (minus Odonata). ACCDC Staff, 1 rec.
1	Douglas, S.G. & G.C. Chaput & R. Bradford. 2001. Status of Striped Bass (Morone saxatilis) in the southern Gulf of St. Lawrence in 1999 & 2000. DFO Canadian Science Advisory Secretariat Res. Doc. 2001/058, 2001/058. 1 rec.
1	e-Butterfly. 2018. Selected Maritimes butterfly records from 2016 and 2017. Maxim Larrivee, Sambo Zhang (ed.) e-butterfly.org.
1	Edsall, J. 1993. Summer 1993 Report. New Brunswick Bird Info Line, 2 recs.
1	Forbes, G. 2021. Email to John Klymko regarding Riparia riparia observation in New Brunswick. Personal communication.
1	Forbes, G.J. 2020. Email regarding a Snapping Turtle (Chelydra serpentina) occurrence in New Brunswick, from Graham Forbes to John Klymko. pers. comm, 1 record.
1	Forbes, Graham. 2021. Email to John Klymko regarding Glyptemys insculpta observation. Personal communication.
1	Gautreau-Daigle, H. 2007. Rare plant records from peatland surveys. Coastal Zones Research Institute, Shippagan NB. Pers. comm. to D.M. Mazerolle, 39 recs.
1	Godbout, V. 2001. Recherche de l'Aster du St-Laurent (Symphyotrichum laurentianum) dans les marais sales du sud-est du Nouveau-Brunswick. Irving Eco-centre, la Dune du Bouctouche, 23 pp.
1	Hinds, H.R. 2000. Rare plants of Fundy in Rare Plants of Fundy: maps. Wissink, R. (ed.) Parks Canada, 2 recs.
1	Houghton, Andrew. 2021. Email to Sean Blaney re: nesting Snapping Turtle, NB. pers. comm.
1	Jessop, B. 2004. Acipenser oxyrinchus locations. Dept of Fisheries & Oceans, Atlantic Region, Pers. comm. to K. Bredin. 1 rec.
1	Jolicoeur, G. 2008. Anticosti Aster at Chapel Bar, St John River. QC DOE? Pers. comm. to D.M. Mazerolle, 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. 2019. Maritimes Hemiptera records harvested from iNaturalist . iNaturalist.
1	Klymko, J., Sabine, D. 2015. Verification of the occurrence of Bombus affinis (Hymenoptera: Apidae) in New Brunswick, Canada. Journal of and Acadian Entomological Society, 11: 22-25.
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	MacFarlane, Wayne. 2018. Skunk Cabbage observation on Long Island, Kings Co. NB. Pers. comm., 1 records.
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	Martin, Alyssa. 2021. Email to Sean Blaney regarding Wood Turtle sighting, NB. pers. comm.
1	Mazerolle, D.M. Small-flowered Agalinis collection from Quarryville. AC CDC. 2018.
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	McAlpine, D.F. 2020. Email to John Klymko about Epargyreus clarus record from Grand Bay, NB. Pers. comm.
1	Mersey Tobetic Research Institute. 2021. 2020 Monarch records from the MTRI monitoring program. Mersey Tobetic Research Institute, 72 records.
1	Munro, Marian C., Newell, R.E, & Hill, Nicholas M. 2014. Nova Scotia Plants. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia, First edition.
1	New York Botanical Garden. 2006. Virtual Plant Herbarium - Vascular Plant Types Catalog. Sylva, S.; Kallunki, J. (ed.) International Plant Science Centre, Web site: http://sciweb.nybg.org/science2/vii2.asp. 4 recs.
1	Novak, Pam. 2017. Email to John Klymko regarding Chelydra serpentina record.
1	Nye, T. 2002. Wood Turtle observations in Westmorland, Queens Cos. , Pers. com. to S.H. Gerriets, Dec. 3. 3 recs.
1	Ogden, K. Nova Scotia Museum butterfly specimen database. Nova Scotia Museum. 2017.

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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	Richardson, D., Anderson, F., Cameron, R, Pepper, C., Clayden, S. 2015. Field Work Report on the Wrinkled Shingle lichen (Pannaria lurida). COSEWIC.
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	Singleton, J. 2004. Primula mistassinica record for Nashwaak NB. Pers. comm. to C.S. Blaney, 1 rec.
1	Skevington, Jeffrey H. 2020. Syrphid records used for the Field Guide to the Flower Flies of Northeastern North America. Canadian National Collection of Insects.
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	Stevens, Joshua. 2020. Facebook record of Ophiogomphus howei.
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	Vinison, Neil. 2018. Record of Saxifraga paniculata from Fundy NP, emailed to S. Blaney 19 July 2018. Pers. comm.
1	Vinson, N. 2018. Email to S. Blaney regarding new occurrence of Saxifraga paniculata on Point Wolfe River. Parks Canada, 1 record.
1	Vinson, N. 2019. Eastern Waterfan record from Long Reach Brook, Fundy National Park, June 12, 2019. Parks Canada Agency, Fundy National Park, 1 record.
1	Vinson, Neil. 2016. Emails to Sean Blaney regarding yellow flower (Primula veris) and coastal habitat leaf rosettes (Primula laurentiana) in Fundy National Park. pers. comm., 2 rec.
1	Walker, E.M. 1942. Additions to the List of Odonates of the Maritime Provinces. Proc. Nova Scotian Inst. Sci., 20. 4: 159-176. 2 recs.
1	Webster, R.P. Email to John Klymko detailing records of butterflies collected by Reggie Webster in June 2017. Webster, R.P. 2017.
1	Webster, R.P. Reggie Webster's records of Encyclops caerulea . pers. collection. 2018.
1	Wilhelm, S.I. et al. 2019. Colonial Waterbird Database. Canadian Wildlife Service.
1	Wissink, R. 2000. Four-toed Salamander Survey results, 2000. Fundy National Park, Internal Documents, 1 rec.

Appendix D

Vegetation Species List

Sept 16th/2022 - JDI CHIPMAN #22-4686

WL#1 : 876 - 910

WP 905 is an input, possible old trail

WP 885/886 output into cleared area

WP911 - is soil/veg plot

Trees		Shrubs		Herbs	
Picea mariana	15	Vib. cassinoides	15	Carex folliculata	20
Acer rubrum	15	Kalmia ang.	3	O. cinnamomea	20
B. populifolia	10	Alnus incana	5	Lys. borealis	1
		Ilex mucronata	15	Thely. noveboracensis	10
		Abies balsamea	2	Vacc. myrtle	3
				Oxalis montana	1

Hydrology

HWT @ ~10 inches below surface / WSL

Saturation @ surface

Soils

2-0" inches Peat/Sphagnum

0-2" inches 7.5YR 5/1 100% Sand

2-6" inches 7.5YR 3/1 100% Sandy Loam

6-30 inches 7.5YR 3/2 100% Sand

30-48+ inches Gley2 4/10G 85% Sand

→ Redox concentrations in Pore Lining 15%

10YR 5/8

No Restrictive Layer was encountered

Sept 16 - JDI CHIPMAN

WL#2 - 912 - 937
C 935 - outlet to WL#1 @ WP 905
(old overgrown ATV trail)
WP938 - Soil/Veg Plot
ruts

Trees		Shrubs		Herb	
A. balsamea	20	Sorbus americana	5	O. cinnamomeum	10
P. mariana	20	Ilex mucro	10	Cal. canadensis	5
A. rubrum	10	Vib. cassinoides	10	Lys. terrestris	1
		Abies bals.	2	Lys. borealis	1
		Alnus incana	5	Vacc. myrtloides	2
				Cornus canadensis	1
				Carex trisperma	1

Hydrology
HWT @ 12 inches below / WSL
Saturation @ surface /

Soils
3-0" inches Peat/Sphagnum
0-8 inches 7.5YR 3/1 100% Sand
8-18 inches 7.5YR 3/2 100% Sand
18+ 2.5YR 6/1 90% Sandy Clay
C Redox concentration in matrix 10YR 5/8 10%

Restrictive Sandy-Clay layer

Sept 16/22 - JDF CHIPMAN
WP939 - Recently installed WELLHEAD
WP 940 - " "

WL#3 - 941 to 969 => Veg/Soil Plot is WP970

Trees		Shrubs		Herbs	
P. mariana	40	P. mariana	10	Carex stricta	30
Pinus strobus	2	K. angustifolia	2	Vacc. oxycoccus	1
L. laricina	2	Ilex mucronata	2	Maian. trifolium	1
		A. rubrum	2		

Hydrology
HWT @ 12 inches below
Saturation @ surface
Stunted Plants

Soils

8-0" inches	Peat/Sphagnum		
0-6" inches	7.5YR 2.5/1	100%	Black Organics
6-16" inches	7.5YR 5/1	100%	Clay
16-20 inches	Gley 1 5/N	90%	Sandy Clay
	10YR 5/8	10%	Pore Linings + Matrix
20-28+	Gley 2 5/5BG	95%	Clay
	10YR 5/8 - Pore linings		

28+ ↓
Restrictive Layer of tight Clay Continues

Sept 16/22 JDI CHIPMAN

WL#4 - WP971 - 1027

WP 994 is a recently installed WELLHEAD

WP 1006 + 1007 => ephemeral output 230° (SW)

WP1028 - WL#4 Veg/Soil Plot

Trees		Shrubs		Herbs	
B. populifolia	10	A. incana	50	Maian. trifolium	5
P. mariana	10	V. cassinoides	5	Carex trisperma	2
A. balsamea	2	P. mariana	10	Lycopus uniflorus	1
		B. populifolia	10	O. cinnamomeum	5
		A. balsamea	5		
		A. rubrum	5		

Hydrology

Saturated @ surface

HWT @ 4 inches below

Soils

10-0 inches Sphagnum/Peat

0-4 inches 7.5YR 2.5/1 Black Muck organics

4-32" 7.5YR 5/1 Clay Sand 80%

10YR 5/8 Matrix concentrat 20%

32+

Restrictive tight Sand + Clay layer

Sept 16/22 - JDI Chipman

WP 1029 - Ephemeral channel, Suspect that
WL#4 flows to WL#2 @ WP 924

Edge & Disturbance for new residential development
WP 1030 - 1051
1032 - 1033 → where geotech rig entered?
1048 - 1049 - Drainage for WL#1

Appendix E

Wetland Field Sheets

Site #1   (46.18121 , -65.86846)

Tree Composition - wP 40%, bF 30%, wS 20%, wB 5%, rM 5% (rO seedlings & old stumps within stand)

Comments: Dry with sphagnum base in low spot

Botanical Name		Common Name	S Rank	Site Abundance
Abies balsamea		Balsam Fir	S5	D
Acer rubrum		Red Maple	S5	B
Aralia nudicaulis		Wild Sarsaparilla	S5	D
Betula papyrifera		Paper Birch	S5	B
Clintonia borealis		Yellow Clintonia	S5	D
Coptis trifolia	ssp. groenlandica	Goldthread	S5	D
Cornus canadensis		Bunchberry	S5	E
Cypripedium aucaul		Pink Lady's-Slipper	S5	B
Maianthemum canadense		Wild Lily-of-the-valley	S5	D
Picea glauca		White Spruce	S5	C
Pinus strobus		Eastern White Pine	S5	D
Pteridium aquilinum		Bracken Fern	S5	E
Trientalis borealis		Starflower	S5	D
Vaccinium angustifolium		Late Lowbush Blueberry	S5	E
Vaccinium myrtilloides		Sour-top Blueberry	S5	C
Viburnum cassinoides		Northern Wild Raisin	S5	D

Abundance:A = Very rare, B = Rare, C = Uncommon, D = Common, E = Very Common

GPS on WGS 84

Date: July 25, 2022

Site #2 (46.18131 , -65.86768)

