Little River Pumping and Transmission System Project Environmental Assessment Registration

January 5, 2026

Prepared for:
Landrie Lake Water Utility c/o Town of Port Hawkesbury

Prepared by:
Stantec Consulting Ltd.

File Number:
121418143

Table of Contents

Acronyms / Abbreviations ..... **vi**

1 Introduction **1-1**
1.1 Project Information 1-1
1.2 Identification of the Proponent 1-1
1.3 Project Overview 1-2
1.4 Purpose and Need for the Project 1-3
1.5 Regulatory Framework 1-4

2 Project Description **2-1**
2.1 Project Location and Setting 2-1
2.2 Project Components 2-3
2.3 Construction Activities 2-7
2.3.1 Site Preparation 2-7
2.3.2 Water Transmission Pipeline Installation 2-7
2.3.3 Building Demolition 2-11
2.3.4 LRTP Construction 2-11
2.4 Pipeline Operation 2-11
2.5 Maintenance Activities 2-12
2.6 Decommissioning Activities 2-12
2.7 Project Schedule 2-12
2.8 Wastes and Emissions 2-13
2.9 Environmental Management 2-14

3 Engagement and Consultation **3-1**
3.1 The Mi'kmaq of Nova Scotia 3-1
3.2 Government and Regulatory Stakeholders 3-2
3.3 Stakeholders 3-3
3.4 Summary of Questions, Concerns and Comments 3-4
3.5 Ongoing Engagement 3-6

4 Environmental Assessment Scope and Methods **4-1**
4.1 Overall Approach 4-1
4.2 Scope of the Assessment 4-1
4.2.1 Scope of the Project 4-1
4.2.2 Selection of Valued Components 4-2
4.2.3 Assessment Boundaries 4-4
4.3 Potential Project Interactions 4-5
4.4 Mitigation and Management Measures 4-5
4.5 Residual Environmental Effects 4-6
4.6 Follow-up and Monitoring 4-6

5 Environmental Effects Assessment **5-1**
5.1 Atmospheric Environment 5-1
5.1.1 Regulatory Context 5-2
5.1.2 Existing Conditions 5-6
5.1.3 Potential Effect Pathways 5-11
5.1.4 Mitigation and Management Measures 5-12
5.1.5 Residual Environmental Effects 5-12
5.1.6 Follow-up and Monitoring Programs 5-13
5.2 Surface Water Resources 5-13
5.2.1 Regulatory Context 5-14

5.2.2 Existing Conditions 5-14
5.2.3 Potential Effect Pathways 5-31
5.2.4 Mitigation and Management Measures 5-31
5.2.5 Residual Environmental Effects 5-33
5.2.6 Follow-up and Monitoring Programs 5-38
5.3 Fish and Fish Habitat 5-39
5.3.1 Regulatory Context 5-40
5.3.2 Existing Conditions 5-41
5.3.3 Potential Effect Pathways 5-44
5.3.4 Mitigation and Management Measures 5-45
5.3.5 Residual Environmental Effects 5-46
5.3.6 Follow-up and Monitoring Programs 5-50
5.4 Vegetation and Wetlands 5-50
5.4.1 Regulatory Context 5-50
5.4.2 Existing Conditions 5-52
5.4.3 Potential Effect Pathways 5-55
5.4.4 Mitigation and Management Measures 5-56
5.4.5 Residual Environmental Effects 5-57
5.4.6 Follow-up and Monitoring Programs 5-59
5.5 Wildlife and Wildlife Habitat 5-60
5.5.1 Regulatory Context 5-60
5.5.2 Existing Conditions 5-61
5.5.3 Potential Effect Pathways 5-73
5.5.4 Mitigation and Management Measures 5-73
5.5.5 Residual Environmental Effects 5-75
5.5.6 Follow-up and Monitoring Programs 5-76
5.6 Heritage Resources 5-76
5.6.1 Regulatory Context 5-77
5.6.2 Existing Conditions 5-77
5.6.3 Potential Effect Pathways 5-84
5.6.4 Mitigation and Management Measures 5-85
5.6.5 Residual Environmental Effects 5-85
5.6.6 Follow-up and Monitoring Programs 5-85

6 Potential Impacts and Benefits to the Mi'kmaq of Nova Scotia 6-1

7 Other Undertakings in the Area and Cumulative Effects 7-1

8 Effects of the Environment on the Undertaking 8-1
8.1 Climate and Meteorological Conditions 8-1
8.2 Seismic Activity 8-3
8.3 Wildfires 8-3
8.4 Summary 8-3

9 Other Approvals Required 9-1

10 Funding 10-1

11 Closing 11-1

12 References 12-2

List of Tables

Table 1.2.1 Proponent Contact Information 1-2
Table 1.4.1 Potential Future Demand 1-3
Table 1.5.1 Key Environmental Approvals / Permits 1-4
Table 2.2.1 Project Components 2-3
Table 2.8.1 Wastes and Emissions 2-13
Table 3.1.1 Summary of Mi'kmaq Engagement 3-1
Table 3.2.1 Summary of Government Engagement 3-2
Table 3.3.1 Summary of Stakeholder Engagement 3-3
Table 3.4.1 Questions and Concerns Raised During Stakeholder and Indigenous Engagement 3-5
Table 4.2.1 Scoping of Valued Components 4-2
Table 4.2.2 Assessment Boundaries 4-4
Table 4.3.1 Potential Projects Interactions with Valued Components 4-5
Table 5.1.1 Nova Scotia Air Quality Standards 5-2
Table 5.1.2 Canadian Ambient Air Quality Standards 5-4
Table 5.1.3 Air Quality Results at the Port Hawkesbury Air Monitoring Station (2017-2022) 5-6
Table 5.1.4 Nova Scotia's GHG Emissions by Industry (2018-2022) 5-8
Table 5.1.5 Ambient Sound Levels at Monitoring Locations and the Project – Bear Hear LNG Project, October 2014 5-9
Table 5.1.6 Potential Effects, Effect Pathways and Measurable Parameters for Atmospheric Environment 5-11
Table 5.2.1 Summary of Flow to Little River Reservoir 5-18
Table 5.2.2 Seasonal Median Flow Rates, 75% Q50 5-18
Table 5.2.3 Landrie Lake Water Quality – Inorganic/Organic Parameters 5-27
Table 5.2.4 Landrie Lake Water Quality – Trace Metals 5-29
Table 5.2.5 LLWU Supply Requirements and Demand from Little River Reservoir 5-34
Table 5.2.6 Percent-Supplied Demand and EMF for Various Transfer Rates (Meco 2025) 5-36
Table 5.3.1 Abundance of Fish Captured in the Little River Reservoir 5-43
Table 5.3.2 Abundance of Fish Captured in the Landrie Lake 5-43
Table 5.3.3 Aquatic Species at Risk and/or Species of Conservation Concern that may occur in the RAA 5-44
Table 5.3.4 Potential Effects, Effect Pathways and Measurable Parameters for Fish and Fish Habitat 5-44
Table 5.4.1 Wetland Types and Area in the PDA 5-54
Table 5.4.2 Potential Effects, Effect Pathways and Measurable Parameters for Vegetation and Wetlands 5-55
Table 5.5.1 Species List from Square 20PR35 of the Second Maritimes breeding Bird Atlas (2006-2010) 63
Table 5.5.2 Species List from Breeding Bird Survey or Incidental Observations on June 26-27, 2024 67
Table 5.5.3 ACCDC List of Bird SAR and SOCC Observed within 5 km of site (including pelagic birds) 5-71
Table 5.5.4 Potential Effects, Effect Pathways and Measurable Parameters for Wildlife and Wildlife Habitat 5-73
Table 5.6.1 Potential Effects, Effect Pathways and Measurable Parameters for Heritage Resources 5-84
Table 8.1.1 Annual Average Climate Data at the Deming Weather Station (1981 – 2010) 8-1
Table 8.1.2 Annual Average Precipitation Data at the Deming Weather Station (1981 – 2010) 8-2

List of Figures

Figure 2.1 Project Location 2-2
Figure 2.2 Profile of Transmission Line 2-4
Figure 2.3 Pumphouse Site 2-5
Figure 2.4 Raw Water Intake Screen Plan & Sections 2-6
Figure 2.5 Typical Trench Design 2-8
Figure 2.6 Concept Design for Landrie Lake Outfall 2-10
Figure 5.1 Monitoring Locations for the Proposed Bear Head LNG Project 5-10
Figure 5.2 Watershed Area 5-19
Figure 5.3 Bathymetry of Little River Reservoir 5-21
Figure 5.4 Little River Reservoir Stage-Storage Relationship (Meco 2025) 5-22
Figure 5.5 Daily Withdrawal Volume & Reservoir Level at Landrie Lake, 2016 - 2024 5-24
Figure 5.6 Landrie Lake Reservoir Stage-Storage Relationship (Meco 2025) 5-25
Figure 5.7 Daily Withdrawal Rates from Landrie Lake, 2024 5-35
Figure 5.8 Modeled Water Level in Little River with EMF Outflow, No Withdrawal (Meco 2025) 5-36
Figure 7.1 Other Undertakings 7-2

List of Appendices

Appendix A Consultation Material
Appendix B Mapbook
Appendix C Meco 2025
Appendix D Vascular Plant List
Appendix E WESP-AC Summaries
Appendix F AC CDC Data Report
Appendix G ARIA Acceptance Letter

Acronyms / Abbreviations

%HA	percent highly annoyed
˚C	degrees Celsius
µg/m^3	micrograms per cubic metre
AC CDC	Atlantic Canada Conservation Data Centre
AQMS	Air Quality Management System
ATV	All Terrain Vehicle
ARIA	archaeological resource impact assessments
BHE	Bear Head Energy
CAAQS	Canadian Ambient Air Quality Standards
CEPA, 1999	*Canadian Environmental Protection Act, 1999*
cfs	cubic feet per second
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
dB	decibel
dBA	A-weighted dB scale
DFO	Fisheries and Oceans Canada
EA	environmental assessment
EARD	Environmental Assessment Registration Document
ECCC	Environment and Climate Change Canada
EMF	Ecological Maintenance Flow
EPP	Environmental Protection Plan
ERCP	Emergency Response and Contingency Plan
EWF	EverWind Fuels
GHG	greenhouse gas
GHGRP	Greenhouse gas Reporting Program
H_2S	hydrogen sulphide

HADD	Harmful Alteration, Disturbance or Destruction
HDPE	high-density polyethylene
HRP	Heritage Research Permit
km	kilometres
KMKNO	Kwilmu'kw Maw-Klusuaqn Negotiation Office
kt	kilotonnes
LA_{eq}	weighted continuous sound level
L_d	daytime equivalent sound level
L_{dn}	day-night average sound level
L_{eq}	sound pressure level
LLWU	Landrie Lake Water Utility
L_n	nighttime equivalent sound level
LNG	liquid natural gas
LRR	Little River Reservoir
LRTP	Little River Transfer Pumphouse
m	metres
m^3/s	cubic metre per second
MBCA	*Migratory Birds Convention Act, 1994*
MBBA	Maritime Breeding Bird Atlas
MEKS	Mi'kmaq Ecological Knowledge Study
ML/d	megalitres per day
mm	millimetre
MUSGPD	million US gallons per day
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NS ESA	Nova Scotia *Endangered Species Act*
NSCCTH	Nova Scotia Department of Communities, Culture, Tourism, and Heritage
NSECC	Nova Scotia Environment and Climate Change
NSDNRR	Nova Scotia Department of Natural Resources and Renewables
O_3	ozone
PDA	Project Development Area
PM_{10}	particulate matter less than 10 micrometres in diameter

$PM_{2.5}$	particulate matter less than 2.5 micrometres in diameter
ppb	parts per billion
psi	pound per square inch
RoW	right-of-way
SAR	species at risk
SARA	*Species at Risk Act*
SO_2	sulphur dioxide
SOCC	species of conservation concern
t	tonnes
t CO_2e	tonnes of carbon dioxide equivalent
TRS	total reduced sulphur
TSP	total suspended particulate
VC	valued component

1 Introduction

Landrie Lake Water Utility (LLWU), c/o the Town of Port Hawkesbury (the Proponent) is proposing to reinstate the Little River Transfer Pumphouse (LRTP) and enhance yield at the Landrie Lake Reservoir (the Project). The water utility operates under an existing water withdrawal approval 2015-04169-R01 for a withdrawal rate of 36 million litres per day (MLD) with an expiration of December 31, 2025.

The Landrie Lake Industrial Water Utility was constructed in 1969 in support of industrial development in the Point Tupper area of Richmond County and was operated by Nova Scotia Department of Environment until 2001 when it was transferred to the Nova Scotia Department of Transportation and Public Works. In 1992, the Province decommissioned and dismantled the pumping station and pipeline between Little River and Landrie Lake reservoirs because of reduced demand. On March 31, 2019, the Approval Holder was changed from the Province to the LLWU, jointly owned by the Town of Port Hawkesbury and the Municipality of the County of Richmond. With the proposal of green hydrogen projects in the Point Tupper area, Landrie Lake has been identified as a source of water required for green hydrogen development. Therefore, LLWU is proposing to reinstate the LRTP to enhance yield at Landrie Lake.

The Project requires registration as a Class I Undertaking under the Nova Scotia *Environment Act* in accordance with the Environmental Assessment (EA) Regulations because the Project involves transferring water between drainage basins, and the drainage area containing the water to be diverted is larger than 1 km^2. This document satisfies one of the main requirements for an Environmental Assessment Registration Document (EARD) for the Project and has been prepared in accordance with the provincial Proponent's Guide to Environmental Assessment (NSECC 2025).

1.1 Project Information

Name of the Undertaking: Little River Pumping Station and Transmission System Project

Location of the Undertaking: Port Malcolm, Richmond County, Nova Scotia

Project Centre Point: 45.6054° E, -61.2900°W

1.2 Identification of the Proponent

The Project proponent is LLWU, c/o the Town of Port Hawkesbury. Proponent contact details are provided in Table 1.2.1.

Table 1.2.1 Proponent Contact Information

Proponent Information		**Utility Administrator**	
Name:	Landrie Lake Water Utility	Name:	Terry Doyle, P.Eng.
Mailing Address:	606 Reeves Street, Port Hawkesbury, Nova Scotia B9A 2R7	Mailing Address:	Same
E-Mail Address:	tdoyle@townofph.ca	Telephone Number:	902-625-7890

Contact Person for Purposes of the EA	
Name:	Jason MacMillan, CET
Mailing Address:	Same
Telephone Number:	902-625-7899
E-Mail Address:	jmacmillan@townofph.ca

Proponent Signature

January 5, 2026

Date

1.3 Project Overview

The Little River Reservoir historically served as a secondary water source and supplemented the Landrie Lake Reservoir beginning in the 1970s but was decommissioned in the 1990s following a decline in demand. In response to recent industrial growth potential within the Point Tupper Heavy Industrial Park area, there is a renewed requirement for a reliable raw water source. The proposed project will re-establish the Little River water transfer system through the construction of new intake, pumping, and transmission infrastructure.

The Project involves the installation of a 900 millimetre (mm) diameter high-density polyethylene (HDPE) water transmission pipeline approximately 2.75 kilometres (km) in length. The proposed pipeline will generally follow the alignment of the former system, commencing at the proposed new pumping station site at Little River and extending southwest before turning south to terminate at the northwest corner of Landrie Lake. Limited vegetation clearing and brush removal will be required along the corridor to reinstate access.

The existing decommissioned pumping station will be replaced with a modern facility incorporating new pumping and control systems, security fencing, and backup power supply. A new intake structure will also be constructed to provide efficient and environmentally responsible water withdrawal.

Access to the LRTP site will be improved through the reinstatement and upgrade of approximately 2 kilometres of gravel road. The route remains in fair condition and will be upgraded with a new gravel base to accommodate construction and maintenance activities.

1.4 Purpose and Need for the Project

Landrie Lake has been identified by green hydrogen and ammonia production developers (such as Bear Head Energy [BHE] and EverWind Fuels [EWF]) as the source water for their essential processing. The availability, quantity and quality of this resource are factors that makes the sites near the lake in Point Tupper, Richmond County, attractive for the emerging green energy industry. Green hydrogen will be produced for export to Europe and other jurisdictions once the facilities are completed and in operation leading to increased economic growth in the green energy sector in Nova Scotia.

EWF and BHE both have plans to use the Landrie Lake Water Supply in support of their respective projects. A small reserve for future development has also been added to account for future demand. Proposed water demand is provided in Table 1.4.1.

Table 1.4.1 Potential Future Demand

User	2025 Current (MLD)		2028 Phase 1 Growth (MLD)		2035 Phase 2 Growth (MLD)	
	Average	Max	Average	Max	Average	Max
Existing Customer	5.9	13.5	6.4	14.7	7.1	16.2
EverWind[1]	-		8.4	10.7	8.4	10.7
Bear Head Energy[2]	-		18.9	30.3	37.9	60.6
Reserve	-		-	-	5	5
Total			33.7	55.7	58.4	92.5

Notes:

1. As provided by LLWU
2. Email from BHE dated June 9, 2025.

The Landrie Lake Water Utility currently operates under a Water Withdrawal Approval (2005-046169-02) pursuant to part V of the *Environment Act*, which permits the withdrawal of up to 36 MLD from Landrie Lake. The LRTP is required to supplement the volume of available water at Landrie Lake for future use. The actual approved withdrawal volume from Little River Reservoir via operations of the LRTP will be subject to approval through the NSECC Surface Water Withdrawal Approval (SWWA) process. For the purposes of this EARD, the 2028 Phase I Growth demand (Table 1.4.1) is considered the applicable demand scenario. Potential future demand, as estimated in the 2035 Phase 2 Growth scenario, depends on many factors, including future market requirements, and are therefore not included within the scope of this EARD. Phase 2 requirements, should they become necessary, will be addressed under a separate future permitting process.

1.5 Regulatory Framework

The Project is subject to the requirements associated with a Class I registration under the Nova Scotia Environmental Assessment Regulations because the Project involves transferring water between drainage basins, and the drainage area containing the water to be diverted is larger than 1 km^2. A preliminary list of key environmental legislation applicable to the Project is described in Table 1.5.1; this list is expected to evolve as Project design progresses.

Table 1.5.1 Key Environmental Approvals / Permits

Legislation / Approval	Regulating Authority	Relevance
Environment Act and Associated Regulations	Nova Scotia Environment and Climate Change (NSECC)	In addition to EA approval, the Project would require other approvals under the Activities Designation Regulations of the Act, including Water Approvals to authorize surface water withdrawals and alterations to wetlands and watercourses along the RoW. Air Quality Regulations under the Act specify ambient air quality maximum permissible ground level concentrations. Protected Water Areas Designations and Regulations fall under the *Environment Act* and includes the Port Hawkesbury Watershed Protected Water Area Designation and Regulations.
Nova Scotia *Endangered Species Act* (NS ESA)	Nova Scotia Department of Natural Resources and Renewables (NSDNRR)	NS ESA provides for the protection, designation, recovery and other relevant aspects of conservation of species at risk in the Province, including habitat protection. The Act prohibits killing or disturbing endangered or threatened species, destroying or disturbing its residence (habitat) and destroying or disturbing core habitat. Species assessed as endangered threatened, or vulnerable are listed under the NS ESA are legally protected.
Special Places Protection Act	Department of Communities, Culture, Tourism and Heritage	This Act provides for the preservation, protection, regulation, exploration, excavation, acquisition and study of archaeological and historical remains and paleontological sites, which are considered important parts of the natural or human heritage of the Province.
Public Highways Act	Nova Scotia Public Works	Any work within a highway RoW requires a Work within Highway Right-of-Way Permit.
Canadian Environmental Protection Act, 1999 (CEPA, 1999)	Environment Canada and Climate Change (ECCC)	CEPA, 1999 pertains to pollution prevention and the protection of the environment and human health in order to contribute to sustainable development. Among other items, CEPA, 1999 provides a wide range of tools to manage toxic substances, and other pollution and wastes, including disposal at sea.
Fisheries Act	Fisheries and Oceana Canada (DFO)	A Letter of Advice may be required on the Harmful Alteration, Disturbance or Destruction (HADD) of fish habitat.
Migratory Birds Convention Act, 1994 (MBCA)	ECCC	Under the MBCA, it is illegal to kill migratory bird species not listed as game birds or destroy their eggs or young. The Act also prohibits the deposit of oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds.

Table 1.5.1 Key Environmental Approvals / Permits

Legislation / Approval	Regulating Authority	Relevance
Species at Risk Act (SARA)	DFO/ECCC/Parks Canada	SARA is intended to protect species at risk in Canada and their "critical habitat" (as defined by SARA). The main provisions of the Act are scientific assessment and listing of species, species recovery, protection of critical habitat, compensation, permits and enforcement. All activities must comply with SARA. Section 32 of the Act provides a complete list of prohibitions.
West Richmond Planning Area Municipal Planning Strategy and Land Use Bylaw	Eastern District Planning Commission	Municipal Development Permit and Building Permits may be required.
Use of Crown Lands	NSNDRR	Required for any work that may cross or parallel provincially owned land or roads.
Navigation Protection Act	Transport Canada	Landrie Lake and Little River were not listed as navigable waters; however, Transport Canada reserves the right to provide commentary on permanent structures in public waters.