Tree Composition - wP 35%, bF 30%, rS 10%, LTA 20%, rM 5%

Comments: Along old boundary line. Dry site

Botanical Name	Common Name	S Rank	Site Abundance
Abies balsamea	Balsam Fir	S5	D
Acer rubrum	Red Maple	S5	B
Aralia nudicaulis	Wild Sarsaparilla	S5	D
Cornus canadensis	Bunchberry	S5	B
Cypripedium aucaul	Pink Lady's-Slipper	S5	B
Gaultheria procumbens	Wintergreen	S5	B
Maianthemum canadense	Wild Lily-of-the-valley	S5	B
Picea rubens	Red Spruce	S5	C
Pinus strobus	Eastern White Pine	S5	D
Pteridium aquilinum	Bracken Fern	S5	E
Polytrichium juniperinum	Juniper Haircap Moss	S5	D
Populus grandidentata	Large-toothed Aspen	S5	D
Pteridium aquilinum	Bracken Fern	S5	E
Trientalis borealis	Starflower	S5	C
Vaccinium angustifolium	Late Lowbush Blueberry	S5	E

Abundance:A = Very rare, B = Rare, C = Uncommon, D = Common, E = Very Common

GPS on WGS 84

Date: July 25, 2022

Site #3 (46.18128 , -65.86584)

Tree Composition - wP 30%, bF 5%, rS 40%, rM25%

Comments:

Botanical Name	Common Name	S Rank	Site Abundance
Abies balsamea	Balsam Fir	S5	C
Acer rubrum	Red Maple	S5	D
Bazzania trilobata	Bazzania	S5	D
Clintonia borealis	Yellow Clintonia	S5	C
Cornus canadensis	Bunchberry	S5	C
Gaultheria procumbens	Wintergreen	S5	B
Picea rubens	Red Spruce	S5	D
Pinus strobus	Eastern White Pine	S5	D
Pleurozium schreberi	Schrebers Moss	S5	D
Polytrichium juniperinum	Juniper Haircap Moss	S5	D
Populus grandidentata	Large-toothed Aspen	S5	D
Trientalis borealis	Starflower	S5	C
Trillium undulatum	Painted Trillium	S5	C

Abundance:A = Very rare, B = Rare, C = Uncommon, D = Common, E = Very Common

GPS on WGS 84

Date: July 25, 2022

Site #4 (46.18042 , -65.86452)

Tree Composition - wP 40%, bF 25%, rS 5%, wB 5%, rM 10%

Comments:

Botanical Name	Common Name	S Rank	Site Abundance
Abies balsamea	Balsam Fir	S5	D
Acer rubrum	Red Maple	S5	B
Aralia nudicaulis	Wild Sarsaparilla	S5	D
Betula papyrifera	Paper Birch	S5	B
Clintonia borealis	Yellow Clintonia	S5	D
Cornus canadensis	Bunchberry	S5	D
Picea rubens	Red Spruce	S5	C
Pinus strobus	Eastern White Pine	S5	D
Pleurozium schreberi	Schrebers Moss	S5	C
Polytrichium juniperinum	Juniper Haircap Moss	S5	C
Pteridium aquilinum	Bracken Fern	S5	C
Pteridium aquilinum	Bracken Fern	S5	C
Trillium undulatum	Painted Trillium	S5	C
Vaccinium angustifolium	Late Lowbush Blueberry	S5	D
Viburnum cassinoides	Northern Wild Raisin	S5	D

Abundance:A = Very rare, B = Rare, C = Uncommon, D = Common, E = Very Common

GPS on WGS 84

Date: July 25, 2022

Site #5 (46.17971 , -65.86404)

Tree Composition - eH 20%, bF 40%, rS 40%

Comments: Lg portion of sp/fir is 2-4" dbh

Botanical Name	Common Name	S Rank	Site Abundance
Abies balsamea	Balsam Fir	S5	D
Aralia nudicaulis	Wild Sarsaparilla	S5	C
Clintonia borealis	Yellow Clintonia	S5	C
Cornus canadensis	Bunchberry	S5	D
Gaultheria procumbens	Wintergreen	S5	C
Lycopodium obscurum	Ground Pine	S5	C
Maianthemum canadense	Wild Lily-of-the-valley	S5	D
Picea rubens	Red Spruce	S5	D
Pleurozium schreberi	Schrebers Moss	S5	D
Ptilium crista-castrensis	Feather Moss	S5	C
Trillium undulatum	Painted Trillium	S5	C
Tsuga canadensis	Eastern Hemlock	S5	D

Abundance:A = Very rare, B = Rare, C = Uncommon, D = Common, E = Very Common

GPS on WGS 84

Date: July 25, 2022

Site #6 (46.17950 , -65.86531)

Tree Composition - wP 20%, bF 15%, wB 5%, rM 30%, LTA 30%

Comments

Botanical Name	Common Name	S Rank	Site Abundance
Abies balsamea	Balsam Fir	S5	C
Acer rubrum	Red Maple	S5	D
Betula papyrifera	Paper Birch	S5	B
Clintonia borealis	Yellow Clintonia	S5	C
Gaultheria procumbens	Wintergreen	S5	C
Lycopodium obscurum	Ground Pine	S5	B
Maianthemum canadense	Wild Lily-of-the-valley	S5	C
Osmunda claytoniana	Interrupted Fern	S5	B
Pinus strobus	Eastern White Pine	S5	D
Populus grandidentata	Large-toothed Aspen	S5	D
Spinulum annotinum	Interrupted Clubmoss		C
Trillium undulatum	Painted Trillium	S5	C

Abundance:A = Very rare, B = Rare, C = Uncommon, D = Common, E = Very Common

GPS on WGS 84

Date: July 25, 2022

Site #7 (46.18145 , -65.86517)

Tree Composition - rS 45%, rM 30%, bS 10%, LTA 10%

Comments: Wettest part of block

Botanical Name		Common Name	S Rank	Site Abundance
Acer rubrum		Red Maple	S5	D
Alnus incana		Speckled Alder	S5	B
Aralia nudicaulis		Wild Sarsaparilla	S5	B
Coptis trifolia	ssp. groenlandica	Goldthread	S5	C
Cornus canadensis		Bunchberry	S5	D
Kalmia polifolia		Bog Laurel	S5	B
Maianthemum trifolium		3-Leaved Solomons Seal	S5	B
Osmunda cinnamomea		Cinnamon Fern	S5	C
Picea mariana		Black Spruce	S5	C
Picea rubens		Red Spruce	S5	D
Pleurozium schreberi		Schrebers Moss	S5	C
Populus grandidentata		Large-toothed Aspen	S5	B
Sphagnum spp.		Sphagnum Moss	S5	E
Vaccinium angustifolium		Late Lowbush Blueberry	S5	B
Vaccinium myrtilloides		Sour-top Blueberry	S5	C
Viburnum cassinoides		Northern Wild Raisin	S5	C

Abundance:A = Very rare, B = Rare, C = Uncommon, D = Common, E = Very Common

GPS on WGS 84

Date: July 25, 2022

CommonName	ScientificName	SRank	noteRank	SRankDate
Red Maple	Acer rubrum	S5		2015 07 21
Mountain Holly	Ilex mucronata	S5		2015 07 21
Wild Sarsaparilla	Aralia nudicaulis	S5		2015 07 21
Hairy Flat-top White Aster	Doellingeria umbellata	S5		2015 07 21
Three-leaved Rattlesnakeroot	Nabalus trifoliolatus	S5		2015 07 21
Whorled Wood Aster	Oclemena acuminata	S5		2015 07 21
Downy Goldenrod	Solidago puberula	S5		2015 07 21
Rough-stemmed Goldenrod	Solidago rugosa	S5		2015 07 21
Speckled Alder	Alnus incana	S5		2015 07 21
Paper Birch	Betula papyrifera	S5		2015 07 21
Gray Birch	Betula populifolia	S5		2015 07 21
Pale St John's-Wort	Hypericum ellipticum	S5		2015 07 21
Fraser's St. John's-wort	Hypericum fraseri	S5		2015 07 21
Common St. John's-wort	Hypericum perforatum	SNA	Exotic	2015 07 21
Bunchberry	Cornus canadensis	S5		2015 07 21
Twinflower	Linnaea borealis	S5		2015 07 21
Canada Fly Honeysuckle	Lonicera canadensis	S5		2015 07 21
Northern Wild Raisin	Viburnum nudum	S5		2015 07 21
Trailing Arbutus	Epigaea repens	S5		2015 07 21
Creeping Snowberry	Gaultheria hispidula	S5		2015 07 21
Eastern Teaberry	Gaultheria procumbens	S5		2015 07 21
Sheep Laurel	Kalmia angustifolia	S5		2015 07 21
Late Lowbush Blueberry	Vaccinium angustifolium	S5		2015 07 21
Velvet-leaved Blueberry	Vaccinium myrtilloides	S5		2015 07 21
Small Cranberry	Vaccinium oxycoccos	S5		2015 07 21
Northern Red Oak	Quercus rubra	S5		2015 07 21
American Witch-Hazel	Hamamelis virginiana	S5		2015 07 21
American Water Horehound	Lycopus americanus	S5		2015 07 21
Convulsion-Root	Monotropa uniflora	S5		2015 07 21
Common Wood Sorrel	Oxalis montana	S5		2015 07 21
Northern Starflower	Lysimachia borealis	S5		2015 07 21
Swamp Yellow Loosestrife	Lysimachia terrestris	S5		2015 07 21
Shinleaf	Pyrola elliptica	S5		2015 07 21
Goldthread	Coptis trifolia	S5		2015 07 21
Smooth Serviceberry	Amelanchier laevis	S5		2015 07 21
Bristly Dewberry	Rubus hispidus	S5		2015 07 21
Dwarf Red Raspberry	Rubus pubescens	S5		2015 07 21
Dewdrop	Rubus repens	S4S5		2015 07 21
American Mountain Ash	Sorbus americana	S5		2015 07 21
White Meadowsweet	Spiraea alba	S5		2015 07 21
Partridgeberry	Mitchella repens	S5		2015 07 21
Balsam Poplar	Populus balsamifera	S4		2015 07 21
Large-toothed Aspen	Populus grandidentata	S5		2015 07 21
Trembling Aspen	Populus tremuloides	S5		2015 07 21

Balsam Fir	Abies balsamea	S5	2015 07 21
Tamarack	Larix laricina	S5	2015 07 21
White Spruce	Picea glauca	S5	2015 07 21
Black Spruce	Picea mariana	S5	2015 07 21
Red Spruce	Picea rubens	S5	2015 07 21
Jack Pine	Pinus banksiana	S4	2015 07 21
Eastern White Pine	Pinus strobus	S5	2015 07 21
Star Sedge	Carex echinata	S5	2015 07 21
Northern Long Sedge	Carex folliculata	S5	2015 07 21
Broom Sedge	Carex scoparia	S5	2015 07 21
Tussock Sedge	Carex stricta	S5	2015 07 21
Three-seeded Sedge	Carex trisperma	S5	2015 07 21
Harlequin Blue Flag	Iris versicolor	S5	2015 07 21
Narrow-Panicled Rush	Juncus brevicaudatus	S5	2015 07 21
Soft Rush	Juncus effusus	S5	2015 07 21
Yellow Bluebead Lily	Clintonia borealis	S5	2015 07 21
Wild Lily-of-The-Valley	Maianthemum canadense	S5	2015 07 21
Three-leaved False Soloman's Seal	Maianthemum trifolium	S5	2015 07 21
Cucumber Root	Medeola virginiana	S5	2015 07 21
Rose Twisted-stalk	Streptopus lanceolatus	S5	2015 07 21
Painted Trillium	Trillium undulatum	S5	2015 07 21
Pink Lady's-Slipper	Cypripedium acaule	S5	2015 07 21
Bracken Fern	Pteridium aquilinum	S5	2015 07 21
Marginal Wood Fern	Dryopteris marginalis	S5	2015 07 21
Round-branched Tree-clubmoss	Dendrolycopodium dendroideum	S5	2015 07 21
Stiff Clubmoss	Lycopodium annotinum	S5	2015 07 21
Interrupted Fern	Claytosmunda claytoniana	S5	2015 07 21
Royal Fern	Osmunda regalis	S5	2015 07 21
Cinnamon Fern	Osmundastrum cinnamomeum	S5	2015 07 21
New York Fern	Parathelypteris noveboracensis	S5	2015 07 21

Appendix F

Field Photos

Drainage Feature

Upland Forest

Upland Forest

Wetland 1

Wetland 1

Wetland 2

Wetland 3




Wetland 3

Wetland 3

Wetland 4

Wetland 4

Wetland 4

Previously Installed Wellhead (WSSA)

Appendix G

Summary of JDI Environmental Field Surveys and Best Management Practises

Summary of Environmental Surveys of the "Chipman Development Project" undertaken by Irving Woodlands staff in 2022.