The federal *Impact Assessment Act*, administered by the Impact Assessment Agency of Canada (IAAC), outlines specific thresholds in the Physical Activities Regulations that determine when a project requires federal assessment. For water transfers between watersheds, the relevant trigger is:

- Section 60: The construction, operation, decommissioning, or abandonment of a new structure for the diversion of 10,000,000 m^3/year or more of water from one natural water body into another.

The anticipated transfer of water as part of this assessment (2028 Phase 1 Growth) for this Project is less than the federal Impact Assessment trigger which is the equivalent of an average of 27.4 MLD in a year. The Project therefore does not trigger an impact assessment under the federal *Impact Assessment Act* (2019).

2 Project Description

2.1 Project Location and Setting

The Project is located in the Point Tupper area of Richmond County within the Landrie Lake and Little River watersheds (Figure 2.1). The watersheds were designated as a Protected Water Area on May 3, 1971 (Port Hawkesbury Watershed). The designation defines an area that encompasses Landrie Lake and extends north to include the watersheds of Little River Reservoir, Beaver Dam Lake, and MacIntyre Lake and consists of approximately 150-200 separate PID parcels, much of which is crown owned interspersed with a number of privately owned parcels. The land surrounding Landrie Lake and the land on which the pumping station sits is owned by EverWind Fuels (Gulf Oil, PIDs 75035725 and 75101634). The Pipeline is located on PIDs 75101634, 75226670, 75101535, 75175646, 75101535, 75151381, 75101535, and 75035725.

Lands within the protected area are mainly undeveloped, and while the delineation of the designated area approximates the natural drainage area, there are some portions of the natural drainage area that lie outside the protected area and which contain industrial development (e.g., petroleum storage tank farm). The immediate area of the Landrie Lake reservoir consists of the different zoning categories:

- M1: ‘General Industrial’ zone to the northwest of the reservoir, encompasses the Joint Industrial Park property
- M2: ‘Heavy Industrial’ zone to the west and southwest of the reservoir encompasses most of the Point Tupper Heavy Industrial Park, including the petroleum storage depot (tank farm) adjacent Port Malcolm Road within the watershed drainage area.
- OS: ‘Open Space’ zone encircles Landrie Lake and much of the protected water area.
- RD: ‘Rural Development’ zone encompasses the area to the east of Landrie Lake

As this is a designated protected water area there is no water currently allocated to other users. Recreational uses including bathing, boating, skating, the use of motorized sleds, hunting, and fishing are prohibited in the protected area. Recreational activities such as hiking and all-terrain vehicle use is known to occur in the area. A discussion of traditional use is provided in Section 6.

The area is characterized by coastal hills, with higher relief to the north and is dominated by the manmade Landrie Lake reservoir to the south. Highways 4 and 104, as well as Crandall Road, Long Stretch Road and Barberton Road cross the Protected Water Area.

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Town of Port Hawkesbury; Stantec; Nova Scotia Natural Resources and Renewables; Nova Scotia Environment and Climate Change
3. Background: Service Nova Scotia NSTDB; ESRI

Legend

Project Features
- Pumping Station (Proposed)
- Pipeline Route (Approximate)
- Access Road (Existing)

Built Infrastructure
- Highway
- Road
- Rail Road
- Track
- Transmission Line
- Pipeline
- Built Structures

Other Features
- Watercourse (NSHN)
- County Boundary
- Waterbody (NSHN)
- Wetlands (NS ECC)
- Forested Area

0 500 1,000 m
(At original document size of 8.5x11)
1:50,000

N

Stantec

Project Location
Port Hawkesbury
Richmond County, NS

Prepared by NW on 2024-09-20
TR by GJ on 2024-09-20

Client/Project
121418143_001

Landrie Lake Water Utility
Little River Pumping Station and Transmission Project

Figure No.
2.1

Title
Project Location

\\Ca0213-ppfss01\work_group\1214\active\1XXX - Other PCs\1214_NB\121418143\gis_data\mapping\aprx\121418143_LandrieLakeUtility.aprx Revised: 2025-11-03 By: niwhite

2.2 Project Components

LLWU is proposing to reinstate the Landrie Lake water system by constructing a buried water transmission pipeline, pumping station compound, pumping station intake structure, and the reinstatement of an existing access road. These key components are described in Table 2.2.1.

Table 2.2.1 Project Components

Project Component	Description
Buried Water Transmission Pipeline	The proposed water transmission pipeline is anticipated to be HDPE with a diameter of 900 mm with an approximate length of the route to be 2,750 m. The new water transmission line is anticipated to follow the same route as the former above ground water transmission line, crossing Highway 104 beneath an existing overpass. Between the pumphouse and the discharge will be two 900 mm diameter drain valves within pre-cast concrete chambers, and a 900 mm diameter pressure reducing valve with pre-cast concrete chamber at the transmission line high point (Figure 2.2). The pipeline will discharge at Landrie Lake, and includes the construction of a dissipation structure along the shoreline.
Pumping Station Compound	The new pumping station compound will feature security fencing along its perimeter complete with lockable double gates and "No Trespassing" signage (Figure 2.3). The parking area will have crushed stone and proper drainage with minor ditching around the perimeter to manage surficial water runoff. The new pumping station will include a new back up generator and fuel storage tank complete with concrete containment pad. The building will also include washroom facilities serviced by water from the water system and greywater/sewage disposal in concrete tanks, to be pumped out regularly by a sewage disposal company The pumping station superstructure will consist of load-bearing block masonry walls with a pitched roof. The proposed structure is anticipated to have a footprint of approximately 200 m^2. The pumping station will also include a new wet well to receive the new intake line from Little River. The wet well will be cast-in-place concrete, measuring approximately 7 m by 13 m, with a mud slab for constructability after the existing pumphouse is removed. It will include a slide gate for hydraulic isolation and an aluminum or steel access ladder and platform for maintenance.
Pumping Station Intake Structure	The intake structure for the proposed pumping station will feature a 1050 mm HDPE pipe connecting the new wet well to a pre-engineered intake screen designed to allow adequate inflow while maintaining a maximum velocity for protection of fish (Figure 2.4). The intake pipe is anticipated to be approximately 40 m long (subject to final design). The intake screen would be constructed with proprietary materials, like Z-Alloy, to address potential mussel issues. Additionally, an airburst system, including a compressor, receiver tank, and controls, will be implemented to reduce debris accumulation on the intake screen, enhancing pumping efficiency.
Reinstatement of Existing Access Road	The existing access road to the pumping station is currently overgrown with grasses and weeds and will be upgraded during construction to provide a new gravelled surface. Culverts and localized ditch maintenance or improvements may be warranted.
LRR Discharge Control Structure Modifications	The Little River Reservoir discharge structure will be modified to allow for discharge control. Modifications are anticipated to include the addition of orifice plates or sluice gates to the existing culverts located within the discharge structure.

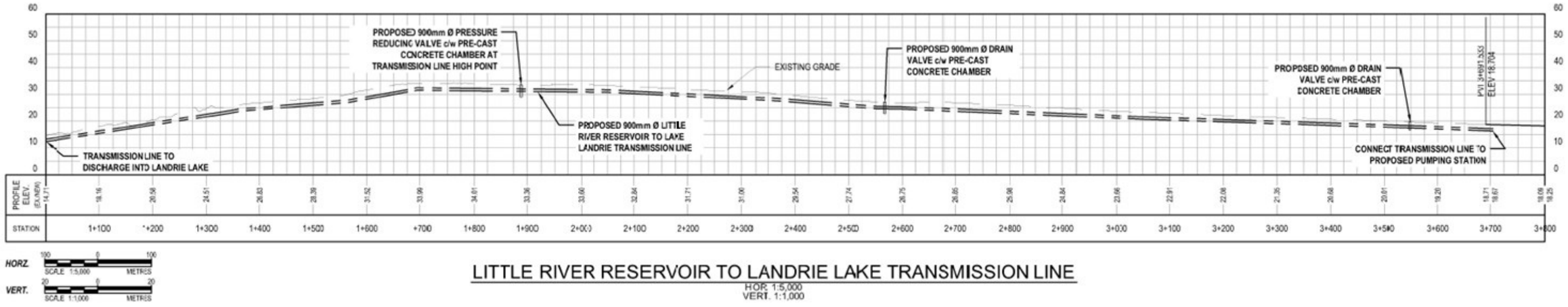
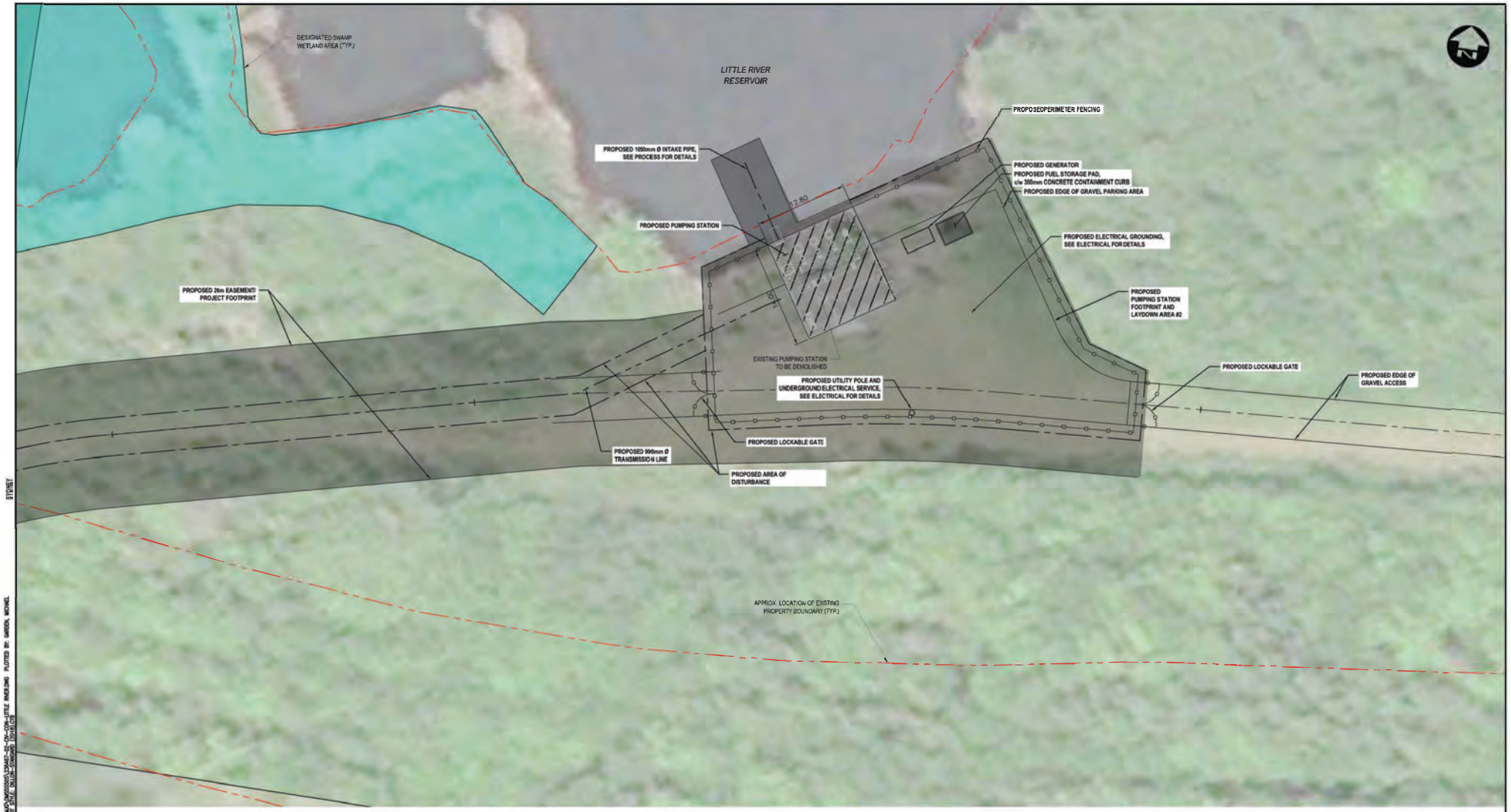


Figure 2.2 Profile of Transmission Line



SITE PLAN

1:250

SCALE 1:250 METRES

Conditions of Use

Verify elevations and/or dimensions on drawing prior to use. Report any discrepancies to Dillon Consulting Limited.

Do not scale dimensions from drawing.

Do not modify drawing, re-use it, or use it for purposes other than those intended at the time of its preparation without prior written permission from Dillon Consulting Limited.

NOT FOR CONSTRUCTION

DILLON CONSULTING

B	PRELIMINARY DESIGN - REV B	2024 OCT 16	MJG
A	PRELIMINARY DESIGN	2023 DEC 08	MJG

DESIGN: MAC REVIEWED BY: DFM
DRAWN: MJG CHECKED BY: MAC
DATE: OCTOBER 2024
SCALE: 1:250

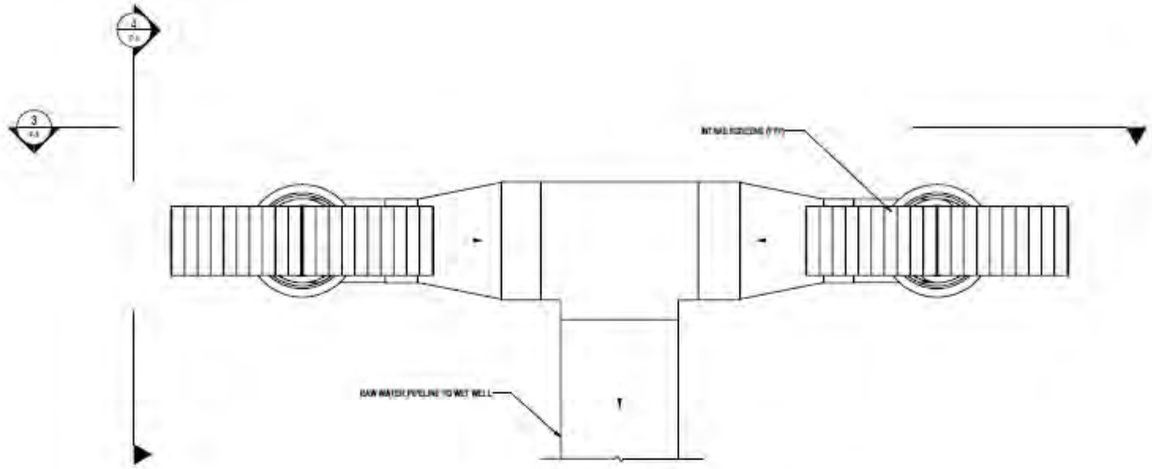
LANDRIE LAKE WATER SYSTEM UPGRADES PROJECT
LITTLE RIVER RESERVOIR PUMPING AND TRANSMISSION SYSTEM

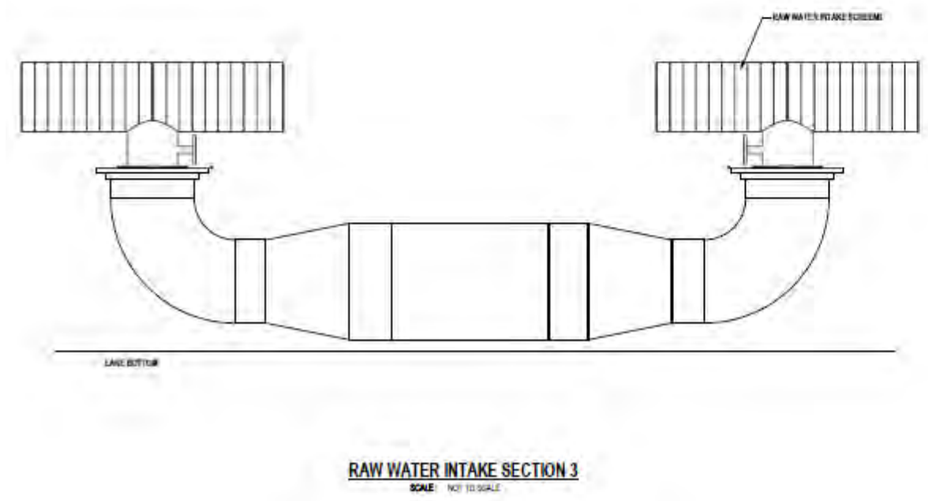
PROJECT NO. 23-6467

Fig 2.3 PUMPHOUSE SITE

SHEET NO. SK-2

PLOTTED BY: GARCIA, MICHAEL
STATUS:





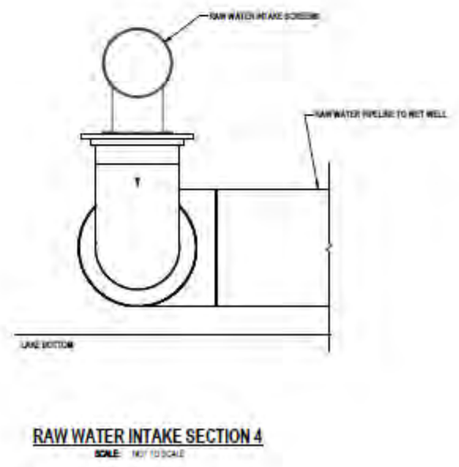


Figure 2.4 Raw Water Intake Screen Plan & Sections

2.3 Construction Activities

2.3.1 Site Preparation

Site preparation activities will include clearing activities as well as an area survey and staking along the pipeline route. Clearing and grubbing will be required along the 20-m wide pipeline RoW to address overgrowth in vegetation and confirm a clear corridor along the pipeline routing for future maintenance access. Prior to installation activities, the pipeline route is precisely marked to allow the trench follows the correct path and adheres to the design specifications. A survey crew will survey and stake the RoW along the water transmission pipeline route. Temporary workspaces to support construction (e.g., lay down areas) are also confirmed and cleared at this time. The main laydown area will be at the pump house.

The existing grassed access road to the pumping station site is accessed from Highway 104, about 5 km southeast of Port Hawkesbury. This access road will be upgraded during construction to provide a new gravelled surface along with the installation of new culverts and localized ditch improvements to address washout concerns. Topsoil and sod will be removed from the surface and the subgrade will be proof-rolled prior to placement of crushed stone material.

2.3.2 Water Transmission Pipeline Installation

Pipeline installation will occur in the following steps: trenching, pipeline installation, backfilling and compaction, and commissioning.

The water transmission pipeline is anticipated to be installed in a typical open trench (Figure 2.5) and is anticipated to follow the same route as the former above ground water transmission line, crossing Highway 104 beneath an existing overpass. Trenches are excavated using large excavators.

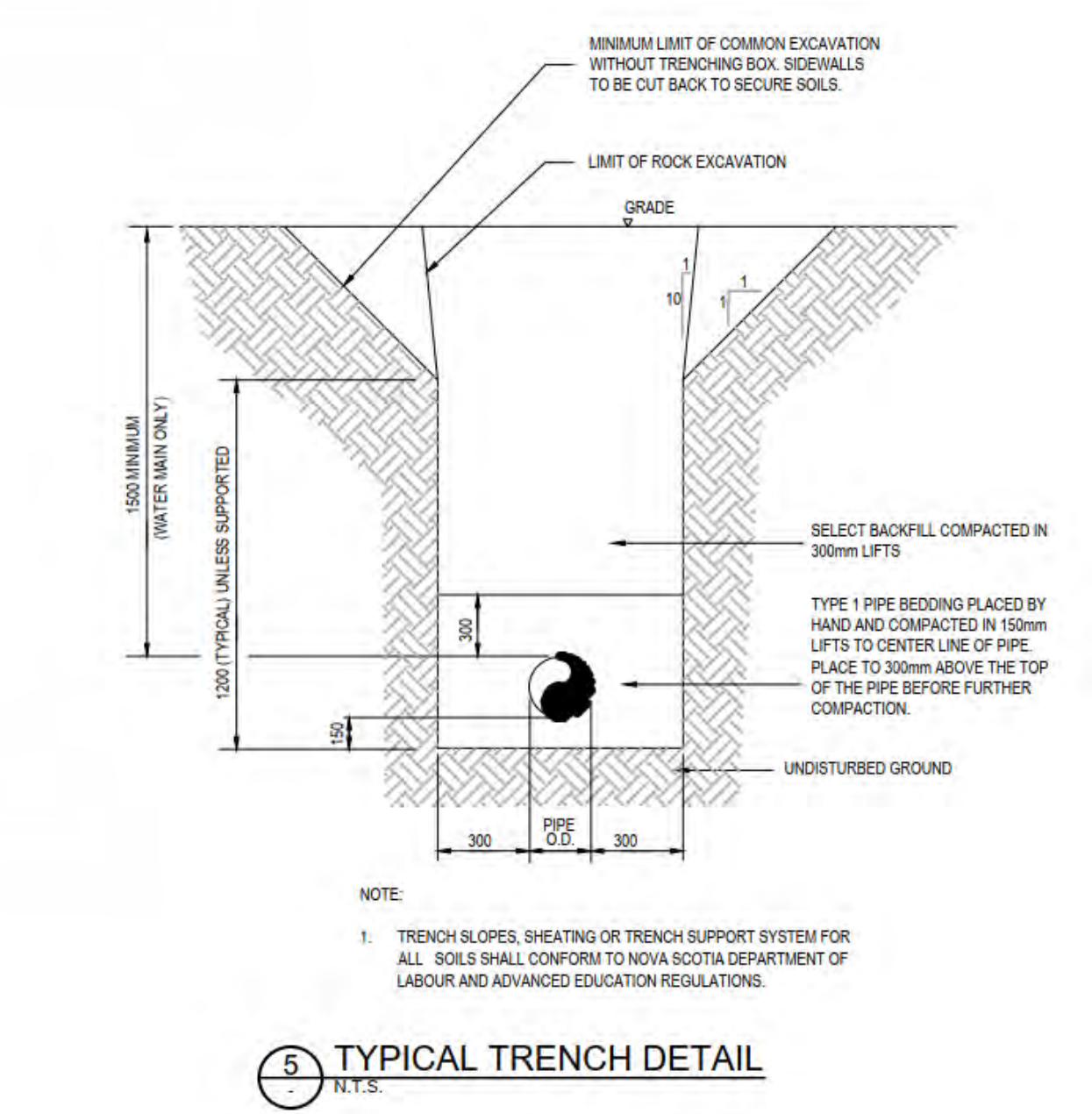


Figure 2.5 Typical Trench Design

Linear pipe will be delivered to the RoW by trucks with flatbed trailers. The pipe is offloaded and positioned along the RoW. The pipe is bent to allow the completed pipeline to match the contours of the RoW (lateral, vertical and compound deflections). Pipe joints are welded together, and pipe coating is applied to the welds. Once trenching is complete, the completed pipe system is placed into the trench. Trench plugs/breakers will be considered by the pipeline designer for wetlands where water flow into or out of the wetland through the pipeline trench is considered a risk. Valve chambers will be placed at key locations that include air release/vacuum valves at high points; and drain valves at low points by using buried concrete utility vaults for valve chambers.