January 9, 2022 - Ward Hunter (Regional Forester - Central New Brunswick). General walk through the property. Ward has received environmental training annually as far back as at least 2008 (from my records) and has a number of nest sites and a few rare plant locations under his belt. (2 hours)

February 10, 2022 – Ward Hunter. Another walk through of the property (2 hours)

March 14, 2022 – Initial conversation between Kelly Honeyman (JDI Fish & Wildlife) and Project Engineering Lead (Mike Turnbull) about finding time to help with initial environmental surveys including hydrology, stick nests and botanical surveys. Maps of site sent to Kelly for preview, including one that identified all super-canopy white pine. This was to aid in the ground-based search for stick nests in the pine.

March 23, 2022 – Taking advantage of snow in the canopy (that makes stick nests easier to identify), Kelly flew block with Bell 407 , making 6 passes over the property at various angles, attempting to locate any canopy top nests. None found. (15 min flight time)

March 24, 2022 – Kelly Honeyman did an initial walk through of the property concentrating on any wet features within. (6 hours)

April 4, 2022 – John Ewasko, Field Forester for Central New Brunswick woodlands took a walk through the site for a general look around as well as a rapid hydrological assessment (1.5 hour). Recent snowfall made the assessment a challenge, so he scheduled another walk though.

April 12, 2022 – John Ewasko back on site (2.5 hours) . He noted no stick nests during either visit. John has undertaken Environmental Training under Kelly Honeyman and John Gilbert since 2020. This training includes identification of stick nests, identification of a dozen raptor and wading birds as well as the identification of indicator plants that help identify rare plant habitat. In addition, John has undergone training in the proper identification of vernal pools, including the identification of wood frog and salamander egg masses. It should be noted that John has identified a number of vernal pools and stick nests when laying out harvest blocks since he began working with Irving Woodlands. He is a New Brunswick certified Wetland Delineator. John is a forester with a keen eye for locating sites of environmental concern.

June 23, 2022 – John Ewasko on site, confirming boundary lines. Found two red oaks within the property that were large enough to warrant Legacy Tree status (2.5 hours)

July 25, 2022 – Kelly Honeyman walked block, performing botanical surveys in 7 areas. (7.5 hours)

September 2, 2022 – John Ewasko on the property again, delineating an area for a Cul de Sac. (2 hours)

September 28, 2022 – Kelly Honeyman walked block again, doing another 4 botanical surveys (4 hours)

Total staff time on block: 28 hours on ground, 15 min of aerial survey time

Note: JDI staff are by necessity, multi-taskers. Whether they were in the block looking for water features, rare plants, legacy trees or confirming boundary lines, they are "always on" looking for all manner of potential environmental concern.

Attached are a few of the environmental training documents that our woodlands staff train to annually.

Titles include:

Late Successional Forest Policy

Rare Plant Pre-Screening Policy

Invasive Species Policy

Diversity in Harvested Areas Policy (includes our Island policy, stick nest protection policy and bird ID, Legacy tree retention guidelines and vernal pool identification and retention)

Wetland Delineation Guide

Identification of Potential Habitats for Rare or Endangered Plants

Chipman/Doaktown District
(excluding St. George area)

Encompassing parts of:
Continental Lowlands/Grand Lake
/Eastern LowlandEco-Regions

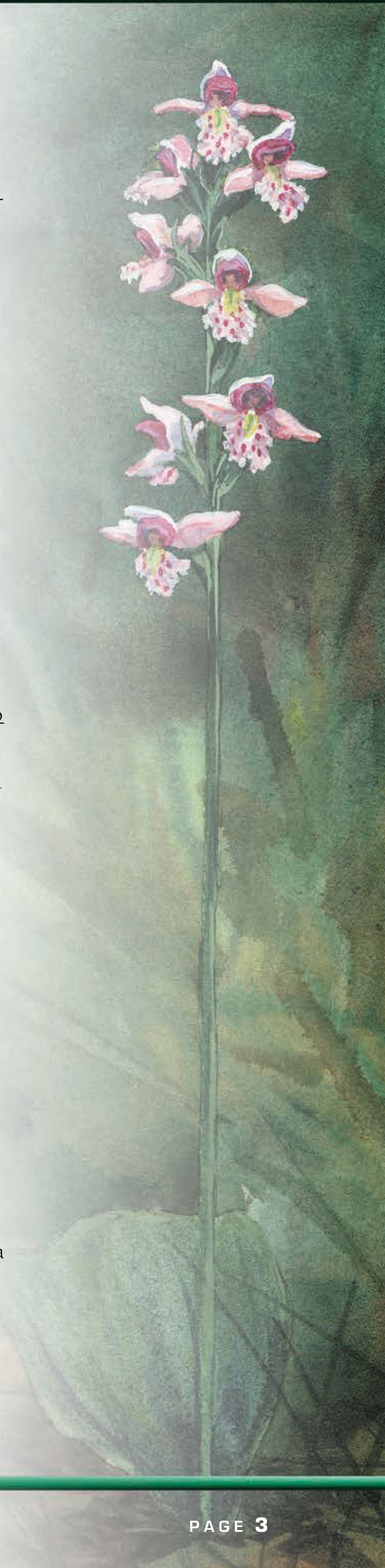
Version 2
(2005)

IRVING

Overview

The following guidebook has been prepared to help you recognize some of the critical forest habitat types in the district that may contain rare or endangered (R/E) plants. Once these areas are recognized and R/E plants are identified, suitable management recommendations can be prescribed to maintain their populations. J. D. Irving, Limited defines R/E plants as those species designated as S1-S3 on the Atlantic Canada Conservation Data Centre rarity ranking (see Section 4).

Table of Contents



Risk Map

A map has been developed to assist in the use of this guidebook. The Risk Map helps forestry staff locate sites that are important to the establishment and retention of R/E plants. It highlights the habitats that have a high (red) and a moderate (yellow) association potential with R/E plants.

Limiting factors within our database made it impossible to map areas such as cedar seeps, rock outcrops, talus slopes, cove forests and vernal pools. Although omitted from the map, these habitats have easily recognizable field features. Use the descriptions in this guidebook to identify these unmapped habitats.

The risk map was created using the habitat information derived from 450+ plants ranked from very rare to uncommon (See Section 4 for a complete definition of these coded rankings). R/E plants with similar habitat requirements were grouped together, yielding eight specific operable forest habitats to locate. These habitat types were described in terms of canopy closure, drainage, tree species dominance, and forest development stage. Both crown and freehold land bases were searched using Arc Info.

The risk map defines the land areas that best match up with the described habitats of the R/E plants.

There is a possibility that poor typing of biotic (ie tree species) and abiotic land features (ie drainage) within the GIS database has allowed some sites to be incorrectly flagged as potential sites. Some potential sites within the district may be unflagged. Knowing this, forestry staff should not rely solely on the risk map. Check the guidebook descriptions to identify a potential site.

Map colour codes are assigned based on GIS data only. There is a chance that the mapped habitats will not match up with what is actually on the ground. It is the responsibility of the forester to verify each sites' potential. Assess what is on the ground with the guidebook descriptions provided then follow these procedures:

The **red** coded habitat indicates high association potential and low habitat occurrence within the district. Do not operate within these areas without first having a detailed survey made by someone suitably trained in plant identification. (See section 5 for a list of contact names for botanical surveys.)

The **yellow** coded habitat indicates a moderate association potential along with a relatively high habitat abundance. Habitat abundance is determined through discussions with local foresters and information from the GIS database. The yellow site may require a detailed botanical survey. (See section 5 for a list of contact names for botanical surveys.)

Acknowledgments

We would like to thank those individuals and organizations for their help in preparing this guidebook: Sean Blaney and Stefen Gerriets of the Atlantic Canada Conservation Data Center (AC CDC);The New Brunswick Museum; Vince Zelazney, Mike Sullivan and Maureen Toner (New Brunswick Dept. of Natural Resources and Energy); The late Hal Hinds (former curator, Connell Memorial Herbarium); Jim Goltz; Judi Pennanen; and JDI staff.

Tolerant Hardwood Forest (Calcareous)

IMPORTANCE: A calcareous tolerant hardwood forest has a high R/E plant association largely because of its rich soil. The low soil acidity (from calcium rich bedrock) allows for better nutrient uptake for plants.

Enduring Features	Medium slope, well-drained, and rich soil
Dominant Canopy	Sugar maple (70%), yellow birch (20%), beech (10%) (Mature/Over-mature Age Class
Other Associates	Hemlock, white pine, red spruce, white ash
Canopy Closure	80%
Prominent Shrub Species	Striped maple, hobblebush, beaked hazelnut, fly honeysuckle
Prominent herbaceous species	There is a moderate amount of understory vegetation, and a diverse number of species which include: Indian cucumber root *(June-July)*, rose twisted stalk *(late May-June)*, purple trillium, dutchman's-breeches, red or white baneberry *(mid May - early June)*, enchanter's nightshade *(mid June - September)*, solomon's seal (polygonatum pubescens) *(June)*, oak fern, virginia grape fern, zig zag golden rod *(August - September)*

1 Baneberry

Grape Fern

2 Fly Honeysuckle

3 Red Trillium

RICH DECIDUOUS

Scientific Name	Common Name	S-Rank
Agrimonia gryposepala	Hooked Agrimony	S3
Botrychium dissectum	Cutleaf Grape-Fern	*S3*
Botrychium lanceolatum	Lanced-Leaved Grape Fern	S3
Cardamine concatenata	Cutleaf Toothwort	S1
Carex cephaloidea	Thinleaf Sedge	S1
Carex hirtifolia	Pubescent Sedge	S1
Carex ormostachya	Necklace Sedge	S2
Carex plantaginea	Plantain-Leaved Sedge	S2
Carex rosea	Rosy Sedge	S3
Caulophyllum thalictroides	Blue Cohosh	S3
Coeloglossum viride var. virescens	Frog-Orchis	S2
Corallorrhiza maculata	Spotted Coral-Root	S3S4S3
Corallorrhiza striata	Striped Coral-Root	S1SX?SH
Cynoglossum virginianum var. boreale	Northern Wild Comfrey	S2
Cypripedium pubescens	Variety of Yellow Ladyslipper	S3
Desmodium glutinosum	Large Tick-Trefoil	S1
Dryopteris clintoniana	Clinton's Shield-Fern	S1
Dryopteris filix-mas	Male Fern	S1
Dryopteris goldiana	Goldie's Fern	S3
Galearis spectabilis	Showy Orchis	S1
Goodyera oblongifolia	Giant Rattlesnake-Plantain	S1S2
Goodyera tesselata	Tesselated Rattlesnake-Plantain	S3
Hepatica nobilis var. obtusa	Round-Leaved Hepatica	S2
Hieracium paniculatum	Panicled Hawkweed	S1
Impatiens pallida	Pale Touch-Me-Not	S1
Panax trifolius	Dwarf Ginseng	S3
Pedicularis canadensis	Wood-Betony	S1
Platanthera hookeri	Hooker's Orchid	S3
Platanthera orbiculata var. macrophylla	Large Round-Leaved Orchid	S1
Platanthera orbiculata var. orbiculata	Round-Leaved Orchid	S3
Polygala paucifolia	Fringed Polygala	S2
Polystichum braunii	Braun's Holly Fern	S3
Rubus occidentalis	Black Raspberry	S2
Sanicula trifoliata	Snakeroot	S1
Verbena urticifolia	White Vervain	S2
Viola canadensis	Canada-Violet	S1S2
Waldsteinia fragarioides	Barren Strawberry	S1

Floodplain Deciduous Forests

IMPORTANCE: Floodplain Deciduous Forests are forested land adjacent to a river channel. This forest is built of sediments and covered with water when the river overflows its banks at flood stages. Sediment contributes to the richness of the site. There may be similar sites along large streams in your district.