Surfaces impacted by the pipeline installation work will be reinstated upon completion. This includes backfilling of excavated soil or other suitable material and the RoW restored to its original condition, including the restoration of wetland habitat. The goal is to stabilize the soil, prevent erosion and establish vegetation. After the pipeline is placed in the trench, the excavated soil is backfilled into the trench and graded and smoothed to match the natural contours of the surrounding environment. Topsoil is spread over the area and native grasses, and vegetation is established.

Prior to being put into service, the water transmission pipeline will undergo pressure testing to confirm it will withstand the operating pressures without leaks or failures. Pressure testing is likely to be completed using water from Little River Reservoir, and released into Landrie Lake, as there would be no anticipated contamination. Pressure testing is therefore not carried forward in the assessment.

Initial structure concept design for the Landrie Lake outfall is shown on Figure 2.6.

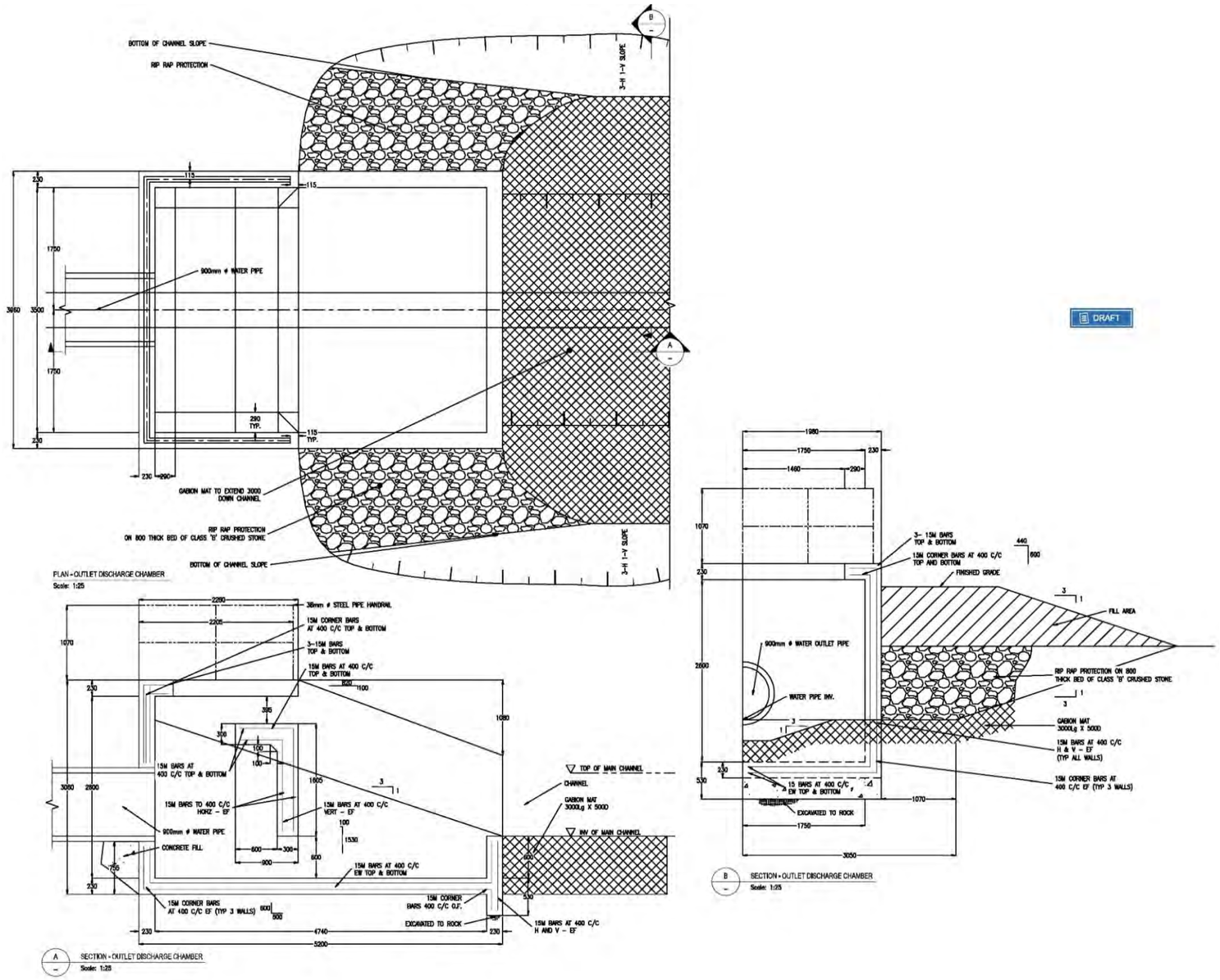


Figure 2.6 Concept Design for Landrie Lake Outfall

2.3.3 Building Demolition

As part of the Project, the existing pumping station on the site will be demolished (including existing concrete wet well) and waste materials will be hauled off site to an approved disposal location. This will also include the removal of any mechanical, electrical and process equipment from the site.

2.3.4 LRTP Construction

The intake structure for the pumping station will feature a 40-m long 1050 mm HDPE pipe (subject to final design) connecting the new wet well to a pre-engineered intake screen. The installation work would likely take place with the use of a barge for the pipe further out in the lake along with proposed construction of coffer dam along the shoreline. The intake pipe will meet the station's maximum flow requirements, supported by evenly spaced concrete ballasts to prevent flotation. The intake screen will be constructed with proprietary materials, like Z-Alloy, to address potential mussel issues. An airburst system, including a compressor, receiver tank, and controls, will be implemented to reduce debris accumulation on the intake screen, enhancing pumping efficiency.

The proposed pumping station superstructure will consist of load-bearing block masonry walls with a pitched roof. The proposed structure is anticipated to have a footprint of approximately 200 m².

The pumping station will also include a new wet well to receive the new intake line from Little River. The wet well will be cast-in-place concrete, measuring approximately 7 m by 13 m, with a mud slab for constructability after the existing pumphouse is removed. It will include a slide gate for hydraulic isolation and an aluminum or steel access ladder and platform for maintenance.

2.4 Pipeline Operation

Currently, Little River Reservoir is not operated as a water supply reservoir. Inflow to Little River is received from the upstream watershed through two (2) 1.5 m diameter culverts at elevation 12.56 m. For the proposed Project, a percentage of the current flow will be transferred to the Landrie Lake Reservoir based on the daily demand. Water will be pumped through the Little River Reservoir intakes and transferred via the 900 mm diameter pipeline to the shoreline of Landrie Lake. The discharge location at Landrie Lake will be protected from scour and erosion through a rip-rap scour pad, where required.

The Little River Reservoir transfer will be operated to maintain a safe yield or net positive annual water balance. Safe yield is the reliable withdrawal rate of water that can be provided by reservoir storage during dry climate conditions (i.e., the 1950 to 1953 drought of record, Meco 2023). The reservoir level will be operated to maintain the highest possible supply reservoir level. The Little River reservoir outlet will be modified and operated to maintain an Ecological Maintenance Flow (EMF), a continuous flow to the downstream environment to sustain the ecosystem. For this assessment, EMF was based on the 75% of the median monthly flow statistic (NSE 2016) to Little River at the discharge location. The monthly flows at Little River were prorated based on watershed area from a nearby representative ECCC hydrometric station - 03FJ003 MacAskills Brook at Birch Cove, between 1978 to 2023. A site-specific fish habitat simulation model (HSM) will be completed to assess EMF requirements at a species level.

Surplus storage to Little River Reservoir above the EMF will be continually pumped to Landrie Lake Reservoir until storage is full but not spilling. The full normal operating range of Little River Reservoir is 8.47 m (low supply level) to 14.56 m (top of spillway). Little River Reservoir will be operated to supplement water levels at Landrie Lake, and transfer rates will vary depending on demand and climate. The reservoir level in both Landrie Lake and Little River will be continuously monitored using automated data loggers and data acquisition software to adjust pumping rates hourly to meet established operating rule curves.

2.5 Maintenance Activities

The pumping station compound will be properly secured and protected by suitable fences to prevent tampering by unauthorized parties. The fenced areas will be maintained for safety as well as an acceptable appearance.

Typical maintenance or routine activities during pipeline operation may include vegetation control, routine patrolling, and emergency leak repairs. Vegetation control on the RoW will be accomplished primarily by mechanical means.

The access road will be maintained for safety and functionality. This may include regular grading by either redistributing gravel or adding gravel to fill ruts and potholes. Proper drainage is also important to the longevity of gravel roads. Ditches, culverts and other drainage features will be kept clear of debris to prevent water pooling on the road. Vegetation may also encroach on gravel roads. Vegetation control, as described above, will be used to keep the road free of vegetation.

2.6 Decommissioning Activities

The water transmission pipeline and pumphouse are designed and will be operated and maintained to provide safe and efficient service for approximately 50 to 100 years. Decommissioning will be undertaken in accordance with the regulatory requirements applicable at the time of such activities and appropriate technology will be used.

2.7 Project Schedule

While a construction start date has not been confirmed, construction is anticipated to start within the next two years. Construction is estimated to take approximately 16 months with an operational life of 50 to 100 years. Once the schedule has been updated and a proposed start date identified, the proponent will notify NSECC.

In general, RoW clearing activities will be scheduled to avoid potential interactions with Valued Components (VCs) during sensitive periods (e.g., breeding bird periods between April 15 and August 31) where recommended as specific mitigative measures, as general environmental protection practices (Section 2.9), or to comply with specific conditions of required permits. Instream work at watercourses will generally be limited to the period from June 15 through September 30 to avoid fish migration and periods of higher precipitation and runoff potential.

2.8 Wastes and Emissions

The Project will meet or improve upon the compliance standards outlined in applicable regulations or standards with respect to liquid and gaseous emissions and discharges, sedimentation, and waste management. Where no standards exist, appropriate industry practices will be adopted, where feasible. Volumes of wastes and concentrations of contaminants entering the environment will be reduced through best management practices, following applicable legislation, and mitigation planning including the development of an Environmental Protection Plan (EPP). A description of potential wastes and emissions is provided in Table 2.8.1.

Table 2.8.1 Wastes and Emissions

Waste/Emission	Description	Mitigation/Management Measures
Air Emissions and Greenhouse Gas (GHG) Emissions	Air emissions associated with construction activities are generally related to the generation of dust and routine emissions from the operation of construction equipment. Potential air emissions during decommissioning and abandonment will be similar to emissions associated with construction if the pipeline is removed. The primary sources of GHGs are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and carbon dioxide equivalent (CO_{2e}). The Project will interact with the atmospheric environment to result in a change in GHGs through the release of GHGs into the atmosphere during construction as defined above for air quality. Operational air emissions will be limited to occasional use of the back-up generator.	• Control measures, such as use of dust suppression techniques, will be used in construction zones as required to reduce the impacts from fugitive dust. • Routine inspection and maintenance of construction equipment will reduce exhaust fumes. • Air emissions will be maintained within the Nova Scotia Air Quality Regulations (*Environment Act*) and *Canadian Environmental Protection Act* Ambient Air Quality Objectives.
Noise Emissions	Noise emissions during construction are generally associated with operation of construction equipment and activities. Operational noise emissions will be limited to occasional use of the back-up generator. Pump noise generated from within the pumphouse will generally be contained within the building.	• Construction noise will be intermittent, as equipment is operated on an as-needed basis and mostly during daylight hours.
Liquid Wastes	Liquid wastes generated during construction include oils and greases from the construction equipment and solvents. Liquid wastes typically produced during operation will be primarily from domestic water/sewage use.	• Liquid wastes will be collected and disposed of in accordance with applicable local and provincial regulations. • Other liquid wastes, including sewage and domestic wastewater, will also be collected and disposed of offsite consistent with local and provincial standards.

Table 2.8.1 Wastes and Emissions

Waste/Emission	Description	Mitigation/Management Measures
Surface Run-off and Sedimentation	There is potential for erosion and sedimentation of freshwater systems associated with land-based construction activities as well as sediment re-suspension associated with in-water construction activities.	• An EPP will be developed and will include plans for erosion and sediment control measures and will be developed prior to commencement of construction activities.
Solid and Hazardous Wastes	Solid wastes generated during construction will include brush, extra subsoil and rock, temporary fencing, signs, metal containers, canisters as well as scrap pipe, cables, welding rods, and domestic wastes.	• Solid wastes will be collected and disposed of in a manner consistent with local and provincial standards. • Non-hazardous wastes will be separated as recyclable and non-recyclable, with recyclable material collected and transported to a licensed recycling facility. • Dangerous goods will be stored onsite in a separate temporary dangerous goods storage area provided with full containment. • Dangerous goods will be removed from the site by a licensed contractor and recycled or disposed of at an approved facility.

2.9 Environmental Management

Environmental protection has been integrated into the Project as a key feature throughout Project planning. Project components have been located in previously disturbed areas to avoid sensitive environmental areas wherever possible. For instance, Project design has been modified to avoid discharge into a stream and have carried the pipeline the entirety of the route to Landrie Lake. The pipeline has been designed to comply with all current codes and standards reflecting the most current knowledge about pipeline safety. An EPP will be developed to provide the required procedures to adhere to regulatory obligations and other environmental commitments. The purpose of the EPP is to:

- Identify the company's commitments to reduce environmental effects in general and to meet specific regulatory commitments
- Provide concise and clear instructions regarding procedures for protecting the environment and reducing potential environmental effects
- Document environmental concerns and appropriate protection measures associated with activities
- Provide a reference document for planning and conducting specific activities that may have an effect on the environment
- Function as a training document and guide for environmental education and orientation
- Detail reporting and communication requirements
- Communicate changes in the program through the revision process

The EPP will serve as an umbrella document that includes standard and Project-specific mitigation, management plans (e.g., erosion and sediment control), and the Emergency Response and Contingency Plan (ERCP).

A Project-specific ERCP for unplanned events will be prepared. This will include spill management and response procedures to prevent and respond to spills. In the case of an accidental release of materials, reporting and clean-up procedures will follow provincial emergency spill regulations as required. Lubricants and other petroleum products will be stored and waste oils will be disposed of in accordance with provincial regulations. Small spills will be contained by onsite personnel using spill kits kept at the site.

A Decommissioning and Reclamation Plan will also be developed prior to Project decommissioning.

3 Engagement and Consultation

A stakeholder and Mi'kmaq engagement plan was developed to identify stakeholders and Mi'kmaq communities who may have an interest in or potentially be impacted by the proposed Project. The plan also outlined the methods of engagement to be used to provide Project information and opportunities to ask questions and discuss areas of interest and concerns.

3.1 The Mi'kmaq of Nova Scotia

Table 3.1.1 identifies the Mi'kmaq communities and organizations engaged regarding the proposed Project. Who to engage and the methods of engagement were determined based discussions with representatives of the Kwilmu'kw Maw-Klusuaqn Negotiation Office (KMKNO), the Proponents' Guide: The Role of Proponents in Crown Consultation with the Mi'kmaq of Nova Scotia (Nova Scotia Office of Aboriginal Affairs 2011), the Office of L'nu Affairs and professional judgement.

Outreach began early in the EA process. A letter providing a description of the proponent and proposed Project, environmental field work and schedule, location figure and contact information for questions or a discussion of areas of interest or concerns was sent to the Chief of each of the Unama'ki Nations (Table 3.1.1) on behalf of LLWU. As Potlotek and Paqtnkek Mi'kmaw Nations are in closest proximity to the proposed Project, in addition to receiving the letter, a representative of the Kwilmu'kw Maw-klusuaqn (KMKNO) committed to contacting community representatives offering a meeting with the proponent to discuss the proposed Project in more detail. Table 3.1.1 summarizes Mi'kmaq engagement.

Table 3.1.1 Summary of Mi'kmaq Engagement

Date	Organization/Community	Method of Engagement	Purpose and Focus
May 2024 June 2024	KMKNO Representatives	Phone Email	Discussion to introduce and describe the proposed Project. Discussed the process for the Environmental Assessment Class I Undertaking. Discussed Mi'kmaq communities closest to the proposed Project and recommended approach for engaging with the Unama'ki Nations. Provided update on status of letters sent to the Unama'ki Nations and request to the Potlotek and Paqtnkek Mi'kmaw Nations to meet, if requested.
June 2024	Chief, Eskasoni First Nation	Email (letter)	Provided description of the proponent and proposed Project, environmental field work and schedule, location map and contact information for questions and or concerns.
June 2024	Chief, Membertou First Nation	Email (letter)	
June 2024	Chief, Wagmatcook First Nation	Email (letter)	
June 2024	Chief, We'koqma'q First Nation	Email (letter)	
June 2024	Chief, Potlotek First Nation	Email (letter)	
June 2024	Chief, Paqtnkek First Nation	Email (letter)	

A Mi'kmaq Ecological Knowledge Study (MEKS) was prepared by Membertou Geomatics Solutions and is discussed in Section 6.

3.2 Government and Regulatory Stakeholders

The Project was introduced to the EA Branch of NSECC with the provision of a project description for regulatory review prepared by Mitchelmore Engineering Company Limited (Meco 2023) submitted February 28, 2023. An email response and EA evaluation for the proposed Project was received March 29, 2023, confirming it meets the Class 1 trigger for EA Registration outlined in Section 1. F, Schedule A of the EA regulations. A summary of government and regulatory stakeholder engagement is provided in Table 3.2.1.

Table 3.2.1 Summary of Government Engagement

Date	Organization/Community	Method of Engagement	Purpose and Focus
December 2022	NSECC EA Branch NSECC Local Office • Manager • Engineer • Hydrologist • Inspector	Virtual Meeting	• Discussions related to the utility seeking information related to environmental permitting, approvals, and regulatory matters within the watershed • The utility also updated NSECC on discussions with green hydrogen developers and the likelihood of the required reinstatement of the Little River Reservoir water transfer connection
January 2023	NSECC	Virtual Meeting	• EA trigger(s) review • Approach to Environmental Assessment Evaluation • One Window program • Fisheries consultation
January 2023	NSECC EA Branch NSECC Local Office • Manager • Engineer • Hydrologist DFO	Virtual Meeting	• Discussion to highlight potential regulatory requirements associated with the re-establishment of the connection between Little River Lake and Landrie Lake, meeting focused on the non-EA related areas such as water withdrawal, construction approvals, etc.
November 2023	NSECC EA Branch NSECC Local Office • Manager • Engineer • Hydrologist	Virtual Meeting	• Discussion to focus on the potential adjustments to water withdrawal approval from NSECC when renewed • Discussion on hydrology study and data to be provided with withdrawal approval renewal application and review of hydrological study requirements with EA submission
May 2024	NSECC EA Branch NSECC Local Office • Manager • Engineer	Virtual Meeting	• General review of the Dillon pre-design report(s) for required upgrades at the Little River Reservoir site and Landrie Lake • Review of listed required approvals and study

Table 3.2.1 Summary of Government Engagement

Date	Organization/Community	Method of Engagement	Purpose and Focus
	• Hydrologist DFO		• Update on EA work for Little River connection • Bathymetry survey • Schedule and next steps
May 2024	NSECC EA Branch NSECC Wetlands Specialist NSECC Wildlife Specialist NSDNRR	Virtual Meeting	• This meeting was for the purposes of reviewing the Little River Water Transfer project to Landrie Lake, and scoping the required inputs and information needed in preparation of the environmental assessment project
May 2024	Office of L'nu Affairs	Phone Call Meeting	• Discussion to introduce and describe the proponent and proposed Project. • Discussed the proponent's approach for engaging the Mi'kmaq of Nova Scotia.