Enduring Features	Flat, riparian area, poorly drained, rich fluvial deposits
Dominant Canopy	Silver maple (40-100%), butternut (5%), american elm (20-30%), Burr Oak (20-30%), red maple (40%), Manitoba maple (5%), ash (10%) Mature/Over-mature Age Class **depending on river speed and drainage, tree species and their abundance can vary appreciably.
Canopy Closure	90-100%
Prominent Shrub Species	Striped maple, hobblebush, beaked hazelnut, fly honeysuckle
Prominent herbaceous species	There is an abundant amount of understory vegetation which likely will contain the following species: Ostrich fern, sensitive fern, jack-in-the pulpit, Wild ginger, red and white baneberry, wood nettle, zig-zag goldenrod, white snakeroot


1 Wild Ginger


2 Jack-in-the-Pulpit


3 Ostrich Fern

FLOODPLAIN DECIDUOUS

Scientific Name	Common Name	S-Rank
Agrimonia gryposepala	Hooked Agrimony	S3
Adiantum pedatum	Maidenhair Fern	S3
Agrimonia gryposepala	Hooked Agrimony	S3
Allium tricoccum	Wild Leek	S2S3
Boehmeria cylindrica	False Nettle	S1
Botrychium dissectum	Dissected Grapefern	S3
Botrychium lanceolatum	Lance-Leaved Grapefern	S3
Bromus latiglumis	Broad-Glumed Brome	S1
Carex amphibola var. turgida	Narrowleaf Sedge	S1
Carex sprengelii	Sprengel's Sedge	S2
Carex lupulina	Hop Sedge	S2
Caulophyllum thalictroides	Blue Cohosh	S3
Cephalanthus occidentalis	Common Buttonbush	S1
Cinna arundinacea	Stout Wood Reed-Grass	S1
Cornus amomum	Silky Dogwood	S1
Crataegus mollis	Hawthorn	S1S2
Dryopteris clintoniana	Clinton's Wood-Fern	S1
Elymus hystrix var. bigeloviana	Bottlebrush Grass	S1
Festuca subverticillata	Nodding Fescue	S1
Helianthus decapetalus	Thin-Leaved Sunflower	S1
Leersia virginica	Virginia Cutgrass	S1
Osmorhiza longistylis	Smoother Sweet-Cicely	S2
Phryma leptostachya	Lopseed	S2
Pilea pumila	Clearweed	S2
Platanthera grandiflora	Large Purple-Fringed Orchid	S2
Platanthera flava var. herbiola	Pale Green Orchid	S1
Quercus macrocarpa	Burr Oak	S3
Sanicula odorata	Black Snake-root	S1
Triosteum aurantiacum	Coffee Tinker's-Weed	S1S2
Verbena urticifolia	White Vervain	S2
Viburnum lentago	Nannyberry	S1

Cedar Swamps (Calcareous)

IMPORTANCE: Cedar Swamps are cool, low-lying forests that are usually adjacent to a stream or a meandering set of streams. The presence of cedar generally indicates high soil richness. The shaded, moist and rich site conditions make these sites good habitat for many orchids and other R/E plants.

Enduring Features	Flat, poorly-drained, rich bedrock
Dominant Canopy	Eastern white cedar 80-90% Mature / Over-mature Age Class
Other Associates	Tamarack, black spruce, balsam fir, black ash
Canopy Closure	50-90%
Prominent Shrub Species	Wild raisin
Prominent herbaceous species	Amount of understory vegetation is scarce due to moist, shaded conditions. Species include: lady slipper, goldthread, sweet scented bedstraw, naked miterwort, and twayblades

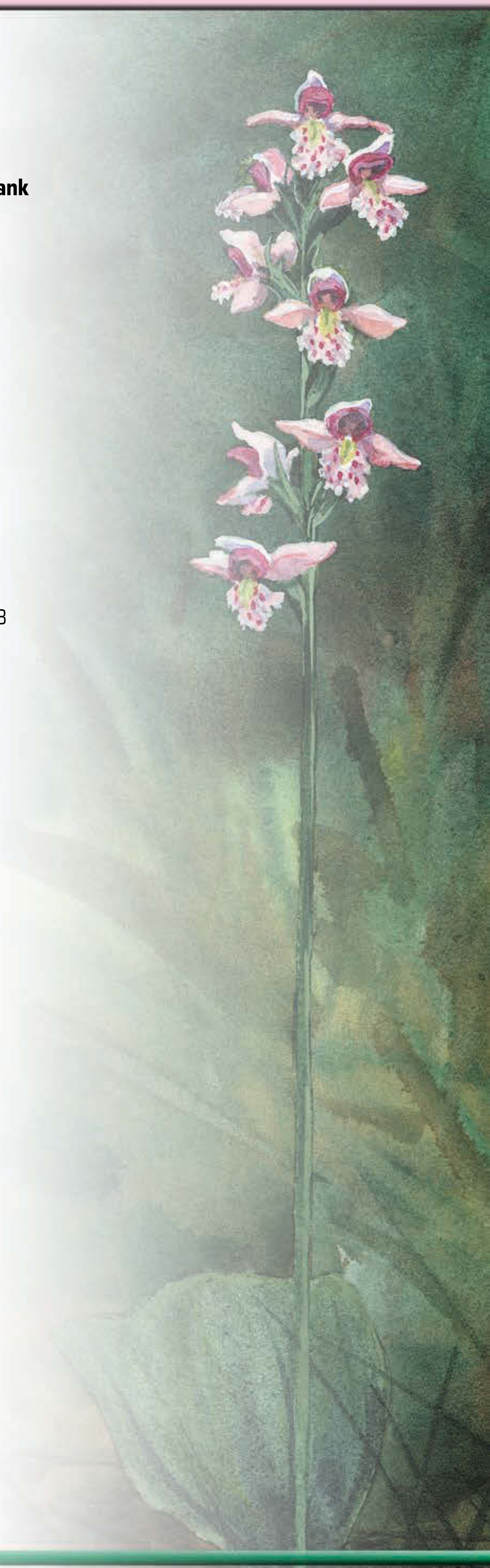
1 Broad Lipped Twayblade

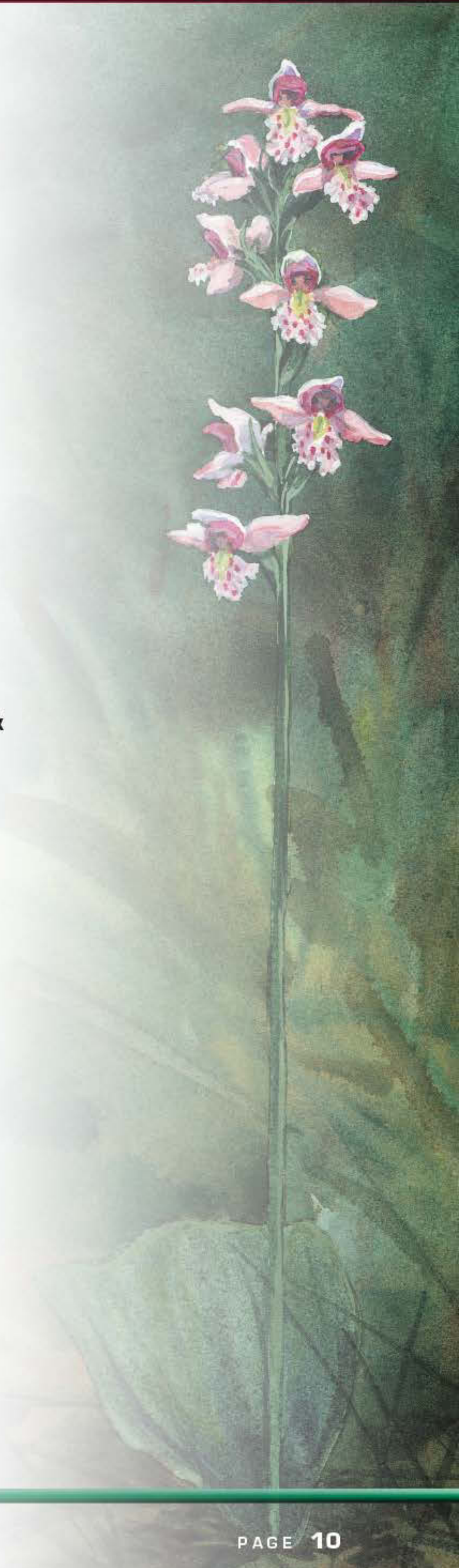
2 Naked Miterwort

3 Gold Thread

CEDAR SWAMP

Scientific Name	Common Name	S-Rank
Amerorchis rotundifolia	Round-Leaved Orchis	S1
Aster borealis	Rush Aster	S2
Calypso bulbosa var. americana	Fairy Slipper	S2
Carex diandra	Lesser Tussock Sedge	S3
Carex gynocrates	Northern Bog Sedge	S2
Carex livida	Livid Sedge	S1
Carex prairea	Prairie Sedge	S2
Carex tenuiflora	Sparse-Flowered Sedge	S2
Carex vaginata	Sheathed Sedge	S2
Corallorhiza striata	Striped Coralroot	SH
Cypripedium pubescens	Yellow Lady's-Slipper	S3
Cypripedium reginae	Showy Lady's-Slipper	S2
Lonicera oblongifolia	Swamp Fly-Honeysuckle	S2S3
Botrychium oneidense	Blunt-Lobe Grape-Fern	S1
Epilobium strictum	Downy Willowherb	S2
Galium kamtschaticum	Northern Wild Licorice	S2
Galium labradoricum	Labrador Bedstraw	S2
Listera auriculata	Auricled Twayblade	S2
Listera convallarioides	Broad-Lipped Twayblade	S3
Listera cordata	Heart-Leaved Twayblade	S3
Malaxis monophylla	White Adder's-Mouth	S1
Polemonium vanbruntiae	Jacob's-Ladder	SX
Pyrola minor	Lesser Pyrola	S3
Ranunculus lapponicus	Lapland Buttercup	S1
Viola nephrophylla	Kidney-Leaved Violet	S3
Valeriana dioica var. sylvatica	Wood Valerian	S1
Valeriana uliginosa	Marsh Valerian	S2





Older Growth White Pine Stands

IMPORTANCE: For hundreds of years, large white pine stands have been commercially targeted. Many white pine stands are relatively young. There is one R/E plant (Giant Pinedrops) that has a close association with the older growth (90+ years) stands. Since there are so few 90+ year stands, they require special attention.

Enduring Features	Medium slope, rapidly drained, poor bedrock
Dominant Canopy	White Pine 70-90% Large diameter with large crowns (90+ Years)
Other Associates	Hemlock, black spruce, balsam fir
Prominent Shrub Species	Blueberry
Prominent herbaceous species	There is a scarce amount of understory vegetation, due largely to the acidity of the soil.

R/E PLANTS OF OLDER GROWTH WHITE PINE STANDS

Scientific Name	Common Name	S-Rank
Pterospora andromedea	Giant Pinedrops	S1

Giant Pinedrops

Tolerant Hardwood Cove Forest

IMPORTANCE: A Tolerant Hardwood Cove Forests is a potentially critical plant habitat because of its exceptional soil richness, sustained soil moisture and relative warm temperature. Sheltered depressions with a minimum area of 0.25 hectares. The depression acts as a funnel, channeling the nutrient-rich water into a small area. Protection from the wind, by the hillside, creates a warmer micro-climate within the hardwood forest.