3.3 Stakeholders

Planning for engagement included reviewing parties who have previously expressed interest in LLWU activities, and organizations and communities that may have an interest in, and or may potentially be impacted by the Project. When speaking with stakeholders, recommendations were sought regarding other potential stakeholders that may have an interest in the proposed Project. The organizations, communities and companies provided in Table 3.3.1 were identified as stakeholders. Stakeholders were engaged early in the EA process using various methods including one-on-one discussions, email, letter, and a newsletter. Table 3.3.1 summarizes stakeholder engagement activities.

A Project-specific, plain language, newsletter was prepared to inform stakeholders; including a description of proposed Project activities, location figure, the EA process and schedule and contact information to discuss questions or concerns (Appendix A). The newsletter was emailed to stakeholders noted in Table 3.3.1. To reach community residents, the newsletter was posted to the Town of Port Hawkesbury Facebook page and distributed by the Strait Area Chamber of Commerce through their August 29, 2024, membership update by email, Facebook, LinkedIn, and Instagram (Appendix A).

Table 3.3.1 Summary of Stakeholder Engagement

Date	Organization / Community	Method of Engagement	Purpose and Focus
July 2024	BHE	Phone Email	Discussion to introduce and describe the proposed Project. Discussed the process and schedule for the Environmental Assessment Class I Undertaking. Discussed questions and concerns related to the proposed Project.

Table 3.3.1 Summary of Stakeholder Engagement

Date	Organization / Community	Method of Engagement	Purpose and Focus
July 2024	EWF	Phone Email	Discussion to introduce and describe the proposed Project and discuss the process and schedule for the Environmental Assessment Class I Undertaking. Discussed questions and concerns related to the proposed Project
July 2024	Nova Scotia Power	Phone Email	Discussion to introduce and describe the proposed Project and discuss the process and schedule for the Environmental Assessment Class I Undertaking. Discussed questions and concerns related to the proposed Project
July 2024	West Richmond Riders Association	Phone Email	Discussion to introduce and describe the proposed Project and discuss the process and schedule for the Environmental Assessment Class I Undertaking. Discuss where, how, and when the Project area is used by Association members. Discussed questions and concerns related to the proposed Project
July 2024 August 2024	Town of Port Hawkesbury	Phone Email	Discussed the stakeholder and Indigenous engagement process for the proposed Project. Discussed methods to inform community residents of the proposed Project.
August 2024	Port Malcolm Residents	Social Media – Facebook, LinkedIn, Instagram Email - Strait Area Chamber of Commerce membership.	Described the proposed Project, the EARD process and schedule and provided contact information to discuss questions or concerns.
August 2024	Lower River Inhabitants Residents		
August 2024	Walkerville Residents		
August 2024	Whiteside Residents		
August 2024	Evanston Residents		

3.4 Summary of Questions, Concerns and Comments

Feedback on the proposed Project received to date has been positive, with stakeholders understanding the need for the upgrade. BHE, as a potential user of the source water, is supportive of the proposed Project. EFW has not provided a response to date. At the time of writing the EARD Mi'kmaq communities and the KMKNO have not provided feedback on the proposed Project.

Questions, concerns and comments raised during Mi'kmaq and stakeholder engagement are summarized in Table 3.4.1.

Table 3.4.1 Questions and Concerns Raised During Stakeholder and Indigenous Engagement

Question/Concern/Comment	Stakeholder	Response
Will project activities impact residents use of Beaver Dam Lake?	Resident on Beaver Dam Lake	Project activities will not impact residents of Beaver Dam Lake.
Will project activities impact the designated trails used by all terrain vehicle (ATV) riders?	West Richmond Riders Association Representative	ATV riders may experience temporary disruption of trail use during construction; if so, this will be communicated to the Association in advance. Designated ATV trails will not be permanently impacted by the proposed Project.
Will the Landrie Lake Water Utility be able to continue to supply adequate pressure on a daily basis to the Point Tupper Generating Station with two new industrial facilities taking water from the same line?	Nova Scotia Power Representative	Response provided via letter dated July 18, 2025. The scope of the EARD involves the transfer of water between basins; water withdrawal at Landrie Lake is not in scope.
Will the transfer of water from Little River Reservoir to Landrie Lake impact the water quality in Landrie Lake? Will the significant increase in water withdraw from Landrie Lake for the two new hydrogen facilities impact water chemistry? NS Power will need to understand changes to water quality to assess the ability of the Point Tupper water treatment plant to respond to those changes.	Nova Scotia Power Representative	Response provided via letter dated July 18, 2025. The potential impact of the transfer of water from Little River Reservoir to Landrie Lake on the water quality in Landrie Lake is considered in the EARD. The scope of the EARD involves the transfer of water between basins; changes to water chemistry due to water withdrawal from Landrie Lake is not within the scope of the EARD.
Will the Environmental Assessment incorporate climate change predicted impacts on that area and what that means for the future of the watershed?	Nova Scotia Power Representative	Response provided via letter dated July 18, 2025. Yes, the EARD will incorporate climate change considerations in its analyses.
The Point Tupper Generating Station operates an ambient air monitoring station along the access road to the Landrie Lake Water Utility and pumping station. The monitoring station is a regulated requirement in the Industrial Approval for the Point Tupper Generating Station. The station collects data for sulphur dioxide, nitrogen oxides, wind speed and wind direction. Construction activities in this area may impact local air quality.	Nova Scotia Power Representative	Response provided via letter dated July 18, 2025. The Project infrastructure is not in the general area of the air monitoring station, located more than 3 km south of the Project footprint, on the other end of the lake.

3.5 Ongoing Engagement

The LLWU is committed to ongoing engagement with the Mi'kmaq of Nova Scotia and stakeholders and will continue to respond to questions, comments, or concerns regarding the proposed Project.

Once submitted to NSECC, the EARD will be posted online for public review and comment, with printed copies available in the local community, providing stakeholders, Mi'kmaq communities, and the KMKNO with additional opportunities to learn more about the proposed Project and raise questions, comments or concerns for consideration. Comments submitted on the EARD will be considered by the Minister of Environment and Climate Change during the decision-making process.

4 Environmental Assessment Scope and Methods

4.1 Overall Approach

The assessment methods and approach used for this EARD have been developed to meet the requirements of a Class I EA Registration under the Nova Scotia *Environment Act* and Environmental Assessment Regulations.

The scope of assessment considers the proposed Project components and activities; knowledge of the existing conditions and sensitivities of the surrounding environment; other EA documents (i.e., the Bear Head Energy Green Hydrogen and Ammonia Production, Storage and Loading Facility Project) that have been prepared for projects of a similar nature and/or occurring in the same region; applicable regulations, policies and guidelines; the influence of consultation and engagement conducted thus far; and professional experience. The approach assumes a precautionary; that is, to generally overestimate rather than underestimate potential adverse effects.

In recognition of spatial and temporal boundaries set for the assessment, baseline conditions are described for each VC, drawing on baseline studies / programs previously completed and field studies conducted in support of this Project. Potential interactions between the Project and VCs are identified and residual effects described (i.e., after application of mitigation). The significance of these residual effects is then determined against defined thresholds. Where there may be data gaps or some uncertainty around an effects prediction or effectiveness of mitigation, follow-up and monitoring is proposed.

This chapter describes the EA methods and approach used in this EARD.

4.2 Scope of the Assessment

4.2.1 Scope of the Project

The scope of the Project to be assessed includes the components and activities described in Section 2. This includes the construction and operation and maintenance of the buried water transmission pipeline, pumping station compound, and pumping station intake structure. The Little River Reservoir discharge structure will be modified to allow for discharge control and provision of downstream EMF. Modifications are anticipated to include the addition of orifice plates or sluice gates to the existing culverts located within the discharge structure. The modifications are not anticipated to interact with the environment (i.e. water flow downstream will be maintained during construction) and are therefore not carried forward for assessment. Since minimal work is expected to restore the access road to usable condition, this component has not been assessed further. Maintenance work required to reinstate the access road will follow best management procedures and obtain applicable permits, as required (i.e., installation and maintenance of culverts).

The scope of this EARD includes the 2028 Phase I Growth demand (Table 1.4.1). Phase 2 demand requirements, should they become necessary, will be addressed under a separate future permitting process.

4.2.2 Selection of Valued Components

VCs are elements or attributes of the physical, biological or socio-economic environment that may be potentially affected by a proposed project and are selected to be the focus of an environmental assessment given their relative importance in the context of the Project. VCs upon which this assessment is focused were selected in consideration of the following:

- Regulatory guidance and requirements
- Technical knowledge about the Project
- Existing conditions for the physical, biological, and socio-economic environments
- Potential Project-environmental interactions
- Issues raised by the Mi'kmaq of Nova Scotia
- Issues raised by public and regulatory stakeholders
- Professional judgement of the EA study team

Table 4.2.1 lists the biophysical and socioeconomic components to be addressed, along with the rationale for inclusion or exclusion as a VC.

Table 4.2.1 Scoping of Valued Components

Environmental Components	Scoping Considerations	Selected VC
Air Quality	Air Quality is regulated by ECCC under the *Environment Act*. During construction, the Project will emit air emissions including dust and criteria air contaminants. Dust and air emissions can affect human and ecological health. There are no nearby residential receptors, only occasional recreational users (e.g., hikers). During the operations phase, there will be air emissions associated with occasional vehicle and equipment use during operation and RoW maintenance as well as the occasional use of the backup generator.	Atmospheric Environment
Acoustic Environment	During construction, the Project will cause increases in noise levels. Noise can cause annoyance and/or negative health effects to people and can adversely affect birds and other wildlife. Noise (for public nuisance) is governed by provincial noise criteria and municipal by-laws. There are no nearby residential receptors, only recreational (e.g., hikers). During the operations phase, there will be noise emissions associated with occasional vehicle and equipment use during RoW maintenance as well as the occasional use of the backup generator.	Atmospheric Environment
Climate Change	The Project will generate greenhouse gas (GHG) emissions primarily from the operation of construction equipment. Predicted climate change will affect precipitation and temperature in the Project area thus potentially affecting surface water hydrology.	Atmospheric Environment, Effects of the Environment on the Project, Surface Water
Groundwater	Project activities are not predicted to interact with groundwater resources. There are no groundwater users in the area and the Project is not anticipated to intersect aquifers or groundwater supplies.	No Further Assessment Required

Table 4.2.1 Scoping of Valued Components

Environmental Components	Scoping Considerations	Selected VC
Hydrology/Surface Water	Surface water is an integral part of the local environment, providing habitat for fish, vegetation, and aquatic populations, and contributing socio-economic value. Changes to hydrology are also provincially regulated (i.e., Water Approvals to authorize water withdrawal and alterations to wetlands and watercourses along the RoW).	Surface Water
Fish and Fish Habitat	Freshwater fish and fish habitat are protected by the federal *Fisheries Act*. There are several watercourse crossings along the pipeline route, and water withdrawal has the potential to affect fish and fish habitat in Little River Reservoir.	Fish and Fish Habitat
Vegetation	Project activities could potentially affect vegetation including species at risk (SAR) or species of conservation concern (SOCC) and potentially affect species biodiversity, unique species assemblages, and uncommon habitats. This may include changes in vegetation species diversity or community diversity due to direct habitat loss or indirect changes to habitat (e.g., changes in soil, hydrological effects, dust, light exposure changes, competition from invasive plants).	Vegetation and Wetlands
Wetlands	Wetlands are valued resources, protected by the *Environment Act* as well as the Nova Scotia Wetland Conservation Policy. Project activities have the potential to directly and indirectly affect wetland habitat in the vicinity of the Project Area.	Vegetation and Wetlands
Wildlife and Wildlife Habitat	Project activities could potentially directly or indirectly affect wildlife and their habitat including SAR and/or SOCC. Protection of species biodiversity is administered through SARA, the *Endangered Species Act*, and Nova Scotia *Wildlife Act*. Protection of migratory birds is mandated by the MBCA. Project activities, particularly clearing of the pipeline RoW during construction, will change the quality and availability of habitats used by terrestrial wildlife and avifauna in the vicinity of the Project. Changes in habitat and potentially food availability may result in changes in wildlife abundance, diversity and distribution within the affected area.	Wildlife and Wildlife Habitat
Heritage Resources	Ground disturbance associated with Project construction could disturb or destroy previously unidentified archaeological resources present within the disturbance footprint.	Heritage Resources
Socioeconomic Effects	The Project must abide by applicable land use plans and bylaws. The Project is located within a designated protected watershed area and activities, such as bathing, boating, skating, the use of motorized sleds, hunting, and fishing, are prohibited in the protected area. All-terrain vehicle use and hiking activities are known to occur within this area and could be affected by Project activities. It is anticipated, however, that potential effects would mainly occur during the construction phase and with the implementation of standard mitigation (i.e., noise reduction measures, communication of Project schedule) these effects would be negligible. Indigenous traditional land use is discussed in Section 6. Other socioeconomic effects such as employment and changes to the economy could be positive during construction, although generally considered minor on a regional basis. This Project will support other important proposed industrial development such as EverWind and Bear Head green hydrogen projects (see Section 7).	No Further Assessment Required

4.2.3 Assessment Boundaries

The scope of the assessment is defined by spatial boundaries (i.e., geographic extent of potential effects) and temporal boundaries (i.e., timing of potential effects). The spatial boundaries reflect the geographic range over which potential environmental or socio-economic effects may occur, whereas temporal boundaries identify when an environmental or socio-economic effect may occur throughout the different phases of the Project.

The **Project Development Area (PDA)** encompasses the project footprint and is the anticipated area of physical disturbance associated with the construction, operation and decommissioning of the project. For the purposes of this assessment, the PDA comprises of the buried water transmission pipeline, pumping station compound, and pumping station intake structure.

The **Assessment Area** encompasses the area within which project-related environmental effects can be predicted or measured for assessment. The Assessment Area varies by VC depending on the area of influence associated with Project pathways of effects and potential interactions. Assessment Areas for each VC are described in Table 4.2.2.

Table 4.2.2 Assessment Boundaries

VC Name	Assessment Area
Atmospheric Environment	The Assessment Area for the assessment of air quality and noise includes the PDA and a 1-km buffer of the PDA. Since climate change is a global effect, the spatial boundary for the assessment of effects from routine Project activities on GHGs is the global atmosphere.
Surface Water	The Assessment Area for the assessment of surface water includes a 1-km buffer of the PDA, watershed, or property boundary.
Fish and Fish Habitat	The Assessment Area for the assessment of fish and fish habitat includes a 500 m buffer of the PDA, or property boundary.
Vegetation and Wetlands	The Assessment Area for the assessment of vegetation and wetlands includes the PDA and a 180-m buffer of the PDA to capture edge effects, plus additional wetland catchment areas where they extend beyond 180 m.
Wildlife and Wildlife Habitat	The Assessment Area for the assessment of wildlife and wildlife habitat includes the PDA and a 1-km buffer of the PDA in consideration of potential noise effects on wildlife beyond the PDA boundary.
Heritage Resources	The Assessment Area for the assessment of heritage resources include the area within or immediately adjacent to the PDA.

The temporal boundaries for assessment address the potential effects during the construction and operation and maintenance phases of the Project over relevant timescales. For the purposes of this assessment the temporal boundaries are:

- Construction: Approximately 16 months, anticipated to begin within the next 2 years
- Operation and Maintenance: Designed and will be operated and maintained to provide service for approximately 50 to 100 years

Decommissioning will be undertaken in accordance with the regulatory requirements applicable at the time of such activities and appropriate technology will be used. Project related effects are expected to be similar to construction. Impacts will be determined with development of a decommissioning plan. Decommissioning, therefore, has not been assessed further in this EARD.

4.3 Potential Project Interactions

Table 4.3.1 indicates where there is potential for interaction between Project activities and the VCs identified for the assessment.

Table 4.3.1 Potential Projects Interactions with Valued Components

Project Activities	Atmospheric Environment	Surface Water Resources	Fish and Fish Habitat	Vegetation and Wetlands	Wildlife and Wildlife Habitat	Heritage Resources
Construction						
Site Preparation (including clearing, grubbing)	✓	✓	✓	✓	✓	✓
Water Transmission Pipeline Installation	✓	✓	✓		✓	
Building Demolition	✓					
LRTP Construction	✓	✓	✓			
Operation and Maintenance						
Pipeline and Pumphouse Operation	✓	✓	✓			
Maintenance Activities (including vegetation control, pump station compound maintenance)	✓			✓	✓	

4.4 Mitigation and Management Measures

Once potential effects are described for a VC, mitigation measures to reduce potential adverse environmental effects and improve positive effects are identified and described. Technically and economically feasible mitigation measures are proposed to eliminate (e.g., avoid), reduce, or control adverse environmental effects, to address public concerns, and/or to optimize beneficial effects. Mitigation measures may include standard management practices as well as VC-specific measures to address VC-specific issues, such as habitat offsetting/compensation, or planned environmental management and response measures. Standard mitigation is provided in Section 2.9. VC-specific mitigation is provided in the respective VC assessments.

4.5 Residual Environmental Effects

The effects assessment considers relevant scientific literature, baseline results and other available information in the analysis of potential Project-related environmental changes to the VC that may result through one or more mechanisms or pathways. The focus of the effects assessment is on residual effects, which are the effects that remain after application of planned mitigation. In consideration of applied mitigation, the discussion of residual effects considers the magnitude, geographic extent, duration, frequency, degree of reversibility, and possibility of occurrence. The significance of predicted residual effects is then determined in consideration of VC-specific thresholds, which, if a residual effect surpassed (i.e., after mitigation) would represent a significant effect.

4.6 Follow-up and Monitoring

Follow-up and monitoring programs are identified for each VC, where applicable. VC-specific follow-up and monitoring programs may be required to verify the accuracy of key EA predictions and the effectiveness of prescribed mitigation measures, as well as compliance monitoring that will be undertaken as necessary to verify compliance with applicable regulatory requirements, including the terms and conditions of any environmental permits, approvals, or authorizations that may be issued in support of the Project.

5 Environmental Effects Assessment

5.1 Atmospheric Environment

The Atmospheric Environment was selected as a VC because the Project could result in the release of emissions to the atmosphere. The Atmospheric Environment includes the consideration of air quality, GHG emissions, and the acoustic environment (i.e., noise), described below.

Air quality is defined by the composition of the ambient air, including the presence and quantity of air contaminants that may have adverse effects on human health, or vegetation and wildlife. Air quality is highly influenced by local sources of air contaminants (e.g., vehicle traffic or nearby industrial facilities) and can also be influenced by air contaminants transported from sources that are farther away. The concentrations of air contaminants in the ambient air can be compared to air quality criteria and objectives, which are established to protect environmental and human health.

The release of GHGs globally increases the concentrations of GHGs in the atmosphere on a worldwide scale over time and contributes to climate change (IPCC 2014). Emissions resulting from the construction and operation of any single project would have small or negligible effects on global climate change. However, the releases of GHG emissions from a single project can be compared to provincial and national GHG releases and reduction targets to establish magnitude and potential local effects in relation to achieving targets. GHGs considered in this assessment include CO_2, CH_4, and N_2O (expressed in the form of tonnes of carbon dioxide equivalent, t CO_2e; other GHGs are excluded because they are not expected to be released in substantive amounts.

The acoustic environment (i.e., noise) is characterized by the type, frequency, and duration of sound. Noise is unwanted sound that can adversely affect humans and wildlife. Sound pressure levels (L_{eq}) are measured in decibels (dB). An A-weighted decibel scale (dBA) is used to report sound pressure levels in environmental assessments because the A-weighting is used to account for changes in human hearing sensitivity as a function of frequency.

Activities associated with the construction and operation of the Project have the potential to interact with the environment in such a way that adversely affects air quality, GHG emissions, and the acoustic environment. A significant residual adverse effect on Atmospheric Environment for the Project is defined as any of the following:

- For air quality, the Project-related maximum ground level air contaminants released plus the background levels result in frequent exceedances of applicable ambient air quality objectives, guidelines or standards. Frequent is defined as once per week for one-hour objectives and once per month for 24-hour objectives.

- The significance of Project GHG emission totals will be determined as compared to the provincial and federal GHG reduction totals by comparing Project GHG emission estimates to provincial and national GHG annual emissions and established reduction targets. Project emissions will be classified as low, moderate, and high.
  - Low is defined as 10,000 t CO_2e or less per year. Projects emitting less than 10,000 t CO_2e per year are not required to report their GHG emissions to ECCC Greenhouse Gas Reporting Program (GHGRP) and therefore, are considered small, with emissions that are not substantive.
  - Moderate is defined as emissions contributing 10-25% to provincial/federal GHG emissions totals, or 10-25% in comparison to provincial GHG reduction targets.
  - High is defined as emissions contributing more than 25% to provincial/federal GHG emissions totals, or more than 25% in comparison to provincial GHG reduction targets.
- For the acoustic environment, Project-related noise from construction and operation activities plus the background sound pressure levels would cause frequent exceedances of applicable regulated noise limits and impacts to nearby residences (e.g., annoyance and sleep disturbance) and would result in exceedances of local noise by-laws and provincial noise criteria (Section 5.1.1.3).