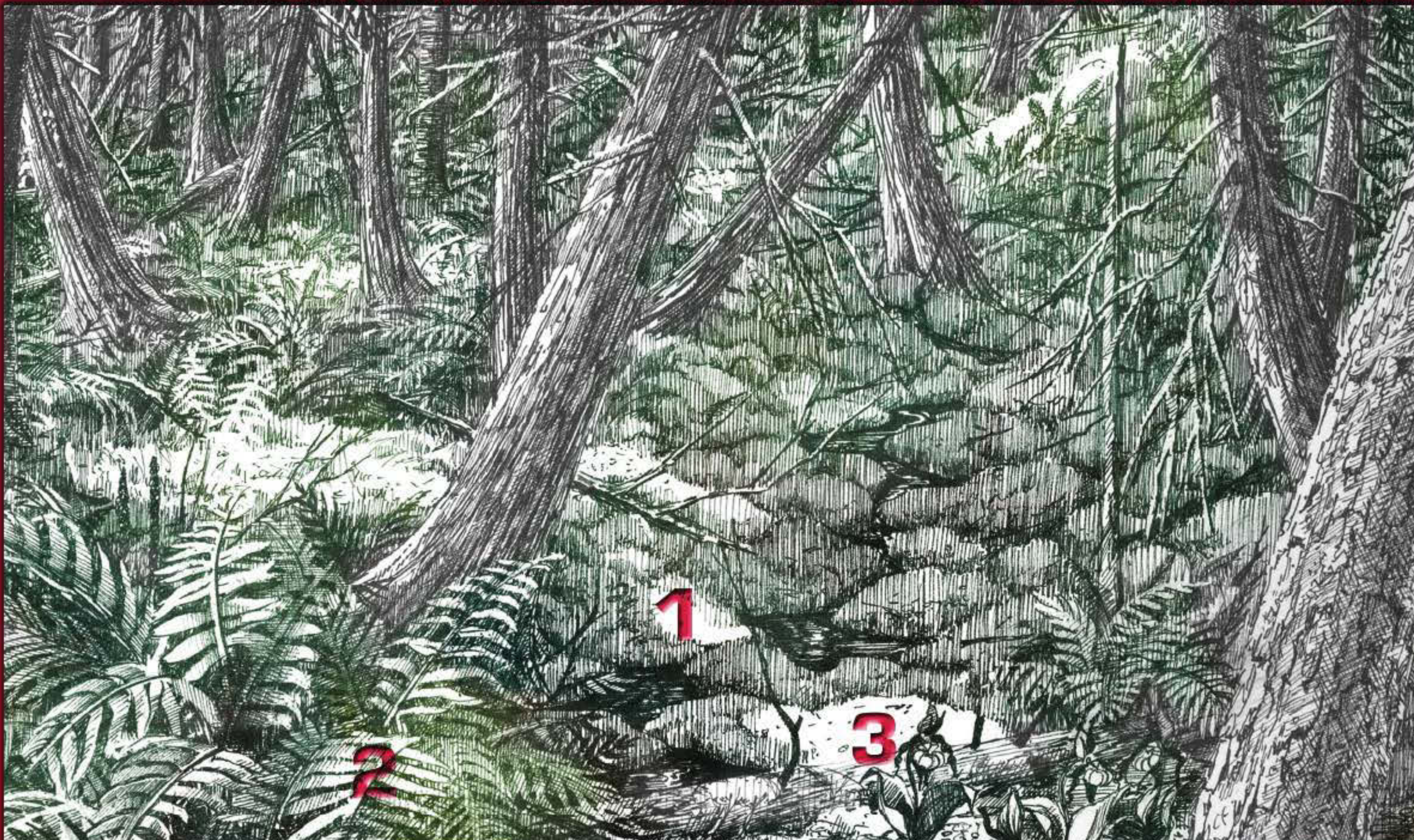
1 Blood Root

2 Dutchman's Breeches

Enduring Features	Medium to strong slope, depression in slope, or foot of slope on calcareous bedrock.
Dominant Canopy	**Large, tall trees**: Sugar maple (40%), yellow birch (40%), Hemlock, White Ash, Basswood (20%) Mature / Over-mature Age Class
Canopy Closure	90%
Prominent Shrub Species	Hobblebush, striped maple
Prominent herbaceous species	There is an abundant amount of diverse understory vegetation which likely contains: Indian cucumber root *(June-July)*, rose twisted stalk *(late May & early June)*, purple trillium *(late May - mid June)*, dutchman's breeches *(mid May - mid June)*, enchanter's nightshade *(mid June - September)*, soloman's seal (polygonatum pubescens) *(June)*, oak fern, Virginia grape fern, jack-in-the pulpit *(mid May - early July)*, zig zag golden rod *(August - September)*

TOLERANT HARDWOOD COVE FOREST

Scientific Name	Common Name	S-Rank
Agrimonia gryposepala	Hooked Agrimony	S3
Botrychium dissectum	Cutleaf Grape-Fern	S3
Botrychium lanceolatum	Lanced-Leaved Grape Fern	S3
Cardamine concatenata	Cutleaf Toothwort	S1
Carex cephaloidea	Thinleaf Sedge	S1
Carex hirtifolia	Pubescent Sedge	S1
Carex ormostachya	Necklace Sedge	S2
Carex plantaginea	Plantain-Leaved Sedge	S2
Carex rosea	Rosy Sedge	S3
Caulophyllum thalictroides	Blue Cohosh	S3
Coeloglossum viride var. virescens	Frog-Orchis	S2
Corallorrhiza maculata	Spotted Coral-Root	S3S4S3
Corallorrhiza striata	Striped Coral-Root	S1SX?SH
Cynoglossum virginianum var. boreale	Northern Wild Comfrey	S2
Cypripedium pubescens	Variety of Yellow Ladyslipper	S3
Desmodium glutinosum	Large Tick-Trefoil	S1
Dryopteris clintoniana	Clinton's Shield-Fern	S1
Dryopteris filix-mas	Male Fern	S1
Dryopteris goldiana	Goldie's Fern	S3
Galearis spectabilis	Showy Orchis	S1
Goodyera oblongifolia	Giant Rattlesnake-Plantain	S1S2
Goodyera tesselata	Tesselated Rattlesnake-Plantain	S3
Hepatica nobilis var. obtusa	Round-Leaved Hepatica	S2
Hieracium paniculatum	Panicled Hawkweed	S1
Impatiens pallida	Pale Touch-Me-Not	S1
Panax trifolius	Dwarf Ginseng	S3
Pedicularis canadensis	Wood-Betony	S1
Platanthera hookeri	Hooker's Orchid	S3
Platanthera orbiculata var. macrophylla	Large Round-Leaved Orchid	S1
Platanthera orbiculata var. orbiculata	Round-Leaved Orchid	S3
Polygala paucifolia	Fringed Polygala	S2
Polystichum braunii	Braun's Holly Fern	S3
Rubus occidentalis	Black Raspberry	S2
Sanicula trifoliata	Snakeroot	S1
Verbena urticifolia	White Vervain	S2
Viola canadensis	Canada-Violet	S1S2
Waldsteinia fragarioides	Barren Strawberry	S1



Cedar Seeps

IMPORTANCE: Cedar seeps are pockets of cedar within a coniferous forest that are saturated by a cold groundwater source. The shrub layer is generally sparse, with the ground layer consisting mainly of sphagnum moss. The moist environment, calcium-laden groundwater and low light conditions, make cedar seeps favourable to many R/E plants.

1 Sphagnum Moss

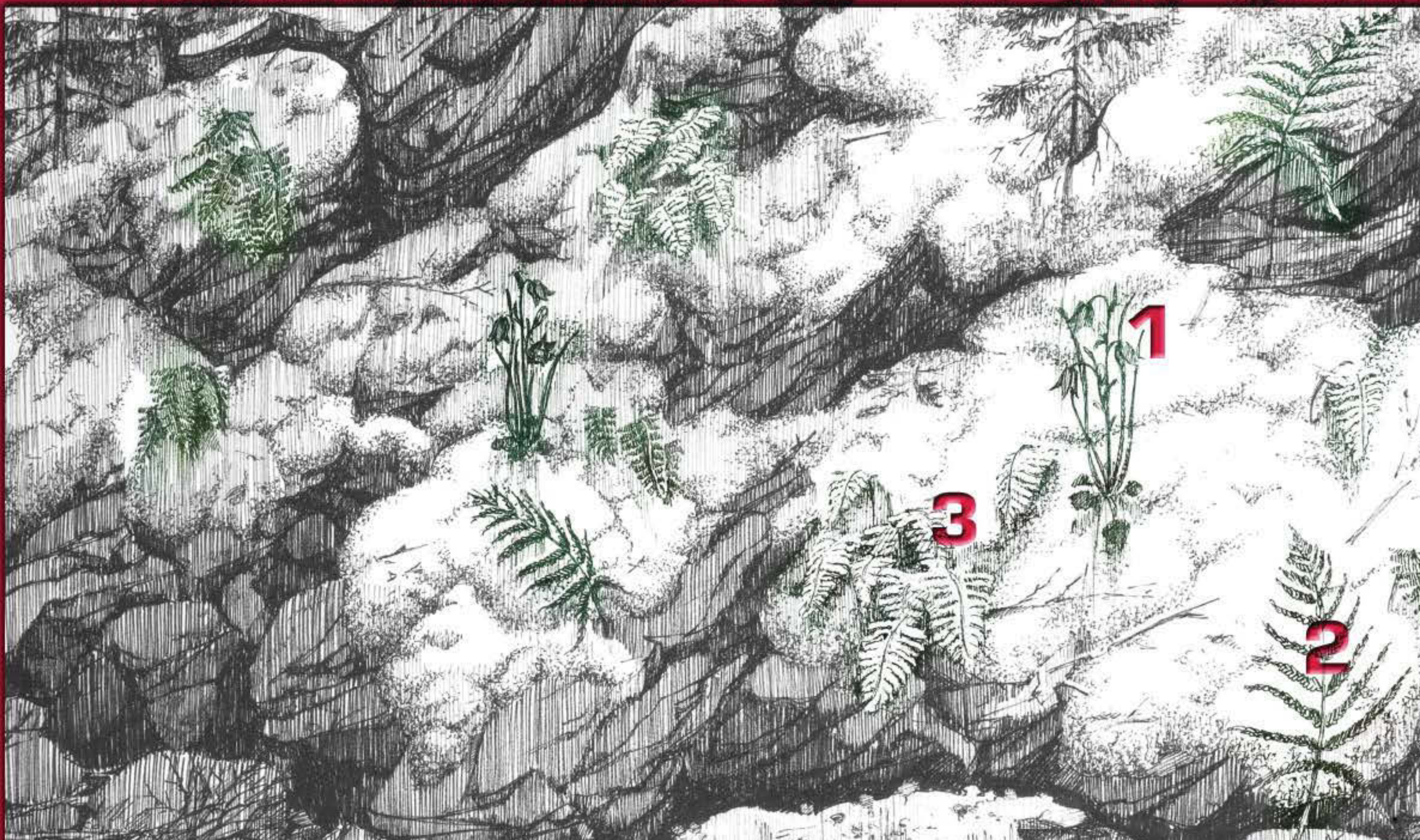
2 Cinnamon Fern

Enduring Features	Gently sloped, open water source, poorly drained, rich bedrock
Dominant Canopy	Cedar (80%), black spruce (10%), balsam fir (10%) Mature / Over-mature Age Class
Other Associates	Black ash
Canopy Closure	60-80%
Prominent herbaceous species	There is a scarce amount of understory vegetation which likely will contain the following species: Grass, sphagnum moss, mnium moss, step moss, wild raisin, yellow lady slipper

3 Yellow Lady Slipper

CEDAR SEEPS

Scientific Name	Common Name	S-Rank
Amerorchis rotundifolia	Round-Leaved Orchis	S1
Aster borealis	Rush Aster	S2
Calypso bulbosa var. americana	Fairy Slipper	S2
Carex diandra	Lesser Tussock Sedge	S3
Carex gynocrates	Northern Bog Sedge	S2
Carex livida	Livid Sedge	S1
Carex prairea	Prairie Sedge	S2
Carex tenuiflora	Sparse-Flowered Sedge	S2
Carex vaginata	Sheathed Sedge	S2
Corallorhiza striata	Striped Coralroot	SH
Cypripedium pubescens	Yellow Lady's-Slipper	S3
Cypripedium reginae	Showy Lady's-Slipper	S2
Lonicera oblongifolia	Swamp Fly-Honeysuckle	S2S3
Botrychium oneidense	Blunt-Lobe Grape-Fern	S1
Epilobium strictum	Downy Willowherb	S2
Galium kamtschaticum	Northern Wild Licorice	S2
Galium labradoricum	Labrador Bedstraw	S2
Listera auriculata	Auricled Twayblade	S2
Listera convallarioides	Broad-Lipped Twayblade	S3
Listera cordata	Heart-Leaved Twayblade	S3
Malaxis monophylla	White Adder's-Mouth	S1
Polemonium vanbruntiae	Jacob's-Ladder	SX
Pyrola minor	Lesser Pyrola	S3
Ranunculus lapponicus	Lapland Buttercup	S1
Viola nephrophylla	Kidney-Leaved Violet	S3
Valeriana dioica var. sylvatica	Wood Valerian	S1
Valeriana uliginosa	Marsh Valerian	S2

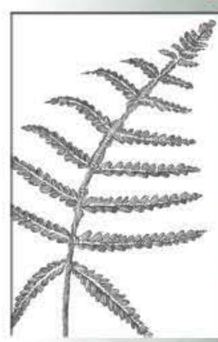


Cliff Ledge (moist and dry ledges)

IMPORTANCE: Cliff ledges on either calcareous or non-calcareous bedrock have a high association potential with some R/E plants. The harsh conditions (ie lack of soil) reduces competition from common species for many R/E plants. Moist, shaded cliffs of rich bedrock will usually host more R/E plants than those on dry, exposed, poor bedrock.