5.1.1 Regulatory Context

5.1.1.1 Air Quality

The Nova Scotia Air Quality Regulations under the *Environment Act* regulate air quality in the province. The Regulation and Act provide measures to regulate the releases of air contaminants to the atmosphere, establish maximum permissible ground-level concentrations of specified air contaminants, among other requirements. The provincial Air Quality Regulations are under review and the government has developed a suite of proposed ambient air quality standards based on global health guidance (NSECC 2022a). The provincial limits for air contaminants (current and proposed) are presented in Table 5.1.1.

Table 5.1.1 Nova Scotia Air Quality Standards

Air Contaminant	Averaging Period	Air Quality Regulations, Schedule A	Proposed Ambient Air Quality Standards[1]
		µg/m³	µg/m³
Carbon Monoxide (CO)	1 hour	34,600	35,000
	8 hours	12,700	10,000
Hydrogen Sulphide (H_2S)	1 hour	42	-
	24 hours	8	-
Total Reduced Sulphur (TRS)*	24 hours	-	7
Nitrogen Dioxide (NO_2)	1 hour	400	200
	24 hour	-	25
	Annual	100	10
Ozone (O_3)**	1 hour	160	-

Table 5.1.1 Nova Scotia Air Quality Standards

Air Contaminant	Averaging Period	Air Quality Regulations, Schedule A	Proposed Ambient Air Quality Standards[1]
		µg/m^3	µg/m^3
Sulphur Dioxide (SO_2)	1 hour	900	-
	24 hours	300	40
	Annual	60	-
Total Suspended Particulate (TSP)	24 hours	120	100
	Annual	70***	60
particulate matter less than 2.5 micrometres in diameter ($PM_{2.5}$)	24 hours	-	15
	Annual	-	5
particulate matter less than 10 micrometres in diameter (PM_{10})	24 hours	-	45
	Annual	-	15

Notes:

* TRS has been selected to replace H_2S as it is considered a better measure of the total impact of reduced sulphur compounds. TRS includes the measurement of H_2S but also includes other related compounds (NSECC 2022a).

** O_3 is no longer included in the proposed ambient air quality standards because no activity emits ozone; it is a secondary pollutant formed through photochemical reactions involving primary chemicals (NSECC 2022a).

*** geometric mean

µg/m^3 = micrograms per cubic metre

PM2.5 = particles less than 2.5 micrometre in diameter

PM10 = particles less than 10 micrometre in diameter

[1] Source: NSECC 2022a

The Canadian Ambient Air Quality Standards (CAAQS), developed by the Canadian Council of Ministers of the Environment in 2013, provide federal guidance for managing the release of air contaminants in Canada. The CAAQS are presented in Table 5.1.2.

Table 5.1.2 Canadian Ambient Air Quality Standards

Air Contaminant	Averaging Period	parts per billion (ppb)	µg/m^3
Ozone (O_3)	8 hours	60	118
Nitrogen Dioxide (NO_2)	1 hour	42	79
	1 year	12	23
Sulphur Dioxide (SO_2)	1 hour	65	170
	1 year	4	10
$PM_{2.5}$	24 hours	-	27
	1 year	-	8.8

The CAAQS includes standards for 2015, 2020 and 2025; the 2025 standards are listed above, with the exception of fine particulate matter since there is no 2025 standard available. The 2020 standard for fine particulate matter is presented above.

Metrics for each measured parameter:

$PM_{2.5}$ (24 hour) 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
$PM_{2.5}$ (annual) 3-year average of the annual average concentrations
O_3 (8 hour) 3-year average of the annual 4th highest maximum 8-hour average concentrations
SO_2 (1 hour) 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations
SO_2 (annual) Arithmetic average over a single calendar year of all the SO_2 1-hour average concentrations during the year
NO_2 (1 hour) 3-year average of the annual 98th percentile of the NO_2 daily maximum 1-hour average concentrations
NO_2 (annual) Arithmetic average over a single calendar year of all the NO_2 1-hour average concentrations during the year

Source: CCME 2024

The Air Quality Management System (AQMS), also developed by the Canadian Council of Ministers of the Environment, provides a framework for reducing emissions and ambient concentrations of pollutant of concern (CCME 2024). The AQMS categorizes air quality management into four levels, identified by the colours green, yellow, orange and red. Each management level corresponds to a range of concentrations of air pollutants, established during the development of CAAQS (CCME 2024). Each management level has specific actions and objectives, as follows:

- Red Management Level, to reduce pollutant levels below the CAAQS through advanced air management actions
- Orange Management Level, to improve air quality through active air management and prevent exceedances of the CAAQS
- Yellow Management Level, to improve air quality using early and ongoing actions for continuous improvement
- Green Management Level, to maintain good air quality through proactive air management measures to keep clean areas clean

5.1.1.2 Greenhouse Gas Emissions

The Nova Scotia government requires industrial facilities in the province to report and verify GHG emissions under the Quantification, Reporting and Verification Regulations if the facility releases 50,000 t CO_2e or more per year. There are also reporting and verification requirements for natural gas distributors and petroleum product suppliers. The province of Nova Scotia has committed to reducing GHG emissions. The *Environmental Goals and Climate Change Reduction Act* sets the following GHG reduction targets:

- reduce GHG emissions by 53% below 2005 levels by 2030
- achieve net-zero GHG emissions by 2050.

Federally, industrial facilities that emit 10,000 t CO_2e or more per year during operation are required to report GHG emissions to the ECCC GHGRP. The federal government's Emissions Reduction Plan aims to reduce emissions across Canada by 40-45% below 2005 levels by 2030 (Government of Canada 2023b). The federal government has also committed to achieving net-zero emissions by 2050 (Government of Canada 2024a).

5.1.1.3 Acoustic Environment

Locally, the Municipality of the County of Richmond, and the Town of Port Hawkesbury have noise by-laws to limit nuisance noise levels. The limits of both by-laws are 65 dBA during daytime hours, and 55 dBA at night (Municipality of the County of Richmond 2019, Town of Port Hawkesbury 2002).

The provincial government also has noise criteria published in the *Guideline for Environmental Noise Measurement and Assessment*, limiting noise levels to 65 dBA during the day, 60 dBA in the evening, and 55 dBA at night (NSEL 2023).

Federally, Health Canada's *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise* (Health Canada 2017) includes noise criteria related to nuisance and sleep disturbance. Noise mitigation measures are recommended when the percent highly annoyed (%HA) at any given noise receptor location exceeds 6.5% during long-term construction, or operation of a project (Health Canada 2017). The %HA is an estimate of the percentage of people who are potentially annoyed by noise emissions and is based on studies completed by the United States Environmental Protection Agency. To calculate %HA, the measured daytime equivalent sound levels (L_d) and nighttime equivalent sound levels (L_n) are combined to calculate a day-night average sound level (L_{dn}). The L_{dn} is used to calculate the %HA value due to project-related noise emissions.

5.1.2 Existing Conditions

5.1.2.1 Approach and Methods

To characterize the existing conditions for the Atmospheric Environment, the following existing literature and desktop information was reviewed.

- Provincial and national GHG emissions data published by ECCC in annual National Inventory Reports, and data pertaining to existing large-scale emissions of GHG in Nova Scotia, acquired from the federal GHGRP.
- Existing ambient air quality data from the provincial and federal ambient air monitoring networks, published by NSECC and ECCC, including data pertaining to existing large-scale emissions of air contaminants near the Project
- Existing noise data obtained from relevant environmental studies for other developments located near the Project

5.1.2.2 Description of Existing Conditions

5.1.2.2.1 Ambient Air Quality

The provincial government publishes air zone reports annually. The air zone reports compare ambient air quality monitoring results to federal management levels and CAAQS. The 2022 air quality monitoring results from the Port Hawkesbury station, which is the closest station to the Project (approximately 3.5 km southeast), are presented in Table 5.1.3.

Table 5.1.3 Air Quality Results at the Port Hawkesbury Air Monitoring Station (2017-2022)

Reporting Year	Ozone (O_3) 8-hour (ppb)	PM2.5 24-hour ($\mu g/m^3$)	PM2.5 annual ($\mu g/m^3$)	Sulphur Dioxide (SO_2) 1-hour (ppb)	Sulphur Dioxide (SO_2) Annual (ppb)	Nitrogen Dioxide (NO_2) 1-hour (ppb)	Nitrogen Dioxide (NO_2) Annual (ppb)
2017	48	11	5.5	-	-	-	-
2018	48	11	5.3	-	-	-	-
2019	48	11	5.4	-	-	-	-
2020	48	11	5.2	44	0.6	36	2.5
2021	49	11	5.3	35	0.8	33	2.2
2022	49	11	5.4	35	0.8	33	2.3
Air Quality Criteria							
Air Quality Regulations, Schedule A	-	-	-	900	60	400	100
Proposed Ambient Air Quality Standards	-	15	5	-	-	200	10

Table 5.1.3 Air Quality Results at the Port Hawkesbury Air Monitoring Station (2017-2022)

Reporting Year	Ozone (O_3) 8-hour (ppb)	PM2.5 24-hour ($\mu g/m^3$)	PM2.5 annual ($\mu g/m^3$)	Sulphur Dioxide (SO_2) 1-hour (ppb)	Sulphur Dioxide (SO_2) Annual (ppb)	Nitrogen Dioxide (NO_2) 1-hour (ppb)	Nitrogen Dioxide (NO_2) Annual (ppb)
CAAQS 2025*	60	27*	8.8*	65	4	42	12

Notes:
$\mu g/m^3$ micrograms per cubic meter
ppb parts per billion
- not available
* The CAAQS 2025 do not have a criterion for $PM_{2.5}$, so the 2020 criterion is shown
** The Nova Scotia Proposed Ambient Air Quality Standards
Green Indicates parameter is in the green air zone management level range, meaning air quality is good and can be maintained through proactive air management measures to keep clean areas clean
Yellow Indicates parameter is in the yellow air zone management level range, meaning air quality could be improved using early and ongoing actions for continuous improvement
Orange Indicates parameter is in the orange air zone management level range, meaning air quality could be improved through active air management and preventing exceedances of CAAQS
Source: CCME 2024, NSECC 2022a, NSECC 2024

The air contaminant concentrations measured at the Port Hawkesbury station have been within the same management levels since 2017. The concentrations of NO_2 (1-hour) are in the orange management level, meaning the air quality should be monitored and managed to prevent exceedances of CAAQS. Other monitored parameters are yellow (meaning air quality could be improved using early and ongoing actions for continuous improvement) and green (meaning air quality is good and can be maintained through proactive air management measures to keep clean areas clean). The measured concentrations of O_3, SO_2 (1-hour and annual), and NO_2 (annual) are below the maximum permissible ground-level concentrations set out by the provincial Air Quality Regulations and proposed ambient air quality standards, and CAAQS. The $PM_{2.5}$ concentrations (24-hour and annual) are above both the proposed Nova Scotia ambient air quality standards and CAAQS. The concentration of NO_2 is well below the Nova Scotia Air Quality Regulations and proposed ambient air quality standards, and slightly below CAAQS.

5.1.2.2.2 Greenhouse Gases

The quantity of GHG emissions released to the atmosphere in Canada in 2022 (the most recently published data from Canada's National Inventory Reports) was 707,767 kilotonnes (kt) of CO_2e, of which 14,776 kt CO_2e were released in Nova Scotia (ECCC 2024a. Therefore, Nova Scotia's GHG emissions represented approximately 2% of Canada's emissions in 2022. A breakdown of GHG emissions in Nova Scotia over the last five years, by industry category, is presented in Table 5.1.4.

Table 5.1.4 Nova Scotia's GHG Emissions by Industry (2018-2022)

Industry Category		kt CO_2e by year				
		2022	**2021**	**2020**	**2019**	**2018**
Energy	Stationary Combustion	7,833	8,010	8,307	8,872	9,403
	Transport	5,492	5,260	4,923	5,807	5,579
	Fugitive Sources	54	63	151	196	145
	Total Energy	**13,379**	**13,334**	**13,381**	**14,875**	**15,128**
Industrial Processes		468	466	478	447	447
Agriculture		341	341	344	338	346
Waste		588	580	568	549	525
Total		**14,776**	**14,721**	**14,771**	**16,208**	**16,475**

Note:
Kt kilotonnes
Source: ECCC 2024a

GHG emissions in Nova Scotia have been declining in recent years (16,475 kt CO_2e in 2018 compared to 14,776 kt CO_2e in 2022). Canada's GHG emissions have also been on the decline (752 631 kt CO_2e in 2018 compared to 707,767 kt CO_2e in 2022) (ECCC 2024a).

Canada's GHGRP collects data on GHG emissions from facilities across Canada on an annual basis. It is a mandatory program for facilities that emit over 10,000 t CO_2e per year. In 2022 (the most recently published data from the GHGRP) the largest emitting facility in Nova Scotia was the Lignan Generating Station, with over 2 million t CO_2e (or 14% of Nova Scotia's total GHG emissions; Government of Canada 2023a).

5.1.2.2.3 Acoustic Environment

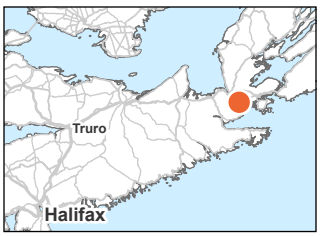
In 2014, an ambient noise assessment was conducted for the proposed Bear Head LNG Project (SNL Lavalin 2015). The proposed Bear Head Liquid Natural Gas (LNG) Project site is located approximately two kilometres south of Landrie Lake. As part of the assessment, sound pressure levels were measured during daytime, evening and nighttime hours at the proposed Bear Head LNG Project site, and at three receptors located to the south and south west, on the west side of the Strait of Canso (Figure 5.1).

A summary of the measured baseline sound levels from the proposed Bear Hear LNG Project are presented below in Table 5.1.5. The daytime, evening and nighttime sound levels were below the local noise by-law limits and provincial noise criteria. Since there has been no changes in industrial activity or land use since the assessment, the Bear Head LNG Project noise monitoring results are considered to remain representative of baseline noise levels in the area.

Table 5.1.5 Ambient Sound Levels at Monitoring Locations and the Project – Bear Hear LNG Project, October 2014

Monitoring Location	07:00 to 19:00 L_{Aeq} (dBA)*	19:00 to 23:00 L_{Aeq} (dBA)*	23:00 to 07:00 L_{Aeq} (dBA)*	Day-Night Average Sound Level (L_{dn}) (dBA)
Bear Head LNG Project Site	46	39	37	46
Receptor 1	50	47	43	55
Receptor 2	50	43	42	55
Receptor 3	50	41	40	54
Provincial Noise Criteria**	65	60	55	None

Notes:
LAeq = weighted continuous sound level
Ldn = day-night average sound level
*Source: SNC Lavalin 2015
**Source: NSEL 1990



Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. SNC Lavalin. 2015. Bear Head LNG Updated Registration Document. Bear Head LNG Corporation.
3. Data Sources: Town of Port Hawkesbury; Stantec; Nova Scotia Natural Resources and Renewables; Nova Scotia Environment and Climate Change
4. Background: Service Nova Scotia NSTDB; ESRI

Legend

- Noise Monitoring Locations[2]

Project Features

- Pumping Station (Proposed)
- Pipeline Route (Approximate)
- Access Road (Existing)
- Study Area (1 km)

Built Infrastructure

- Highway
- Road
- Rail Road
- Transmission Line
- Pipeline
- Built Structures

Other Features

- Watercourse (NSHN)
- Waterbody (NSHN)
- Wetlands (NS NRR)
- Forested Area

0 500 1,000 m

(At original document size of 8.5x11)
1:70,000

N

Stantec

Project Location
Port Hawkesbury
Richmond County, NS

Prepared by NW on 2024-09-20

Client/Project
121418143_008

Landrie lake Water Utility
Little River Pumping Station and Transmission Project

Figure No.
5.1

Title
Monitoring Locations for the proposed Bear Head LNG Project

\\ca0213-pp\fs01\work_group\12141active\1XXX - Other PCs\1214_NB\121418143\gis_data\mapping\aprx\121418143_LandrieLakeUtility.aprx Revised: 2024-10-21 By: niwhite

5.1.3 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Atmospheric Environment is provided in Table 5.1.6. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.1.6 Potential Effects, Effect Pathways and Measurable Parameters for Atmospheric Environment

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in Air Quality	• Interactions between activities and the environment that result in direct effects to the quality of air.	• Concentrations (µg/m^3) of carbon monoxide (CO); total reduced sulphur (TRS), nitrogen dioxide (NO_2), ozone (O_3), sulphur dioxide (SO_2), total suspended particulate matter (TSP), $PM_{2.5}$ and PM_{10}.
Change in Greenhouse Gases	• Interactions between activities and the environment that result in increased GHG emissions.	• Emissions (tonnes per year) of carbon dioxide equivalent (CO_2e)
Change in Acoustic Environment	• Interactions between activities and the environment that result in changes to the existing acoustic environment.	• Sound pressure levels (L_{eq}, dBA), day night average sound level (L_{dn}, dBA), and change in % highly annoyed (%HA).

The Project will interact with the Atmospheric Environment resulting in a change in air quality, change in greenhouse gases, and change in acoustic environment as a result of the following activities:

- Operation of diesel-powered heavy equipment during site preparation along the transfer pipeline RoW and at the pumping station compound
- Operation of diesel-powered heavy equipment during building demolition and building construction, and pipeline installation (i.e., pipe benders, excavators, generators, side boom tractors, rock drills)
- Operation of light duty trucks fueled by diesel and gasoline during construction and operation
- Operation of a back-up generator fueled by diesel and located at the new pumping station compound, during construction and operation
- Fugitive dust from the use of unpaved roads

5.1.4 Mitigation and Management Measures

The following mitigation measures specific to Atmospheric Environment have been identified for the Project:

- Construction equipment will be maintained in good working order, in adherence to manufacturer's recommended schedules and properly muffled.
- Idling of equipment will be reduced, where practical.
- Haul distances to disposal sites will be reduced where possible.
- Disturbed areas will be revegetated as soon as possible to limit dust emissions.
- Construction-related fugitive road dust will be controlled with measures such as road watering on an as-needed basis and speed limits on Project-controlled gravel roads.
- Construction activities will be limited to daytime hours as feasible to limit nuisance noise to off-site receptors at night.

In addition, environmental management practices outlined in Section 2.9 will be implemented to avoid or reduce potential effects on Atmospheric Environment.

5.1.5 Residual Environmental Effects

5.1.5.1 Change in Air Quality

Project-related releases of air contaminants combined with background releases are not expected to exceed provincial or federal air quality objectives, guidelines or standards. During construction, air contaminants are expected to be released from the operation of equipment, machinery, trucks, and the generation of dust. During operation, no substantial emissions of air contaminants are expected to occur. The main potential source would be from the occasional use of the backup generator during operation. As this would only be needed during power outage, air contaminant emissions would be infrequent. Air contaminants released during decommissioning and abandonment are expected to be similar to, or less than, the emissions associated with construction.

5.1.5.2 Change in Greenhouse Gases

Project-related releases of GHGs are expected to be in the range of low (10,000 t CO_2e or less per year) to moderate (10,000 to 100,000 t CO_2e per year), but not high (over 100,000 t CO_2e per year). During construction, GHGs are expected to be released from the operation of equipment, machinery, and trucks. During operation, no substantial emissions of GHGs are expected to occur. The main source would be from the occasional use of the backup generator. The GHGs released during decommissioning and abandonment are expected to be similar to, or less than, the emissions associated with construction.

5.1.5.3 Change in Acoustic Environment

Project-related noise is not expected to exceed local by-laws, provincial noise guidelines or Health Canada's noise recommendations. Construction noise will be intermittent as equipment will be operated on an as-needed basis, short in duration, confined to the Assessment Area (i.e., 1-km buffer of the PDA), and will mostly occur during daytime hours. During operation, no substantial noise is expected to occur. The primary source of noise is expected to be from the occasional use of the backup generator. The noise associated with decommissioning and abandonment is expected to be similar to, or less than, the emissions associated with construction.

5.1.5.4 Summary

With the implementation of mitigation and environmental protection measures as described in this assessment, it is not anticipated that there will be substantial interaction between the Project and the Atmospheric Environment. The releases of air contaminants are not expected to exceed the provincial or federal objectives, guidelines, regulations or standards during Project construction or operation, or material changes in provincial and national GHG emissions. Emissions of noise are expected to be intermittent, short in duration, will be confined to the Assessment Area, and are expected to mostly occur during daytime hours. The residual environmental effects on the Atmospheric Environment are predicted to be not significant for the Project. Prediction confidence in the assessment of the atmospheric environment is high due to the established mitigation and protection measures.

5.1.6 Follow-up and Monitoring Programs

A dedicated follow-up and monitoring program is not proposed for the Atmospheric Environment.

5.2 Surface Water Resources

Surface Water Resources was selected as a VC because the Project is a surface water taking expansion, and surface water is an integral part of the natural environment given its contribution to the health of fish and fish habitat and wetlands, and its linkage to terrestrial and marine ecosystem components and groundwater. It can be an important source of potable water for surface water-supplied drinking water systems and provides groundwater recharge for groundwater-supplied drinking water systems. Changes to surface water flows, quantity or quality, could potentially affect groundwater recharge, aquatic life, terrestrial and marine ecosystems, and human health.

A significant adverse environmental effect on Surface Water Resources is defined as one in which the Project contravenes a watershed management target including:

- Degrading water quality that causes acute or chronic toxicity to aquatic life and uncompensated loss in fish habitat
- Changes to flow that increase sedimentation and erosion above regulatory guidance in waterbodies receiving surface water runoff

- Changes to flows that affect the ability to meet fish habitat requirements downstream of the Project beyond existing conditions
- Withdrawals that exceed sustainable yield estimates
- Changes to pond and lake levels outside the Project Area to the point that it affects the~~ir~~ ability to support existing ecological functions that are not offset by habitat compensation measures
- Exceeds an implemented water quality guideline such as Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQG-PAL) or a site-specific water quality guideline for the protection of aquatic life
- Exceeds the generally accepted TSS monitoring guideline (CWQG-PAL) applied for Project activities

5.2.1 Regulatory Context

Provincial legislation applicable to the assessment of surface water resources includes the *Water Resources Protection Act*, as well as the Activities Designation Regulations, and Environmental Emergency Regulations (under the *Environment Act*). Surface water withdrawals associated with the operation of planned infrastructure will require a Surface Water Withdrawal Approval (SWWA) under the Activities Designation Regulations of the *Environment Act.*

The Project area is part of the Port Hawkesbury Watershed and is a designated Protected Water Area under the *Environment Act,* that includes the Landrie Lake, Little River Reservoir, Beaver Dam Lake, and Macintyre Lake.

Federally, Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ) pertain to potable water and have been adopted by the Canadian Council of Ministers of the Environment (CCME). Nova Scotia has adopted the GCDWQ (CCME 1999) as legally binding standards for regulated public drinking water supplies and recommended for private well owners (NSECC 2021a).

Acts and regulations pertaining to the protection of aquatic life are described in Section 5.3.

5.2.2 Existing Conditions

5.2.2.1 Approach and Methods

The existing surface water conditions in the LAA were characterized based on a review of the following published databases, digital maps, and reporting:

- Meco Water Transfer Reinstatement Application (Meco 2023) and sustainable yield assessment and supporting reservoir hydrologic modelling (Meco 2025, Appendix C)
- Bathymetry data of Little River Reservoir (Straight Engineering Limited June 2024)
- Landrie Lake Water Utility Operating Data, including Lake Level and Water Demand Flow Monitoring (2016-2023)

- Landrie Lake source analytical water quality from the Town of Port Hawkesbury 2018-2019 and between November 2022 and October 2023
- Water Survey of Canada HYDAT database at MacAskills Brook at Birch Cove (Government of Canada 2025)
- Climate Data at Sydney Airport (ECCC 2024d)
- Nova Scotia Digital Topographic Database (Government of Nova Scotia 2020,2021)
- Nova Scotia Hydrographic Network geographic dataset (Government of Nova Scotia 2020)
- Online Well Log System (OWLS) (NSECC 2023b)
- Protected Water Areas of Nova Scotia Mapping (Province of Nova Scotia 2009)

In addition to the available hydrographic network, additional watercourses and waterbodies were identified from associated field work as discussed in Section 5.3.

5.2.2.2 Description of Existing Conditions

Watershed Characteristics

The Project is located within the River Inhabitants Primary Watershed, as defined in the NSECC (2021b) 1:10000 Nova Scotia Primary Watersheds dataset, which includes numerous secondary watersheds that drain the southwestern shore of Cape Breton to the Gulf of St. Lawrence, Northumberland Strait, St. Georges Bay, Strait of Canso, and Inhabitants Bay. Landrie Lake is located within an unnamed Shore-Direct Secondary Watershed (ID 1FD-SD6), covers an area of 14.8 km^2, and is the primary waterbody within the secondary watershed as defined in the NSECC (2021c) 1:10000 Nova Scotia Secondary Watersheds dataset. The approximate watershed is drained by Seacoal Brook to Inhabitants Bay. For the purpose of this assessment, the secondary watershed is referred to as the Landrie Lake watershed. Little River is at the discharge point of the Little River Secondary Watershed (ID 1FA-2), which includes Beaver Dam Lake and MacIntyre Lake and covers an area of 38.7 km^2 (NSECC 2021b). The Little River Secondary Watershed is located to the immediate east of Landrie Lake watershed and discharges to Inhabitants Bay, although the two watersheds are not hydraulically connected.

The Landrie Lake watershed is characterized by coastal hills, with higher relief to the north and is dominated by the anthropogenic Landrie Lake reservoir to the south. The Landrie Lake watershed is within a designated protected water area that is restrictive of bathing, boating, skating, the disposal of waste, the use of motorized sleds, and hunting in this area (Province of Nova Scotia 2009). Nearby industrial infrastructure includes an export terminal operated by EverWind Fuels and Point Tupper wind farm and generating station operated by Nova Scotia Power Incorporated (NSPI). The watershed area encompasses all waterways of note needed to quantify changes which may occur due to the Project activity. The watershed areas and the protected water area designation are noted on Figure 5.2. Characteristics of the existing water supply are summarized for Landrie Lake, Little River and McIntyre Lake in the subsections below.

The Landrie Lake surface area covers 2.67 km^2, with a maximum depth 9.4 m, when the reservoir is at the maximum operating water level. The predominant riparian habitat is grassland, followed by mixed forests. The visible substrate along the shorelines is organic material and cobble, with emergent and submerged aquatic vegetation present along the lakebed. Landrie Lake is drained at the south end of the lake by Seacoal Brook, which discharges from a dam and enters the Atlantic Ocean in Seacoal Cove approximately 320 meters downstream. Landrie Lake is bordered by Highway 104 to the north, and Port Malcolm Road to the south and east. The reservoir operates under specific water level parameters, with a full supply level of 14.56 m in the 2013 Canadian Geodetic Vertical Datum (CGVD2013), a low supply level of 8.5 m, and a maximum design flood elevation of 15.47 m (Meco 2023). Water levels are controlled by an uncontrolled concrete overflow spillway with a crest elevation of approximately 14.56 m and a design discharge capacity of 50.97 m^3/s with 0.9 m of flow depth. The spillway has a crest length of 30.5 meters and is anchored to fractured sandstone bedrock with steel bars for ice force resistance (Meco 2023). Little River Reservoir is a 0.53 km^2 anthropogenic reservoir northeast of Landrie Lake formed by an embankment dam. The reservoir is fed by the Little River upstream, which is connected to both MacIntyre and Beaver Dam lakes. The outlet consists of two culverts 1.5 m in diameter, discharging to the Little River downstream of the reservoir, flowing to the Atlantic Ocean in Murray Cove approximately 1 km downstream. Riparian habitat is described as grasses and mixed forest, with substrate dominated by cobbles, with patches of gravel and large boulders present. Other infrastructure present includes a causeway and railway bed centrally across the reservoir. The reservoir is bordered by Highway 104 to the south and east, and railway to the west.

MacIntyre Lake is a reservoir 0.85 km^2 in area formed by an embankment dam and spillway to the south that drains to Little River tributary, along with Beaver Dam Lake located south of MacIntyre. McIntyre reservoir directly provides storage to downstream Little River Reservoir, and the control structures are not currently operational. The existing control structures include the embankment dam and an adjacent uncontrolled overflow weir to the south, two saddle dams (dams that retain water during floods) located north of the reservoir, and a 0.76 m Inner Diameter low-level outlet pipe at the deepest point in the reservoir, forming the outlet. The riparian zones of MacIntyre and Beaver Dam Lakes are similarly characterized by grasses on shorelines and mixed forest surrounding. The naturally occurring substrate is cobbles, with patches of gravels interspersed. The Lake is bordered by Barberton Road to the west, and Highway 4 and a railway line to the south and east.

Climate and Climate Change

Nova Scotia's climate is subject to seasonal variability. Substantial precipitation occurs in the province, with most of the precipitation falling as rain in the early spring and late fall. Freezing temperatures and precipitation as snowfall typically occur between the months of November and March. Mid-winter snowmelt is common throughout Nova Scotia (Davis et al., 1996).

Climate at Landrie Lake watershed is represented by the most proximate ECCC climate station to the site at Deming, NS (Station ID: 8201410). The Deming Climate Station is located approximately 40 kilometres south of Landrie Lake on Deming Island (ECCC 2024d). The climate in a given area is described by a 30-year climate normal period of data, for which ECCC has developed statistical summaries. For the 1981 to 2010 period, the annual average temperature is 6.1ºC. Based on the latest global climate models (GCMs)

the Coupled Model Intercomparison Project Phase 6 (CMIP6) and Shared Socioeconomic Pathway (SSP) 2-4.5, Landrie Lake watershed average annual temperature is projected to increase by 2.3 ºC to 8.5ºC for the 2021-2050 period. Projected warmer temperatures result in less snowfall, more rain, and increasingly intense rainfall events (NSECC 2022b).

Nova Scotia has an abundance of fresh surface water (NSMNH 2013). Total annual precipitation at Deming Climate Station for the 1981 -2010 period is 1440.5 mm, comprising 9 % as snowfall and the remainder as rainfall (ECCC 2024d). Total precipitation at the Landrie Lake watershed is predicted to increase by approximately 131 mm or 9% for the 2051 to 2080 period under the CMIP6 and SSP 2-4.5 future climate scenario. Such an increase in rainfall would contribute to higher flood risk, increased erosion and humidity (NSECC 2022b).

Topography, Soils and Geology

Surficial geology consists of stony till plains of granite, greywacke, slate and silty till drumlins. Based on the groundwater regional mapping, the Landrie Lake Watershed is predominantly part of the Sedimentary region with areas north of Little River within the carbonate/evaporite region. Based on the geological map of the province of Nova Scotia (NSDNR 2006a), bedrock in the area consists predominantly of the Cumberland Group, comprised of sandstone, shale, coal, siltstone, limestone, mudstone, with some additional minor conglomerate, halite, anhydrite, and gypsum north of Little River. The surficial geology of the Landrie Lake watershed is predominantly shaped by deposits from the last (Wisconsinan) glaciation, consisting mainly of stony till plains (ground moraine) formed from material released at the base of ice sheets that once covered Nova Scotia (NSDNR 2006b).

The soils of the Landrie Lake watershed belong to the Queens soils group (Canada Department of Agriculture 1972), which are moderately fine in texture and imperfectly drained (non-gravelly silt loam to clay loam; moderately well to imperfect). Slopes generally range from 2–15%, occurring on undulating to moderately rolling till plains, as well as till-mantled uplands and glaciolacustrine basins. These soils are dense and firm, derived from moderately fine-textured till and minor lacustrine deposits. This combination yields a heterogeneous infiltration–storage–runoff framework, where fine tills and low relief encourage perched water tables and shallow throughflow. They are weakly calcareous with slow permeability and a plastic consistency. The soils are typically acidic, ranging from very strongly acidic to slightly acidic. Queens soil commonly results in forested land cover, with some agricultural potential for hay production, pasture, and grain cultivation. However, their agricultural capability is limited (Class 4) due to imperfect drainage, dense subsoil, acidity, low fertility, and slope constraints.

Surface Water and Stream Flow

Inflow into Landrie Lake watershed is ungauged. Meco (2025) completed a hydrologic model to estimate inflow to Landrie Lake and Little River, which is included as Appendix C. The model was developed using climate data from the ECCC Sydney Airport climate station, covering 1941 to 2023.

As presented by Meco (2025), monthly flow rates to Little River for maximum, minimum and average scenarios are summarized in Table 5.2.1.

Table 5.2.1 Summary of Flow to Little River Reservoir

Q (L/s)	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Max	5,093	3,639	3,894	3,769	3,499	3,511	2,665	3,212	4,568	4,380	5,060	6,272
Avg.	2,149	2,077	1,895	1,685	1,262	1,076	751	911	1,234	1,765	2,268	2,381
Min	95	490	495	330	61	54	0	0	88	323	561	1080

The NSECC Guide to Surface Water Withdrawal Approvals recommends using 75% of the seasonal median flow (75% Q50) to assess EMF requirements. Based on this, Meco (2025) has estimated seasonal EMF flow thresholds (Table 5.2.2) which range from 856 L/s to a minimum of 215 L/s.

Table 5.2.2 Seasonal Median Flow Rates, 75% Q50

Season	Months	75% Seasonal Median Flow (75%Q50) (L/s)	75% Seasonal Median Flow (75%Q50) (MLD)
Winter	January–March	851	73.5
Spring	April–June	461	39.8
Summer	July–September	215	18.6
Fall	October–December	856	73.9

It is noted that the natural flow regime at Little River does not meet the 75% Q50 flow during the minimum monthly flow periods from Table 5.2.1. As water level monitoring is not currently conducted at Little River Reservoir, Meco (2025) has simulated reservoir levels associated with the discharge of the 75% Q50 flow to the downstream, assuming no additional water withdrawal. Water levels are generally maintained within a 1 m fluctuation from full supply elevation of 14.56 m (CGVD2013). During August through October, water levels periodically drop lower than 13.56 m.

Notes
1. Coordinate System: NAD 1983 (CSRS) v6 UTM Zone 20N
2. Data Sources: Town of Port Hawkesbury; Stantec; Nova Scotia Natural Resources and Renewables; Nova Scotia Environment and Climate Change
3. Background: Service Nova Scotia NSTDB; ESRI

Legend

- Surface Water Sample Location

Project Features

- Pumping Station (Proposed)
- Pipeline Route (Approximate)
- Access Road (Existing)

Built Infrastructure

- Trans-Canada Highway
- Highway
- Road
- Rail Road
- Built Structures

Lands and Administrative Areas

- County Boundary
- Municipal Boundary
- Protected Water Area
- Subwatershed Boundary (Stantec, 2024)
- Protected Area (Park, Nature Reserve, Wilderness Area, Land Trust)
- Proposed or Pending Protected Area

Other Features

- Watercourse (NSHN)
- Waterbody (NSHN)
- Forested Area

0 500 1,000 m
(At original document size of 8.5x11)
1:75,000

N

Stantec

Project Location
Port Hawkesbury
Richmond County, NS

Prepared by NW on 2024-10-25
TR by RJ on 2024-11-05

Client/Project
121418143_010

Landrie Lake Water Utility
Little River Pumping Station and Transmission Project

Figure No.
5.2

Title
Watershed Area

\\ca0213-ppfss01\work_group\12214\active\12XXX - Other PCs\12141_NB\121418143\gis_data\mapping\aprx\121418143_LandrieLakeUtility.aprx Revised: 2025-11-05 By: niwhite

Surface Water Supply

Surface water is an important source of water for public, agricultural, industrial and commercial water supplies throughout the province (NSMNH 2013). Out of the 82 municipal water supplies in Nova Scotia, approximately 54% obtain their water from surface water sources and 12% use a combination of groundwater and surface water. In addition to industrial use, surface water is also used by some small registered public water systems in areas of Nova Scotia to provide water to facilities such as rural schools, day cares, nursing homes, restaurants, and campgrounds. Other important surface water uses include recreational uses, such as swimming and boating, and habitat services for an interconnected web of aquatic life including insects, fish, fish-eating birds, and mammals.

Little River Water Supply

Bathymetry of Little River Reservoir was surveyed by Strait Engineering Ltd. (2024) in CGVD2013. As shown in Figure 5.3, Bathymetric contours were derived from the bathymetric data points in the lake and provincially available topographic data along the shoreline (GeoNOVA 2024). Figure 5.4 illustrates the low and full supply levels of Little River Reservoir. Based on the most recent bathymetry of the lake (Strait Engineering Ltd 2024), the live storage between low supply and full supply levels is 2.7 million cubic meters (Mm^3). Maximum depth from the spillway outlet is approximately 9.5 m, and the total surface area is 0.53 km^2.

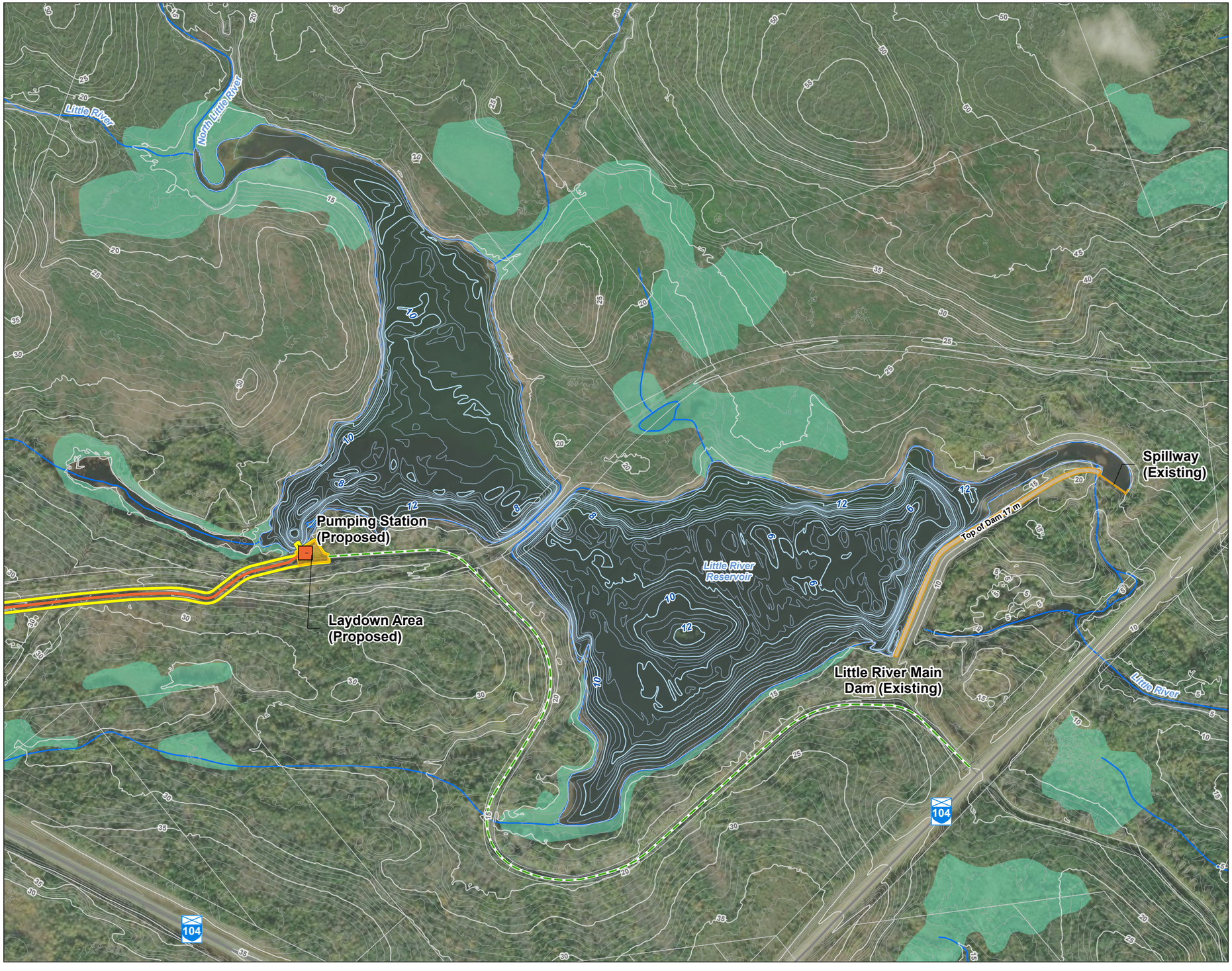


Figure No.