Enduring Features	Exposed rock outcrop. Extreme slope
Dominant Canopy	White birch, spruce
Other Associates	Balsam fir
Prominent Shrub Species	blueberry, mountain ash
Prominent herbaceous species	There is a scarce amount of understory vegetation which likely will contain the following species: Rock polypody fern, sedges, beech fern, lichens, and bluebells

1 Harebells



2 Beech Fern

3 Rock Polypody

CLIFF LEDGE

Scientific Name	Common Name	S-Rank
Agrostis mertensii	Arctic Bentgrass	S1
Anemone multifida	Hudson Bay Anemone	S2
Anemone parviflora	Small-Flowered Anemone	S2
Arabis x divaricarpa	Hairy Rock-Cress	S1
Arnica lonchophylla	Northern Arnica	S1
Arnica lonchophylla ssp. lonchophylla	Northern Arnica	S1
Asplenium trichomanes	Maidenhair Spleenwort	S1S2
Asplenium trichomanes-ramosum	Green Spleenwort	S3
Botrychium minganense	Mingan Moonwort	S1
Carex backii	Rocky Mountain Sedge	S1
Carex concinna	Beautiful Sedge	S2
Carex norvegica	Scandinavian Sedge	S1
Carex norvegica ssp. inferalpina	Intermediate Sedge	S1
Carex scirpoidea	Bulrush Sedge	S1
Cryptogramma stelleri	Fragile Rockbrake	S3
Cypripedium parviflorum	Small Yellow Lady's-Slipper	S2
Draba arabisans	Rock Whitlow-Grass	S1
Draba cana	Hoary Draba	S1
Draba glabella	Rock Whitlow-Grass	S1
Dryas integrifolia	Entire-Leaved Mountain-Avens	S1
Dryopteris fragrans	Fragrant Cliff Wood-Fern	S3
Gentianella amarella ssp. acuta	Northern Gentian	S2
Gymnocarpium jessoense ssp. parvulum	Northern Oak Fern	S1
Gymnocarpium robertianum	Limestone Oak Fern	S1
Hackelia deflexa var. americana	Norhtern Stickseed	S1
Oxytropis deflexa var. foliolosa	Pendent-Pod Crazyweed	S1
Pinguicula vulgaris	Common Butterwort	S1
Poa glauca ssp. glaucantha	Mountain Meadow Bluegrass	S2
Polygala senega	Seneca Snakeroot	S2
Rhynchospora capillacea	Horned Beakrush	S1
Salix myrtillifolia	Myrtle-Leaf Willow	S1
Saxifraga paniculata	White Mountain-Saxifrage	S1
Saxifraga virginiensis	Virginia Saxifrage	S1
Selaginella selaginoides	Low Spike-Moss	S1S2
Solidago multiradiata	Alpine Goldenrod	S1
Solidago simplex ssp. randii	Mountain Goldenrod	S1S2
Woodsia alpina	Northern Woodsia	S2
Woodsia glabella	Smooth Woodsia	S2S3

Cliff Talus Slope - dry and moist talus

IMPORTANCE: Talus is an accumulation of rock debris at the base of cliffs and escarpments. It includes loose boulders, cobble, and sometimes gravel and finer sediment. Talus slopes under shaded (moist) and rich bedrock conditions may provide habitat for some R/E plants, as runoff bedrock nutrients gather at the base of the cliff. Exposed (dry), poor bedrock conditions creates an environment for few R/E plants.

Enduring Features	High slope, rapidly drained
Dominant Canopy	Red spruce, balsam fir, white birch
Other Associates	Yellow birch, balsam fir
Canopy Closure	Moist - 40% , Dry – 20%
Prominent Shrub Species	There is a scarce amount of shrub vegetation which likely will contain the following species: blueberry, sumac
Prominent vegitation	Dry – lichens Moist – bracken fern,wood fern

Wood Fern Purple Clematis on birch

CLIFF LEDGE

Scientific Name	Common Name	S-Rank
Cardamine parviflora	Small–Flower Bitter-cress	S1
Polypodium appalachianum	Appalachian Polypody	S3S4
Rosa acicularis	Prickly Rose	S1SE?
Selaginella rupestris	Ledge Spike-Moss	S1

NOTES:

Tolerant Hardwood Forests (Non Calcareous)

IMPORTANCE: This type of forest tends to occur on well-drained sites. Lacking calcareous bedrock, the nutrient level in this stand is often less than desirable for most R/E plants, but depressions in the forest floor retain higher than normal moisture levels and nutrients. These depressions create small habitat pockets, contributing to an ideal location for many different types of flora, which include some R/E species.

Enduring Features	Medium slope, well-drained, and medium-rich soil
Dominant Canopy	Sugar maple, beech, yellow birch (80%+ in any combination) (Mature/Over-mature Age Class)
Canopy Closure	75-80%
Other Associated Tree Species	Hemlock, white pine, red spruce
Prominent Shrub Species	Striped maple, hobblebush, fly honeysuckle.
Prominent herbaceous species	There is a moderate amount of understory vegetation which likely will contain the following species: Indian cucumber root, false-lily of the valley, shining clubmoss, wood ferns, starflower, partridge berry, rose twisted stalk, and purple trillium

R/E Plants of Tolerant Hardwood Forests (Non Calcareous)

Scientific Name	Common Name	S-Rank
Antennaria parlinii *	A Pussytoes	S1
Carex ormostachya	Necklace Sedge	S2
Clematis occidentalis *	Purple Clematis	S3
Coeloglossum viride var. virescens	Long-Bract Green Orchis	S2
Corallorhiza maculata	Spotted Coralroot	S3
Goodyera tesselata	Tesselated Rattlesnake Plantain	S3
Panax trifolius	Dwarf Ginseng	S3
Hieracium paniculatum	Panicled Hawkweed	S1
Platanthera hookeri	Hooker's Orchid	S3
Platanthera orbiculata var. orbiculata	Round-Leaved Orchid	S3
Polygala paucifolia *	Fringed Polygala	S2
Polypodium appalachianum	Appalachian Polypody	S3S4
Polystichum braunii	Braun's Holly-Fern	S3
Pyrola americana *	Round-Leaved Pyrola	S3
Viburnum acerifolium *	Maple-Leaf Viburnum	S1

** Note: Antennaria parlinii, Clematis occidentalis, Polygala paucifolia (sometimes), Pyrola americana and Viburnum acerifolium are all species of drier stands. The tree species of drier sites may include largetooth aspen, red ample or red oak as co-dominants*

Black Spruce Non Calcareous Swamp

IMPORTANCE: Black Spruce Swamps are found in low-lying, poorly drained areas. These drainage and moisture conditions are favourable to certain R/E species.

Enduring Features	Flat, poorly drained organic soils, poor bedrock
Dominant Canopy	Softwood (Cedar/Black Spruce/Tamarack) is 70% dominant or contains a total of 70% in combination. (Mature/Over-mature Age Class)
Other Associated Tree Species	Balsam fir
Prominent Shrub Species	Sheep laurel,leatherleaf, bog laurel
Prominent herbaceous species	Pitcher plant, sundew, cranberries, cotton-grass

R/E Plant of Black Spruce (Non Calcareous) Swamp

Scientific Name	Common Name	S-Rank
Listera australis	Southern Twayblade	S1

NOTES:

Special Features

VERNAL POOLS – Vernal pools are naturally occurring, seasonal, semi-permanent or permanent bodies of water. They may be found in a variety of wetland settings or as isolated wetlands in an upland matrix. They provide breeding habitat for certain amphibians, reptiles, and invertebrates. Indicator species may include: spotted salamander, blue-spotted salamander, wood frog, and fairy shrimp. These sites are favourable to R/E plants because of the moist and usually shaded conditions.

Refer to Operations Manual for specific operational requirements.

Yellow Spotted Salamander

Wood Frog

Fairy Shrimp

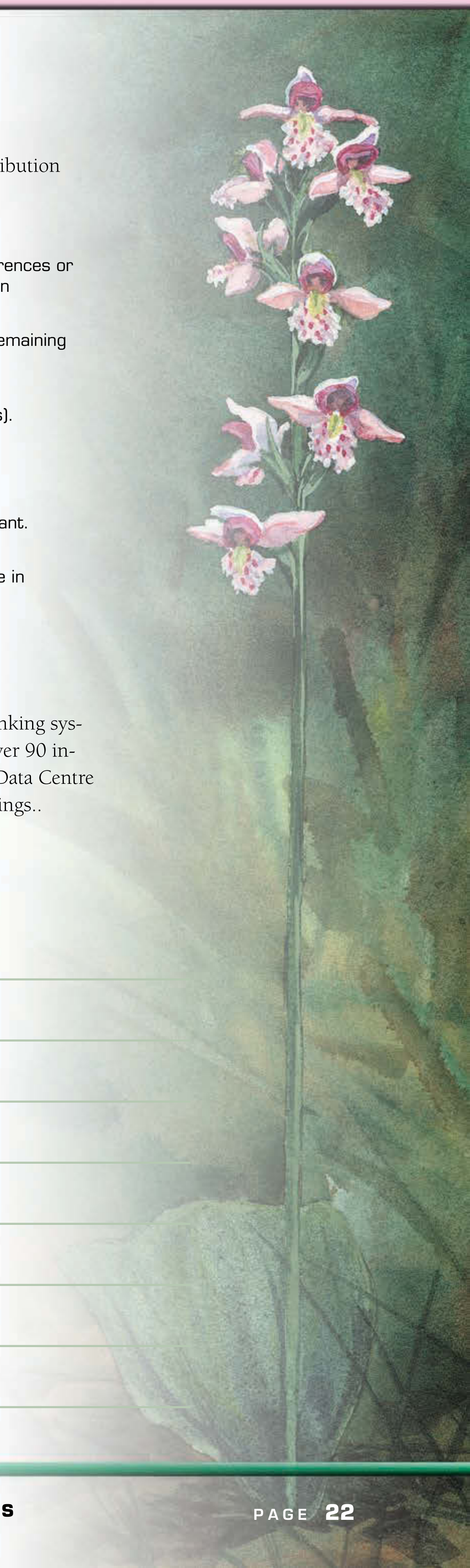
SPECIAL TREE SPECIES – Hemlock, Red oak, Burr oak, Ash (white/black). Check with your district forester about any possible harvesting restrictions/limitations placed on these species.

S-rank Coding System

The S-rank is an objective rarity designation, reflecting a plants' known distribution and abundance in New Brunswick

S1	Very rare throughout its range in the province (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation
S2	Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation.
S3	Uncommon throughout its range in the province (21 to 100 occurrences).
S4	Apparently secure in New Brunswick
S#S#	Numeric range rank. Denotes uncertainty about the exact rarity of the plant.
SE	An exotic species established in New Brunswick; may be native elsewhere in North America
SX	Extinct/Extirpated: Plant is believed to be extirpated in New Brunswick

The S-Rank coding system is part of a larger element (for flora and fauna) ranking system developed by The Nature Conservancy (TNC) and adopted for use in over 90 international Conservation Data Centres. The Atlantic Canada Conservation Data Centre (Sackville, New Brunswick) has provided this project with their official rankings..



NOTES:

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List of Rare and Endangered species provided by NB Committee on Rare and Endangered Species

IRVING

J.D. IRVING, LIMITED

Policy for Maintaining Late-Successional Forests on J.D. Irving, Limited Freehold Lands

JDI is very interested in maintaining a component of late-successional (older growth) stages of certain specific long-lived stand types within our management areas. These are important habitats for plant and animal species that rely on some large, and some dead and fallen trees, and multiple canopy layers for their population survival.

In the forests that JDI owns in New Brunswick, Nova Scotia and Maine; we are concerned about maintaining late-successional stages of five stand types where those stand types occur. These include:

- Old Tolerant Hardwood Stands,
- Old Tolerant Mixed Wood Stands,
- Old Cedar Stands,
- Old Pine / Hemlock Stands, and
- Old Softwood Stands.

JDI will manage our freehold lands with a long term objective to have at least 10% of the present area in each of these above-noted stand types in an "old" or "very old" condition. We will also actively manage to achieve 3% of the particular stand type area in a "very old" condition.

The criteria to ideally qualify as "old" or "very old" are described and summarized in the attached Table. These late-successional conditions are primarily found in areas that have received minimal forest harvesting activity, and might often be associated with inoperable areas, riparian zones, deer wintering areas, or other special habitats.

Our strategy to meet this objective is to identify and map those areas designated to be in these conditions over time. While we will initiate this work promptly, we do not expect to achieve this new objective overnight. We will report progress annually, with an intention to have sufficient area designated to meet the 7% "old" and 3% "very old" conditions by 2017. We plan for ongoing refinement and re-assessment of these important late-successional habitats; that will be mapped and documented in each Management Plan renewal.

- Blake Brunsdon - August 25, 2011.

R.P.

Stand Criteria to Meet "Old or Very Old" Conditions

Stand Type	Species	Composition	Basal Area	Age at "Old"	Age at "Very Old"	Min # of Stems per Ha (acre) ≥30 cm (12in)
Old Tolerant	Sugar maple, Yellow birch,Beech, Oak (all species), Ash (all species)	> 70% hardwood volume	>18m²/ha (80ft²/ac)	≥100 years	≥150 years	≥60 stems / ha (≥24 stems / ac)
Old Tolerant Mixed Wood	Sugar maple, Yellow birch,Beech, Oak, Ash with an additional component of Spruce, Pine, Cedar and Hemlock	> 30% hardwood volume	>18m²/ha (80ft²/ac)	≥!00 years for hardwoods ≥75 years for conifers	≥150 years for hardwoods, ≥100 years for conifers	≥60 stems / ha (≥24 stems / ac)
Old Cedar	Cedar	>50% softwoods of which cedar should comprise >30%	>18m²/ha (80ft²/ac)	≥75 years	≥100 years	≥10 stems / ha (≥4 stems / ac)
Old Pine - Hemlock	Pine and Hemlock	> 50% softwoods of which Pine and Hemlock should comprise > 30% of the volume	>18m²/ha (80ft²/ac)	≥75 years	≥125 years	≥20 stems / ha (≥8 stems / ac)
Old Softwood	Spruce, Fir, Cedar and Pine	>70% softwood and do not meet the criteria of old Cedar or old Pine / Hemlock	>18m²/ha (80ft²/ac)	≥75 years	≥100 years	≥20 stems / ha (≥8 stems / ac)

August 25/11

R. Pirette

IRVING
J.D. IRVING, LIMITED

Policy to Control Invasive Woodland Species on J.D. Irving, Limited Freehold Lands

(Revised August 1, 2012)

Approved by: ROBERT PINETTE R. Pinette

In an effort to control the spread of woodland invasive plant species on J. D. Irving, Limited freehold lands, we will take the following measures:

- All species of fish and wildlife stocked or introduced through JDI's fisheries and wildlife management programs will be approved by the Company's Manager of Fish & Wildlife.
- All species of trees planted in JDI's silviculture program will be approved by the Company's Silviculture Manager.
- All soil stabilization and wildlife seed mixes shall contain species approved by the Manager of Fish and Wildlife.
- Training to recognize designated woodland invasive plant species of concern will be incorporated into JDI's annual Rare Plant Pre-screening training sessions.
- JDI districts will notify the Manager of Fish and Wildlife of locations (on JDI lands) where we have observed the occurrence of noxious woodland invasive plant species of particular concern.
- JDI's Manager of Fish and Wildlife will determine appropriate eradication / control measures (when applicable) and oversee their implementation.
- The success of eradication / control measures undertaken will be appropriately evaluated and reported to interested regulatory organizations

J.D. IRVING, LIMITED

Policy for Maintaining Diversity in Harvested Areas

(Revised March 4, 2013)

Maintaining adequate vertical structure and protecting special habitats such as vernal pools and stick nests in order to provide wildlife habitat, conserve native biodiversity and as sources of coarse woody debris are prime concerns in management planning and during harvesting operations. The information contained in this policy will aid field staff in identifying critical habitat features and determining retention areas that should be maintained in harvested areas.

Maintaining Vertical Structure (Islands)

Retention of vertical structure is particularly important when a management block is scheduled for an even aged harvesting treatment which will remove all of the current overstory in a single pass (clearcut) or in several successive, closely timed operations (overstory removal, two-pass, shelterwood, or commercial thinning) .

Applicability:
All harvest areas with clearcut, overstory removal, two-pass, shelterwood or commercial thinning prescriptions with length and width dimensions exceeding 200 meters (660 ft.).

Number of Islands per Harvested Area:
0 – 10 ha (0 – 25acres) ……. No island is specifically required (however islands, clumps and Legacy Trees should be left as good opportunities present themselves).
> 10 ha (25 acres) ….. ………At least one island is required for each 10 ha (25 acres) of harvested area.

Island Size:
Ideal island size of 0.2 ha (0.5 acres).
Islands smaller than 0.2 ha (0.5 acres) in size and clumps around Legacy Trees etc. may be left; however the total island area must be in excess of 0.2 ha (0.5 acres) for every 10 ha (25 acres) of even-aged management area in order to be in conformance with this Policy.

Island Composition:
Unless the island is focused around unique or outstanding feature, composition should be typical of the block prior to harvesting and should consist of wind-firm trees.

Location:
Islands should be distributed throughout the block however; their location and placement should take advantage of natural and biological features where possible such as:

- Vernal pools
- Wet areas and riparian zones within the block perimeter
- Rocky and steep inoperable areas
- Areas containing uncommon tree species
- Legacy Trees (see following)
- Rare plant areas.

Islands can be located to provide visual screening on hills and adjacent to roads.
In larger harvested areas, several small islands can be joined to protect a significant wildlife habitat or natural feature such as a larger vernal pool as long as the total island area for the block meets the retention area size criteria.
If islands encompassing vernal pools or wetlands are reasonably close to the block boundary, attempts should be made to connect them to the adjacent forest, turning them into peninsulas.

Legacy Tree

A legacy tree is an outstanding live, rare individual tree which provides critical wildlife habitat and has a very high conservation value. These might include:

- Large hollow trees which are providing wildlife dens (Figure 1)
- Trees with decay exhibiting heavy use by cavity excavating birds.
- Trees well outside their normal size, age or distribution range (Figure 2)

Legacy trees should be left standing. In even-aged harvesting prescriptions, legacy trees could form the nucleus of an island. If legacy trees are located near the edge of the block boundary or an adjacent riparian zone, small adjustments to the block boundary should be made to incorporate the legacy tree into the retention zone.

Figure1. Chimney swift colony tree

Figure 2.Oversized smooth-bark Beech

Vernal Pools

A vernal pool, also referred to as a seasonal forest pool, is a natural, temporary to semi-permanent body of water occurring in a shallow depression that typically fills during snow melt in the spring or during fall rains and may be dry for some periods during the summer. They are usually less than 0.2 ha (0.5 acres) in area and less than 1.0 meter (3 ft.) deep, have no permanent inlets or outlets and no predatory fish populations. Standing water on the forest floor from heavy rain or snow melt may not constitute a vernal pool and not all vernal pool habitats are considered "significant". A vernal pool is "significant" habitat if it provides critical breeding habitat for spotted salamanders, blue spotted salamanders, wood frogs or fairy shrimp, or is valuable habitat for any other S1 to S3 ranked plant or animal species. (Block layout staff and harvesting contractors will receive training to help them identify "significant vernal pools". One staff member from each district will receive supplemental training in vernal pool identification and will be the "district expert" in identifying and designating "significant vernal pools".)

The following Best Practices should apply when a potential **"significant vernal pool**" has been discovered:

- Staff and contractors discovering what they feel might be a "significant vernal pool" must back machinery 30 m (100 ft.) away from the pool boundary and call their supervisor for instructions.
- All potential "significant vernal pools" should be given a temporary buffer of 30 meters (100 ft.).
- These potential "significant vernal pools" should be promptly assessed to determine if they really are "significant" by the trained "district expert", or JDI wildlife expert staff.
- If a potential "significant vernal pool" is discovered during the winter it is not possible to determine if it is "significant" then it should be buffered and treated as a "significant vernal pool" until it can be properly assessed the following spring.
- If a potential "significant vernal pool" is determined to be **not significant,** it may be disregarded (note: depending on size

and connection to adjacent watercourses and wetlands, government regulations may apply. J D Irving, Limited rutting guidelines also are applicable).

The following Best Practices will apply once a pool has been determined to be a “**significant vernal pool**”:

- “Significant vernal pools” will receive a 30 meter (100 ft.) buffer with a 15 meter (50 ft.) machine exclusion zone from the outer edge of the pool.
- Harvesting within the 30 meter (100 ft.) zone will be limited to a 30% volume removal to a minimum basal area of 18 m^2 / ha. (80 ft^2/ac). Snags and standing dead and dying trees should be left standing.
- Rutting should be minimized within the 30 meter (100 ft.) buffer zone.
- Understory vegetation and downed woody debris should be maintained.
- If a “significant vernal pool” located in a harvest block with a clearcut prescription is close to the block edge, attempts should be made to connect it to the adjacent forest (Figure 2).

Figure 2. In a clearcut harvest, “significant vernal pools” located close to the block boundary should be connected to the adjacent standing timber.

The following photos are examples of “significant vernal pools”:

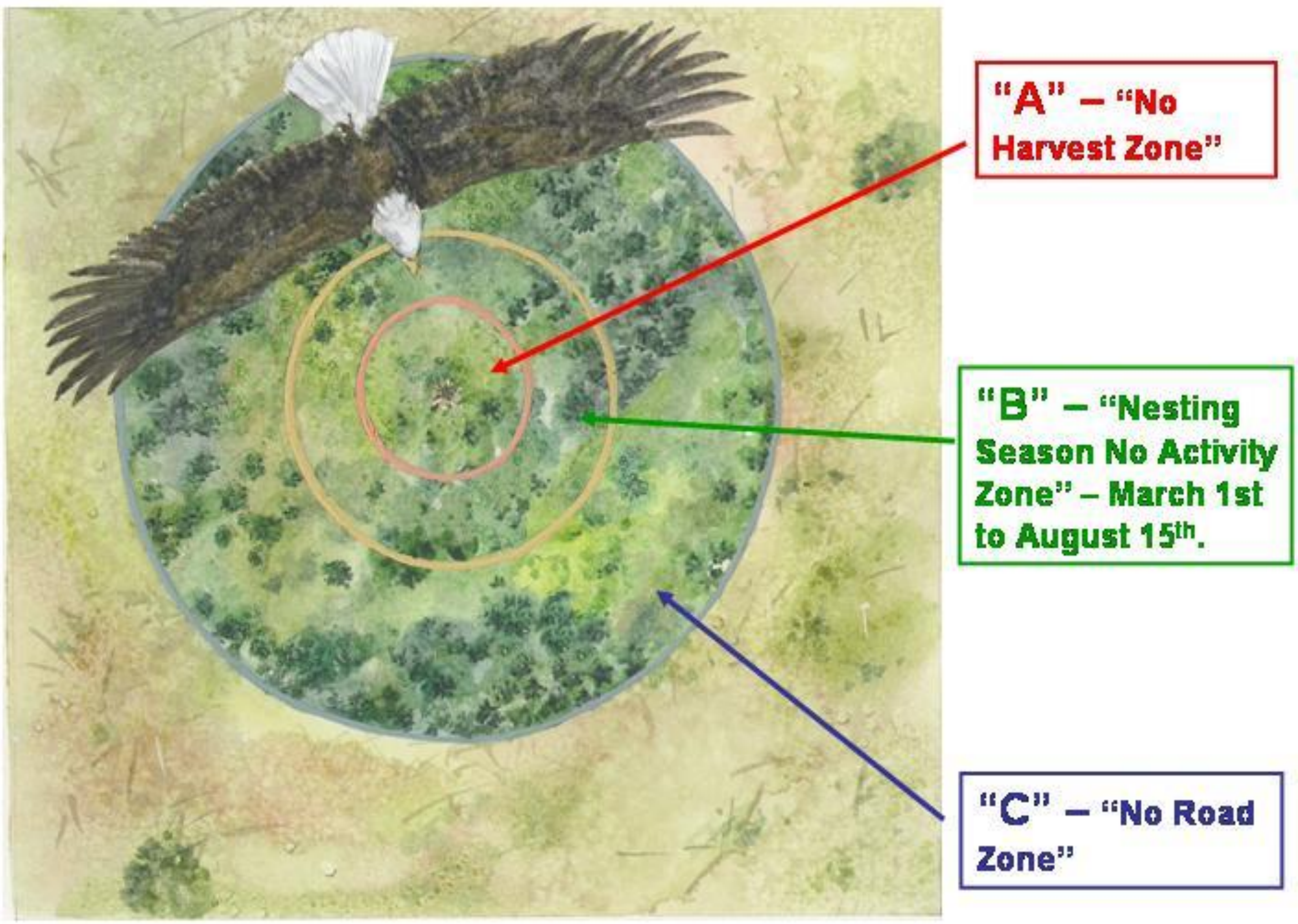
Protection of Raptor and Heron Stick Nests