5.3

Title

Bathymetry of Little River Reservoir

Client/Project

121418143_011

Landrie Lake Water Utility
Little River Pumping Station and Transmission Project

Project Location
Port Hawkesbury
Richmond County, NS

Prepared by NW on 2025-11-05
Updated by SC on 2025-12-15

N

0 100 200 m

(At original document size of 11x17)
1:7,500

Legend

- Bathymetric Contour (0.5 m)
- Contour (1 m)

Project Features

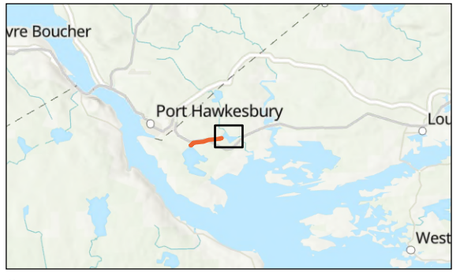
- Pumping Station (Proposed)
- Pipeline Route (Approximate)
- Access Road (Existing)
- Laydown Area (Proposed)
- Project Development Area (20 m RoW)

Built Infrastructure

- Highway
- Road
- Transmission Line
- Pipeline
- Little River Dam (Existing)

Other Features

- Watercourse
- Waterbody
- Wetland
- NSPRD Properties



Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Town of Port Hawkesbury; Strait Engineering; Stantec; Nova Scotia Natural Resources and Renewables; Nova Scotia Environment and Climate Change
3. Background: Service Nova Scotia NSTDB; ESRI

Stantec

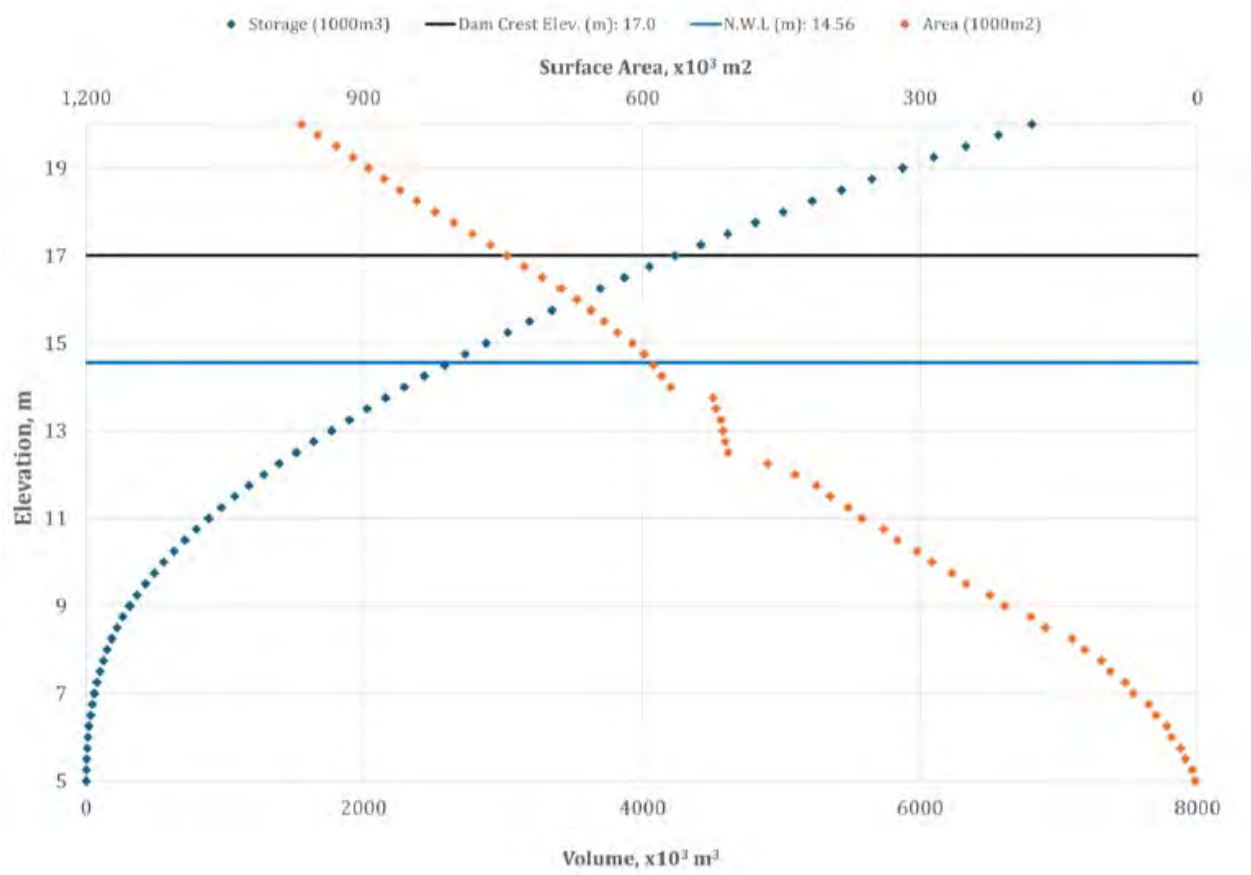


Figure 5.4 Little River Reservoir Stage-Storage Relationship (Meco 2025)

Landrie Lake Water Supply

The Landrie Lake water utility has operated for nearly 50 years to support residential and industrial development in the Point Tupper area of Richmond County. The Town of Port Hawkesbury and the County of Richmond own the utility, which operates under an existing water withdrawal approval 2015-046169-02 for a withdrawal rate of 36 MLD. This approval expires on December 31, 2025. The Landrie Lake Water Utility provides raw water to the Town of Port Hawkesbury, Port Hawkesbury Paper and Nova Scotia Power Point Tupper and EverWind fuels.

As part of the industrial approval to withdrawal water from Landrie Lake, the lake level and water withdrawal volume is continuously monitored. Based on the water demand monitoring records between 2016 to 2024 (Figure 5.5), the average water withdrawal from Landrie Lake is 6.2 MLD; ranging between 3.5 and 18.1 MLD. During that monitoring period, the Landrie Lake level ranged approximately between 14.1 and 14.9 m, CGVD2013. It is noted that the highest average water withdrawal (18,100 m^3) and lowest supply level (14.1 m) were associated with a single, short-term water demand increase occurring in October 2018. Daily water withdrawal from Landrie Lake is consistently between 4,000 and 8,000 m^3 with isolated peaks of limited duration. As the Little River pumping station was decommissioned in 1992, Little River reservoir has not supplemented Landrie Lake during the period of monitoring record.

Landrie Lake reservoir is 2.7 km^2 in area that is formed by an embankment dam and spillway to the south. Landrie Lake Water Supply Infrastructure has an intake and pumphouse to extract the water supply and two principal control structures, which include:

- Embankment dam and uncontrolled 30.5 m wide overflow weir with reinforced concrete wing walls located at the south end of the reservoir
- Auxiliary embankment dam located at the north end of the reservoir

Landrie Lake reservoir does not have a low-level outlet to provide environmental maintenance flow.

Figure 5.6 illustrates the low and full supply levels of Landrie Lake. Based on the most recent bathymetry of the lake (Strait Engineering Ltd. 2024), the total storage at full supply level at Landrie Lake is estimated at 8.9 Million cubic meters (Mm^3) at 2.67 km^2 in surface area.

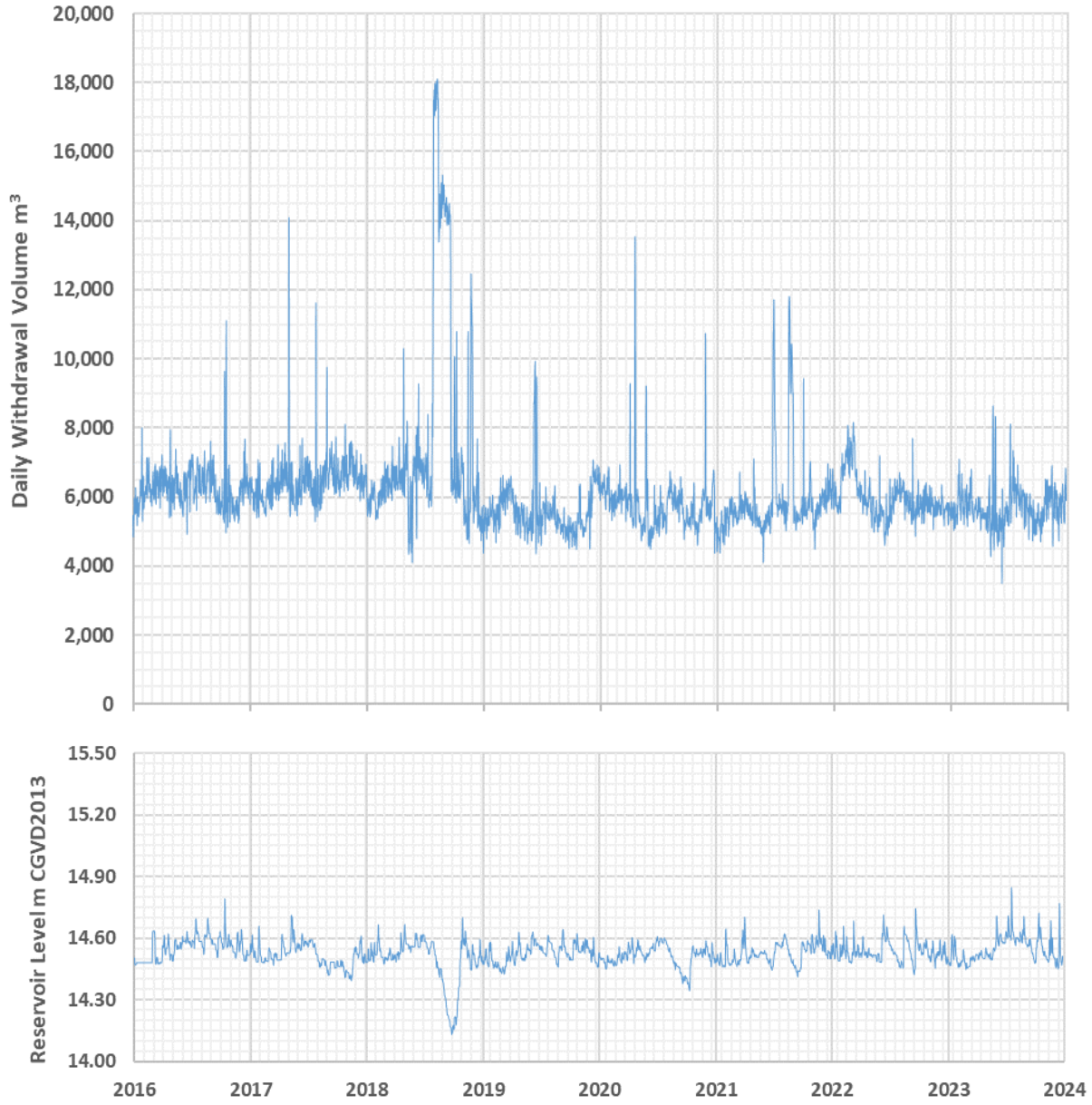


Figure 5.5 Daily Withdrawal Volume & Reservoir Level at Landrie Lake, 2016 - 2024

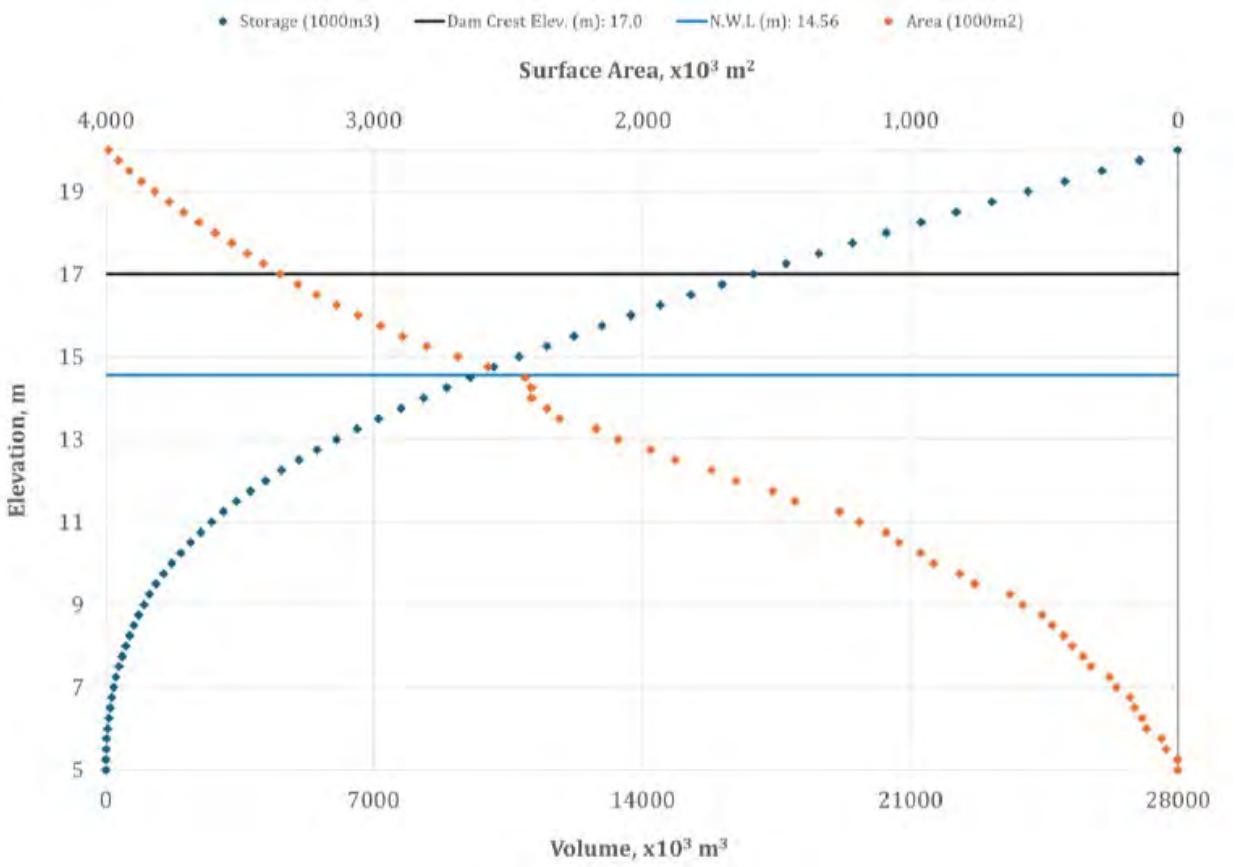


Figure 5.6 Landrie Lake Reservoir Stage-Storage Relationship (Meco 2025)

Surface Water Quality

Surface water quality in Nova Scotia is generally classified as ‘good’ (NSMNH 2013); however, surface waters can be affected by a number of naturally occurring and human-made influences, such as silt, acids, nutrients, metals, mercury, petroleum products, chlorides from road salt, and bacteria. The province of Nova Scotia maintains a Surface Water Quality Monitoring Network of select lakes. The network excludes Little River Reservoir and Landrie Lake, but water quality results are available for Landrie Lake through annual reporting.

A summary of historical water quality results for Landrie Lake are shown in Table 5.2.3 for general chemistry and Table 5.2.4 for total metals. Monitoring statistics are provided, including number of samples, detection limits, minimum, maximum, mean, and 75th percentile values. The CCME CWQG-PAL are used as reference guidelines. The number of guideline exceedances, the number of times the values exceeded the laboratory reportable detection limit (RDL), and the number of non-detects are provided.

Periodic exceedances of the CCME CWQG for PAL are noted for total aluminum, copper and iron. The water quality in Landrie Lake is generally low in turbidity and total suspended solids (TSS), with a trophic status of meso-eutrophic to eutrophic, indicating higher concentrations of total phosphorous (TP). The lake pH is relatively consistent between samples, at an average of 6.7.

Table 5.2.3 Landrie Lake Water Quality – Inorganic/Organic Parameters

Parameter	Units	CCME Freshwater Aquatic Guidelines	Samples Taken	Concentrations (ug/L)				Exceedance Statistics	
				Minimum	Maximum	Mean	75th percentile	Exceedances	Non-Detects
pH		6.5-9.0	19	6.50	6.94	6.70	6.79	0	0
Reactive Silica as SiO2	mg/L	-	18	0.60	2.00	1.21	1.40	0	0
Chloride	mg/L	120.00	19	8.00	15.00	10.52	11.00	0	0
Sulphate	mg/L	120.00	19	4.00	7.10	5.25	5.50	0	0
Alkalinity	mg/L	-	18	2.40	7.60	4.30	4.70	0	3
True Color	TCU	1	19	10.20	37.00	26.07	30.00	0	1
Turbidity	NTU	2	19	0.64	1.90	1.33	1.65	0	0
Electrical Conductivity	µmho/cm	-	18	57.00	73.00	60.78	61.75	0	0
Nitrate + Nitrite as N	mg/L	-	18	0.06	0.18	0.09	0.09	0	12
Nitrate as N	mg/L	13, 5503	19	0.06	0.18	0.09	0.09	0	13
Ammonia as N	mg/L	4	15	0.04	0.58	0.15	0.06	0	13
Total Organic Carbon	mg/L	-	18	3.40	6.50	4.98	5.25	0	0
Ortho-Phosphate as P	mg/L	-	17	0.01	0.02	0.02	0.02	0	16
Total Sodium	mg/L	-	18	6.30	7.60	6.74	6.90	0	0
Total Potassium	mg/L	-	18	0.25	0.40	0.30	0.32	0	0
Total Calcium	mg/L	-	18	2.50	3.80	2.84	2.90	0	0
Total Magnesium	mg/L	-	18	0.67	1.00	0.77	0.80	0	0
Bicarb. Alkalinity (as CaCO3)	mg/L	-	18	2.40	7.60	4.29	4.70	0	3

Table 5.2.3 Landrie Lake Water Quality – Inorganic/Organic Parameters

Parameter	Units	CCME Freshwater Aquatic Guidelines	Samples Taken	Concentrations (ug/L)				Exceedance Statistics	
				Minimum	Maximum	Mean	75th percentile	Exceedances	Non-Detects
Calculated TDS	mg/L	-	18	20.00	36.00	29.95	31.50	0	0
Hardness	mg/L	-	19	9.50	14.00	10.46	10.60	0	0
Total Suspended Solids	mg/L	5	5	1.00	2.60	1.58	1.90	0	9

Notes

1. The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.

2. **Clear flow**: Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer-term exposure (e.g., 30-d period).
High flow or turbid waters:
Maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background is > 80 NTUs.

3. 13mg/L is the standard for long term freshwater, 550mg/L is for short term freshwater. No sample exceeded either value in any of the samples collected.

4. Exceedance threshold for Ammonia as N are dependent on water temperature and pH. Water temperature is not collected, and so thresholds for Ammonia as N cannot be determined.

5.Clear flow: Maximum increase of 25 mg/L from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for a longer-term exposure (e.g., 30-d period).

High flow or turbid waters: Maximum increase of 25 mg/L from background levels at any one time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is ≥ 250 mg/L.

Table 5.2.4 Landrie Lake Water Quality – Trace Metals

Parameter	CCME Freshwater Aquatic Guidelines (ug/L)	Samples Taken	Concentrations (ug/L)				Exceedance Statistics		
			Minimum	Maximum	Mean	75th percentile	Exceedances	Exceedance (%)	Non-Detects
Total Aluminum	100.00	19	25.00	120.00	76.32	100.50	5	26.32	0
Total Antimony	-	1	14.00	14.00	14.00	14.00	-	-	18
Total Arsenic	5.00	0	0.00	0.00	0.00	0.00	0	0.00	0
Total Barium	-	16	5.00	12.00	7.83	8.03	-	-	3
Total Beryllium	-	1	0.00	0.00	0.00	0.00	-	0.00	18
Total Bismuth	-	18	0.00	0.00	0.00	0.00	-	0.00	1
Total Boron	1500.00	5	6.00	9.00	7.60	8.00	0	0.00	18
Total Cadmium	-	19	0.00	0.00	0.00	0.00	-	0.00	19
Total Chromium (CrIII)	8.90	19	0.00	0.00	0.00	0.00	0	0.00	19
Total Cobalt	-	18	0.00	0.00	0.00	0.00	-	0.00	18
Total Copper	2.00	19	0.50	66.00	21.30	42.75	7	36.84	12
Total Iron	300.00	19	91.00	321.00	176.95	220.00	1	5.26	0
Total Lead	1.00	19	0.59	0.60	0.60	0.60	0	0.00	17
Total Lithium	-	14	0.00	0.00	0.00	0.00	-	0.00	14
Total Manganese	513.00	19	22.00	145.00	48.95	53.50	0	0.00	0
Mercury	0.03	15	0.00	0.00	0.00	0.00	0	0.00	15
Total Molybdenum	73.00	18	0.00	0.00	0.00	0.00	0	0.00	18
Total Nickel	25.00	18	0.00	0.00	0.00	0.00	0	0.00	18
Total Phosphorous	-	18	30.00	40.00	35.00	37.50	-	-	16

Table 5.2.4 Landrie Lake Water Quality – Trace Metals

Parameter	CCME Freshwater Aquatic Guidelines (ug/L)	Samples Taken	Concentrations (ug/L)				Exceedance Statistics		
			Minimum	Maximum	Mean	75th percentile	Exceedances	Exceedance (%)	Non-Detects
Total Rubidium	-	14	0.00	0.00	0.00	0.00	-	0.00	14
Total Selenium	1.00	18	1.00	1.00	1.00	1.00	0	0.00	17
Total Silicon	-	14	600.00	860.00	710.00	820.00	-	-	7
Total Silver	0.25	18	0.10	0.10	0.10	0.10	0	0.00	17
Total Strontium	-	18	12.00	18.00	13.11	13.75	-	-	0
Total Tellurium	-	18	0.00	0.00	0.00	0.00	-	0.00	18
Total Thallium	0.80	18	0.00	0.00	0.00	0.00	0	0.00	18
Total Tin	-	18	0.00	0.00	0.00	0.00	-	0.00	18
Total Titanium	-	19	0.00	0.00	0.00	0.00	-	0.00	19
Total Uranium	15.00	18	0.00	0.00	0.00	0.00	0	0.00	18
Total Vanadium	-	19	11.00	11.00	11.00	11.00	-	-	18
Total Zinc	-	18	5.00	43.00	12.03	8.50	-	-	11

Notes:

' -' = no standard available

1. For aluminum, CCME guidelines state limits of 5 ug/L for pH lesser than 6.5, and 100 ug/L for pH exceeding 6.5. All samples exceeded 6.5 pH.
2. For Manganese, limits have been calculated based on hardness.