General:

1. When a tree containing a large stick nest is encountered before or during harvesting operations, attempt to determine the species of bird utilizing the nest. If the species can be positively identified apply the stick nest guidelines (see accompanying table and diagram) and notify the Company Naturalist of the site and your actions.
2. If the stick nest is positively identified as a Bald Eagle or heron nest, or if the species or colony cannot be identified, or you are unsure of the appropriate course of action, stop operations, back machinery at least 400 m (1320 feet) away from the nest or perimeter of the colony and call your immediate supervisor. In addition, please notify the Company Naturalist or Manager of Fish & Wildlife of your actions.

Exception for Maine:

- In Maine, activities around Heron colonies and Bald Eagles nests are regulated by the Maine Department of Inland Fisheries and Wildlife (MDIFW). If a stick nest is positively identified as a Heron or Bald Eagle or if you are unsure of the species, harvesting crews or supervisors should take the steps outlined in General Policy #2 above and, in addition, contact MDIFW. **Do not** apply the buffering standards for Herons or Bald Eagles from the attached table. MDIFW will make the necessary recommendations pertaining to harvest treatment around the nest or colony.


"A" – "No Harvest Zone"
"B" – "Nesting Season No Activity Zone" – March 1st to August 15th.
"C" – "No Road Zone"

RAPTOR & HERON NEST BUFFERING STANDARDS

Species	Nest Type	Buffer Type					
		"A"		"B"		"C"	
		No Harvest Zone (m)		Nesting Season No-Activity Zone from March 1st to August 15th		No-Roads Zone (m)	
		50	100	≥ 100	≥ 200	≥ 100	≥ 400
Bald Eagle	Stick		✓		✓		✓
Peregrine Falcon	Cliff		✓		✓		✓
Cooper's Hawk	Stick		✓		✓	✓	
Red Shouldered Hawk	Stick		✓		✓	✓	
Long-eared Owl	Stick		✓		✓	✓	
Boreal Owl	Cavity		✓		✓	✓	
Hawk Owl	Stick		✓		✓	✓	
Heron (All Species)	Stick		✓		✓		✓
Sharp-shinned Hawk	Stick	✓		✓		✓	
Northern Goshawk	Stick	✓		✓		✓	
Red-Tailed Hawk	Stick	✓		✓		✓	
Broad-winged Hawk	Stick	✓		✓		✓	
Barred Owl	Cavity	✓		✓		✓	
Northern Saw-whet Owl	Cavity	✓		✓		✓	
Osprey	Stick	✓		✓		✓	
American Kestrel	Cavity	✓		✓		✓	
Merlin	Stick	✓		✓		✓	
Great Horned Owl	Stick	✓		✓		✓	

Stick Nesting Bird Identification Guide

Merlin

(F&young brown above Male:Blue-grey) Pointed wings.10-13"

Amer. Kestrel

"Moustached" Pointed wings 9-12"

Credit: USDA Forest Service

Broad-winged Hawk

B&W tail bands are equal width. White chin patch. 14-19" (crow-sized)

Credit: Gaston Chevalier

Peregrine Falcon

"Moustached" M&F adults are blue-grey above. Pointed wings

15-20"

Coopers Hawk

Similar to "Sharpie" but with larger head and longer

14-20"

Osprey

Often flies with bent "wrist". Hovers before plunging feet first in water.

21-24"

Northern Hawk Owl

A day-flying owl. Completely barred under parts and long tail.

14-17"

Credit: Ken Fineberg/USFWS

Red-shouldered Hawk

Rusty red "shoulders" on top and sometimes under.

17-24"

N. Goshawk

Adult pale grey-blue

White stripe over eye.

20-26"

Credit: Washington DF&W

Stick Nesting Bird Identification Guide

Bald Eagle (Adult)
30-43" length

Sharp-shinned Hawk
Small head. Narrow, square tipped tail
10-14"
Credit: State of Utah Natural Resources

Great Blue Heron

Red-tailed Hawk.
Adult has rusty-red tail
19-25"

Boreal Owl
Black facial ring.
9-10"

Great Horned Owl.
White throat bib.
18-25"

Northern Saw-whet Owl.
7-8.5"

Barred Owl
Black facial ring.
17-24"

Long-eared Owl
More slender than GH Owl. Ear tufts closer together than GH Owl 13-16"

Internal Training Document for Educational Purposes Only

J. D. IRVING, LIMITED

TO: **Regional Managers**
District Superintendents
District Foresters

FROM: Blake Brunsdon and John Gilbert

COPY: *R. Pinette*

DATE: April 12, 2004

SUBJECT*: *Rare Plant Pre-screening Policy

Attached is our Rare Plant Pre-screening Policy, finalized after comments and suggestions received from your districts. **This policy will take effect April 1, 2004.**

Certification under SFI requires our company to have a credible program to pre-screen for rare plants.

Rare Plant Pre-screening Guidelines (N.B. & N.S.) or third party agreement (Maine) and associated training programs have been developed. They must be implemented as per the attached **"Policy For The Detection Of Rare And Endangered Plant Habitats"**

Please carefully review this new policy with your relevant staff and ensure that we are in full compliance at all times.

Blake Brunsdon

John Gilbert

Woodlands Division
300 Union Street, Saint John, New Brunswick E2L 4M3
Telephone: (506) 632-7777 Fax: (506) 632-4421

Policy for the Detection of Rare and Endangered Plant Habitats

Provincial, state and federal jurisdictions all require provisions for the protection of rare and endangered species and their habitats. J. D. Irving, Limited has developed a program to pre-screen for these plants and their habitats prior to forest management activities. Differences in the availability of ecological and geological information in Nova Scotia, New Brunswick and Maine have necessitated the development of three different delivery systems for pre-screening rare and endangered plant habitats:

New Brunswick:

- A Guidebook "Identification of Potential Habitats for Rare and Endangered Plants" has been developed for each District and Sub-District and should be used as the principle identification key and training reference.

- A rare plant habitat probability of occurrence (risk) map has been developed for each district and defines the land areas that best coincide with described habitats of grouped rare and endangered plants.

- During operating plan development, rare and endangered plant habitat risk maps must be consulted to determine if harvest blocks or road right-of-ways intersect with red or yellow coded areas.

- Red coded habitat indicates high association potential within a district. **Do not operate within these areas without first having a detailed survey made by someone suitably trained in plant identification.**

Yellow coded habitat indicates a moderate association potential. Prior to a pre-harvest inspection or block layout site visit, the harvesting supervisor should review the GIS stand attributes and consult the districts guidebook for "Identification of Potential Habitats for Rare and Endangered Plants" to evaluate the likelihood of encountering rare plant habitats on the block and be aware of the types of indicator plants that might be encountered. If the pre-harvest site visit reveals small areas with a high potential for rare plants these should be incorporated into islands or expanded riparian zones. If large areas of the block show high potential for rare plant habitat or if any rare plants are encountered, the company naturalist should be contacted.

- Both red and yellow coded areas require a site visit prior to operating the block. Site visits must occur during the months of June, July or August when leaves and flowers make the plants easier to identify.

- When performing pre-harvest site visits or block layout in areas not classified as red or yellow, staff should still be aware of the forest habitat types associated with rare plant habitats and indicator species, as outlined in the company guidebook. When any rare plants are detected, the company naturalist should be contacted to do a site assessment.

- Whenever a rare plant is detected, a management prescription for the site that will best suit the viability and sustainability of the plant population must be developed and implemented. Assistance with this task may be obtained from the company naturalist, if necessary. The management prescription should not necessarily default to "no harvest".

- A copy of the botanical survey, photos of the site as well as location data for all endangered species will then be entered into the Unique Areas Program database. The "unique" layer is incorporated into each district's operating plan.

- Cedar seeps, rock outcrops, talus slopes, cove forests and vernal pools are not included on the risk map. District staff should familiarize themselves with these types of potential high quality rare plant habitats described in the Guidebook.

- All harvesting supervisors and block layout personnel must have attended the company's rare plant training course and should plan on attending periodic updates.

Nova Scotia:

- A Guidebook " Identification of Potential Habitats for Rare and Endangered Plants" has been developed for both Truro and Weymouth sub-districts and should be used as the principle identification key and training reference.

- Inadequate site and soil data in Nova Scotia has made production of a risk map impossible at this time; however one will be developed as soon as the information is available. Field staff must rely on the company guidebook and training to identify important rare plant habitats.

- During pre-harvest site visits and block layout, staff should be on the lookout for forest habitat types associated with rare plant habitats and indicator species, as outlined in the company guidebook. If any rare plant is detected the company naturalist should be contacted to do a site assessment.

- Whenever a rare plant is detected, a management prescription for the site that will best suit the viability and sustainability of the plant population must be developed and implemented. Assistance with this task may be obtained from the company naturalist, if necessary. The management prescription should not necessarily default to "no harvest".

- A copy of the botanical survey, photos of the site as well as location data for all endangered species will be entered into the Unique Areas Program database. The "unique" layer is incorporated into each district's operating plan.

- All harvesting supervisors and block layout personnel must have attended the company's rare plant training course and should plan on attending periodic updates.

Maine:

- The Maine Natural Areas Program (MNAP) has developed a guidebook for Maine titled "Forest Community Guide" This should be used as the principle identification key and training reference.

- Inadequate site and soil data in Maine has made production of a risk map impossible at this time; however, one will be developed as soon as the information is available.

- The "Maine Natural Areas Program" has been contracted to perform rare plant and animal habitat prescreening. The current year's annual Operating Plan must be presented to the MNAP early enough in the calendar year to permit work plan development such that site visits occur during the critical months of June, July or August when plants are most easily identifiable.

- During pre-harvest site visits and block layout, staff should be on the lookout for forest habitat types associated with rare plant habitats and indicator species as outlined in the company guidebook. If any rare plant is detected, a company expert or MNAP staff member should be consulted to obtain their recommendations on the proposed prescription.

- Whenever a rare plant is detected, a management prescription for the site that will best suit the viability and sustainability of the plant population should be developed and implemented. Assistance with this task may be obtained from the company naturalist, if necessary. The management prescription should not necessarily default to "no harvest".

- A copy of the botanical survey, photos of the site as well as location data for all endangered species will be entered into the Unique Areas Program database. The "unique" layer is incorporated into each district's operating plan.

- All harvesting supervisors and block layout personnel must attend the company's rare plant training course and should plan on attending periodic updates.