5.2.3 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Surface Water Resources are provided in Table 5.1. Potential environmental effects and measurable parameters were selected based on regulatory guidance, review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.3 Potential Effects, Effect Pathways and Measurable Parameters for Surface Water Resources

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in Surface Water Quantity	• Changes in streamflow and reservoir water levels	• Inability to sustain Ecological Maintenance Flow (EMF) to downstream watercourses and reservoir water levels
Change in Surface Water Quality	• Use of industrial equipment in or near water • Sedimentation • Discharge of water into a public water supply	• Surface water quality, including general chemistry, total suspended solids (TSS) and bacteria in exceedance of provincial/federal water quality guidelines

The Project will interact with Surface Water Resources resulting in a change in surface water quantity and change in surface water quality as a result of the following activities:

- Water withdrawal during operations of the Project has the potential to alter fish habitat through changes in littoral-zone inundation periods or reductions in downstream flow.
- Project activities may alter surface water quality through a change in TSS concentrations in Little River during construction, or potential changes in water quality within an existing public water supply.

5.2.4 Mitigation and Management Measures

The following mitigation measures specific to Surface Water Resources have been identified for the Project:

- Water quality of the source of supply at Little River will be routinely monitored.
- A SWWA will be secured from NSECC prior to operations of the Little River Reservoir withdrawal. Withdrawal of water from Little River Reservoir will occur under the conditions of the site-specific SWWA.
- A site-specific fish habitat simulation model (HSM) will be completed on Little River using the habitat suitability method defined by DFO (2013b) to estimate required EMF based on channel morphology, hydraulic function and habitat requirements of aquatic species specific to Little River.

- A drought contingency plan will be developed an implemented to enact water saving measures and phased demand reductions based on thresholds associated with lake water levels, with priority supply maintained to municipal water users.
- An EMF threshold for Little River will be decided through a letter of advice, *Fisheries Act* authorizations, or in consultation with DFO.
- EMF will be maintained when hydrological conditions allow; however, it will not extend to periods when natural flow is below the EMF threshold.
- The Little River reservoir outlet will be modified to support the provision of EMF to the downstream environment. EMF supply is contingent on reservoir water levels, which may naturally drop below the EMF threshold.
- An NS Watercourse Alteration Approval will be obtained for work within watercourses and the construction of the intake in Little River Reservoir and the outfall into Landrie Lake.
- A notification will be made to NSECC via the Watercourse Alteration Program for temporary watercourse crossings, if required.
- A Certified Watercourse Alteration Installer will carry out or directly supervise all in-water work.
- In-water worksites will be isolated from flowing water (e.g., by using a cofferdam) to contain or reduce suspended sediment, where possible. Clean, low permeability material and rockfill will be used to construct cofferdams, as required. Fish rescues will be carried out before in-water worksites are isolated.
- If required, all pipeline crossings will be constructed according to NSECC Watercourse Alteration Standards, including but not limited to:
  - Pipeline crossings will cross perpendicular to the watercourse.
  - The pipeline will be installed at least 1 m below the thalweg of the watercourse.
- All activities below the high-water mark (bankfull) will be carried out in isolation of flow, where feasible.
- Cofferdams will be of sufficient height to hold back a 1:2-year return rainfall event.
- Cofferdams will be manufactured cofferdam systems or constructed of bags filled with pea gravel faced with plastic sheet liners.
- During construction, TSS levels downstream will not exceed levels directly upstream by more than 25 mg/L or 10% of background, whichever is greater, or exceed a short-term rise in clear-flow turbidity of up to 8 nephelometric turbidity units (NTU) and 2 NTU long-term. In turbid waters, an increase of up to 8 NTU is acceptable if background is 8–80 NTUs, or a maximum 10% increase if background exceeds 80 NTUs.
- A site-specific Erosion & Sediment Control Plan will be developed for areas of vegetation clearing and trenching within riparian zones and in-water work prior to construction. The sediment and erosion control measures will be adapted to suit the field conditions associated with the specific construction activities as construction proceeds.

- Work will be conducted in a manner to protect watercourses and wetlands from siltation and disturbance in accordance with Best Management Practices or as otherwise agreed upon with the regulator.
- Work will be performed so that materials such as sediment, fuel or other hazardous materials do not enter watercourses and waterbodies through implementation of erosion and sediment control measures and hazardous materials management practices.
- If rutting is observed leading up to a watercourse crossing, brush or rig matting or log corduroy will be installed at the approaches.
- No washing, fueling or maintenance of vehicles or equipment will occur within 100 m of a watercourse or wetland without secondary containment.
- Hydraulically applied seed mixes will include a tackifier to reduce nutrients and seeds in site runoff prior to re-vegetation.
- Weather forecasts will be considered when planning construction and operation activities that may be affected by adverse conditions, such as receipt of materials and supplies, and product deliveries, particularly deliveries of products and diesel fuel. Where required, these activities will be scheduled for periods of favourable weather conditions
- Where the Project involves work below the high-water mark the shorelines will be assessed for erosion, with areas of erosion stabilized.
- The relevant seasonal EMF will be maintained in watercourses and waterbodies where water is diverted during construction or extracted during commissioning and operation.

In addition, environmental management practices outlined in Section 2.9 will be implemented to avoid or reduce potential effects on Surface Water Resources.

5.2.5 Residual Environmental Effects

Effects on habitat within Landrie Lake are excluded from this assessment because the Landrie Lake Water Utility currently operates under a SWWA (2005-046169-02) pursuant to part V of the *Environment Act*, which permits the withdrawal of up to 36 MLD (i.e., it is regulated separately from the transmission of water from Little River Reservoir to Landrie Lake, the scope of this EARD). A reinstatement of withdrawal from Little River will require a separate SWWA where the Utility will be required to complete a water balance analysis to demonstrate that the natural storage in the system will not: degrade in the long term or experience short-term significant drops in water levels; other water users and approval holders can continue their pattern of use without increasing the duration where EMFs are not maintained under existing conditions; wetlands or other sensitive areas will not be adversely affected. The EMF is defined as the quantity and duration of flow required to maintain the ecological functions that sustain fisheries associated with a specific water body and its habitat. General (non-site-specific) EMF criteria are presented in Section 5.2.2.2. A site-specific fish habitat simulation model (HSM) will be completed on Little River using the habitat suitability method defined by DFO (2013b) to estimate required EMF based on channel morphology, hydraulic function and habitat requirements of aquatic species specific to Litle River. This will be completed in support of the required SWWA for Little River.

5.2.5.1 Change in Water Quantity

Operation of the Little River Transfer Station has the potential to change water quantity within the Little River Reservoir and the downstream watercourse. A change in water level within Little River Reservoir is attributed to periods of higher demand from customers of LLWU. Where LLWU is currently permitted to withdraw 36 MLD from Landrie Lake, most of the customer demand is satisfied under the current Landrie Lake withdrawal permit. Meco (2025) anticipates a slightly lower reliable yield 34 MLD for Landrie Lake alone, not including Little River contributions. Considering this, a summary of LLWU demand and supply from the Little River Transfer Station is provided in Table 5.2.5 for the phased growth periods.

Table 5.2.5 LLWU Supply Requirements and Demand from Little River Reservoir

User	2028 Phase 1 Growth (MLD)		2035 Phase 2 Growth (MLD)	
	Average	Max	Average	Max
Existing Customer	6.4	14.7	7.1	16.2
EverWind	8.4	10.7	8.4	10.7
Bear Head Energy	18.9	30.3	37.9	60.6
Reserve	-	-	5	5
Total Demand	33.7	55.7	58.4	92.5
Supply Required from Little River Reservoir	None	21.7	24.4	58.5

The current water supply at Landrie Lake is anticipated to supply new and existing customers under the existing SWWA permit thresholds, with no required operation of the Little River Transfer Station. During Phase 1 maximum demand periods, a transfer of 21.7 MLD is anticipated from Little River Reservoir. This is associated with a relative drawdown of the reservoir by several centimetres (<5 cm). Where historic data shows existing customer demand is consistently at average rates (6.4 MLD) with infrequent periods of peak flow, a 13.4 MLD transfer rate is more likely during periods of maximum demand by green energy users (i.e., EverWind and BHE). It is reiterated that the scope of this assessment includes 2028 Phase 1 demand only. Phase 2 demand information is provided for context and would be subject to separate permitting requirements. Daily withdrawal rates from Landrie Lake are provided from January to December 2024, in Figure 5.7

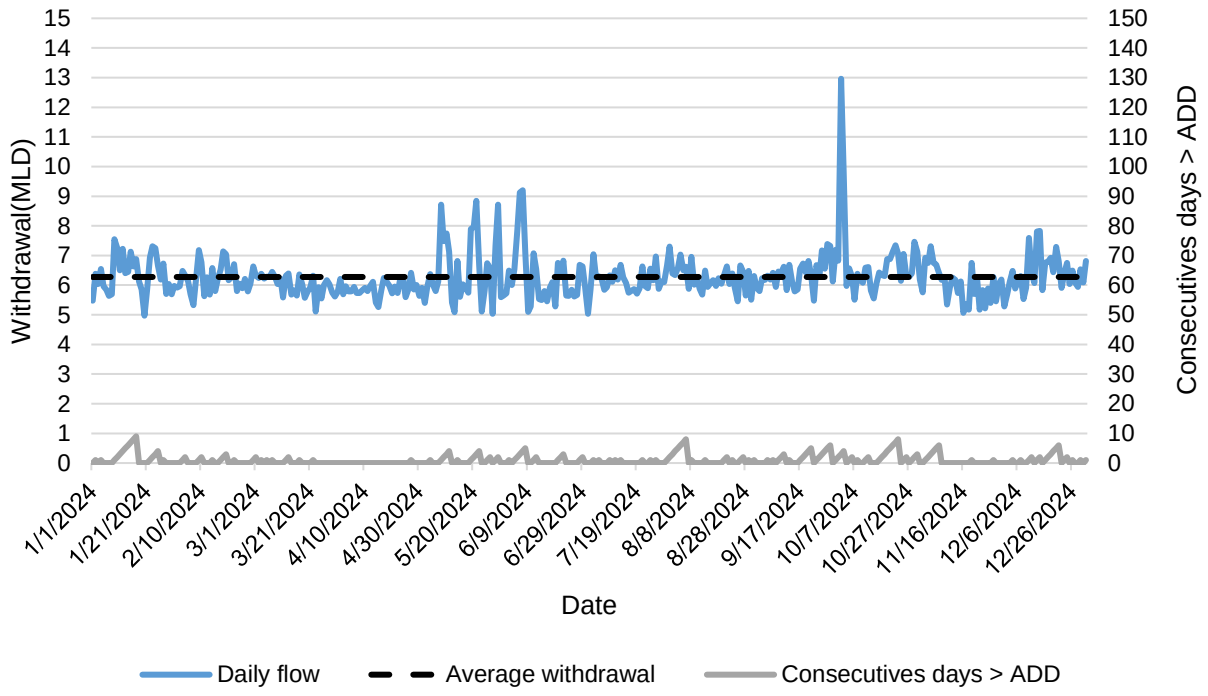


Figure 5.7 Daily Withdrawal Rates from Landrie Lake, 2024

Meco (2025) assessed Little River Reservoir's hydrologic response and safe yield under three outflow scenarios: maintaining 75% Q50 EMF with no withdrawal, 75% Q50 EMF with 14 MLD withdrawal, and 75% Q50 with 22 MLD withdrawal. The selected withdrawal rates represent the required withdrawal from Little River during period of average municipal and peak industrial demand (14 MLD) and peak demand from all users (20 MLD). Based on historical usage data, instances of peak demand from all users are expected to be infrequent and may only occur several times per year (Figure 5.7 and Section 5.2.2.2).

During periods of 14 MLD withdrawal, Meco (2025) found that demand is supplied 96% of the time on an annual basis, with EMF supplied at the 75% Q50 rate for 69% of that time. Percent-supply is slightly lower during the 22 MLD withdrawal, at 94% of demand and 64% of EMF supplied (Table 5.2.6). In the absence of historical water level data for Little River Reservoir, Meco restricted water level changes to 1 m or less for the withdrawal analysis as a conservative approach to mitigating excessive drawdown. Modeling is completed using the historical period of record for the selected climate station and includes periods of significant historical drought (>1:50 year return period).

Table 5.2.6 Percent-Supplied Demand and EMF for Various Transfer Rates (Meco 2025)

Time Period	14 MLD Transfer		22 MLD Transfer	
	Demand % Supplied	EMF % Supplied	Demand % Supplied	EMF % Supplied
Annual	96%	69%	94%	64%
Jan	100%	56%	100%	51%
Feb	100%	68%	100%	65%
Mar	100%	64%	100%	60%
Apr	100%	68%	100%	63%
May	99%	51%	97%	45%
Jun	96%	38%	91%	34%
Jul	86%	30%	79%	26%
Aug	85%	33%	79%	29%
Sep	94%	46%	89%	41%
Oct	98%	49%	97%	46%
Nov	100%	68%	99%	65%
Dec	100%	79%	100%	75%

During a period of no withdrawal, the maintenance of a 75% Q50 EMF resulted in a water level drawdown of >2 m within the reservoir (Figure 5.8). This is representative of natural water level fluctuations at the modelled EMF rate. For Little River, the month with the lowest minimum and average flow rate is July, with daily flow of as low as 0 m^3/s, and an average of 0.75 m^3/s or 64.8 MLD (Meco 2025).

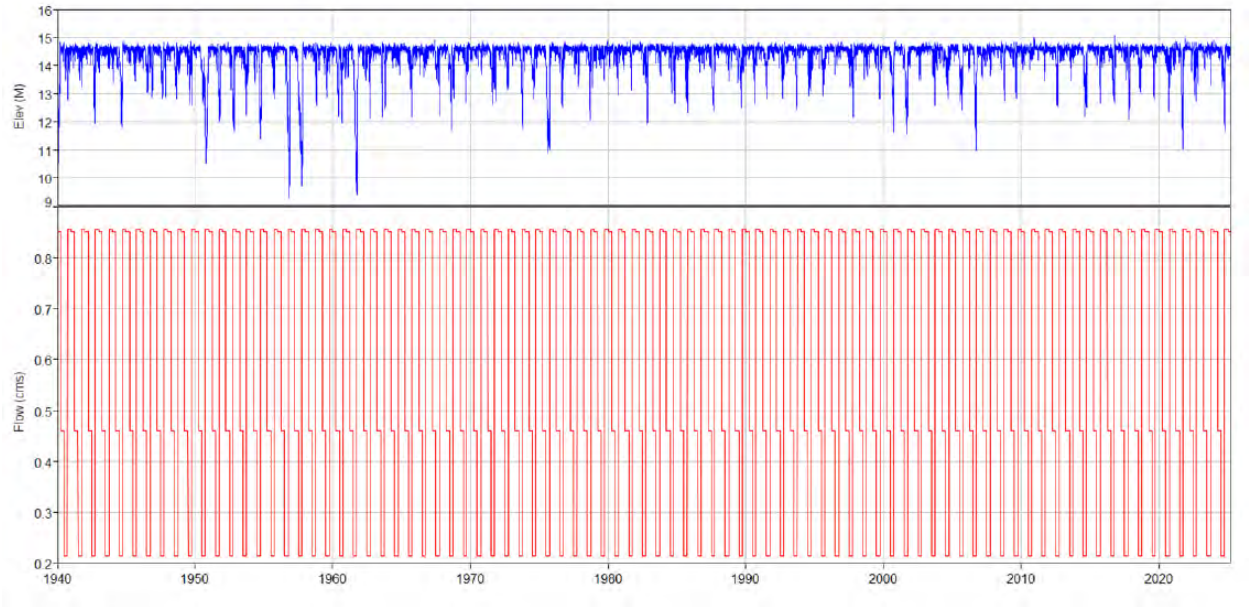


Figure 5.8 Modeled Water Level in Little River with EMF Outflow, No Withdrawal (Meco 2025)

It is expected that the reservoir would be incapable of providing an EMF during periods of low or no inflow, which is common in natural systems in Nova Scotia during the summer months, or during periods of extended drought. Percentages of supplied EMF are anticipated to increase with the integration of drought management planning and the completion of HSM and the development of site-specific EMF criteria.

The average drawdown scenario is not anticipated to affect water levels at Little River Reservoir until withdrawals from Landrie Lake begin to exceed 34 MLD. The peak withdrawal scenario, which requires a taking of 20 MLD from Little River, is anticipated to occur infrequently. A SWWA will be secured from NSECC for the Little River Reservoir for Phase 1 of the required demand. Drought contingency planning and site-specific EMF studies will be integrated into the hydrologic analysis and submitted as part of the Phase 1 SWWA. Should residual adverse effects remain after the implementation of drought management and site-specific EMF criteria, these will be counterbalanced by offsetting through a required authorization pursuant to the *Fisheries Act*, as required by DFO, and further described in the assessment of Fish and Fish Habitat (Section 5.3.5).

Based on requirements of SWWA, the increase in demand required for Phase 2 will require an updated SWWA and associated hydrological assessment prior to 2035. Where the increased demand for Phase 2 will be solely supplied by Little River Reservoir, it is anticipated that a detailed assessment of storage in the upper watershed (McIntyre and Beaver Dam Lakes) will be required at that time.

5.2.5.2 Change in Water Quality

Landrie Lake is generally low in total suspended solids, with expectations that concentrations increase periodically during storm events, which generate turbid surface runoff. Construction activities during the reinstatement of the Little River Transfer Station can increase sediment loadings to the lake if not properly mitigated. The implementation of a site-specific erosion and sediment control plan will reduce the extent of erosion by limiting ground disturbance to critical areas. Where ground disturbance or in-water works is required, sediment control measures and routine monitoring will be used to mitigate environmental effects from potential siltation events.

Water quality at Landrie Lake is routinely monitored and reported on an annual basis as a condition of operation of the Landrie Lake water withdrawal. While municipal users receive treated water, several industrial users receive raw water supplied from LLWU infrastructure. A change in raw water quality would require installation of, or modifications to, existing water treatment facilities of individual industrial users should water quality changes be substantial. A water quality monitoring program will be undertaken at Little River Reservoir to characterize baseline water quality, and monitoring for changes to water quality through operations of the Little River Transfer Station, with results communicated to downstream users prior to construction and commissioning of the station.

5.2.5.3 Summary

Water withdrawals are regulated in Nova Scotia to mitigate potential effects to recreational water uses, consumptive water users, or aquatic species and related habitat. The transfer of a quantity of water from Little River will be completed under the NSECC SWWA process and following the NSECC Guide to Surface Water Withdrawal Approvals (NSECC 2015). DFO's Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada (DFO 2013b) will be used to support further EMF assessment through HSM methods.

Periodic water level changes of >2 m occur in modelled scenarios where an EMF of 75% Q50 is maintained from the system, exclusive of any planned water withdrawals. Restricting water level fluctuation to 1 m in a conservative scenario, Little River can supply required water to Landrie Lake Reservoir while maintaining EMF approximately 50% of the time, on an annual basis. The percent of time that Little River Reservoir can supply EMF to downstream Little River will be updated using the results of the HSM and site-specific EMF assessment prior to submission of the SWWA application. The application will be submitted to withdraw a safe yield from Little River Reservoir, in consideration of reducing periods of drawdown or maintaining drawdown within historical limits and maintaining site-specific EMF to the downstream Little River.

Potential effects on fish habitat are discussed in Section 5.3 Fish and Fish Habitat.

Little River Reservoir is located in an undeveloped forested watershed with minimal anthropogenic influence. Recreational use of the waterbody is also restricted as it is located within the protected water area of the Landrie Lake Water Supply. With mitigation of sediment intrusion through implementation of an erosion and sediment control plan, and restrictions on hazardous material usage in proximity of the reservoir during construction, effects to water quality are anticipated to be minimal. A baseline monitoring program is proposed to characterize raw water quality in the reservoir prior to commencement of construction.

The Project is not anticipated to result in a measurable change on baseline water quality; effects are likely to be short-term in nature (i.e., during the construction phase). Ecological maintenance flow rates will be maintained to Little River as withdrawal from Little River Reservoir will be governed by the provincial SWWA approval process. Therefore, the residual environmental effects on Water Resources are predicted to be not significant for the Project, in consideration of the significant criteria listed in Section 5.2.

5.2.6 Follow-up and Monitoring Programs

Follow-up and monitoring are intended to verify the accuracy of predictions made in the EARD and subsequent permitting to assess the implementation and effectiveness of mitigation. Should an unexpected deterioration of the environment be observed as part of follow-up and/or monitoring, intervention mechanisms will include the adaptive management process. This may include identification of existing and/or new mitigation measures to be implemented to address it (i.e., increased sediment and erosion control).

Follow-up and monitoring to be implemented includes:

- Baseline water quality monitoring at Little River Reservoir (pre-construction)
- Site-specific HSM and EMF assessment to determine required EMF for Little River downstream of Little River Reservoir (pre-submission of a SWWA for withdrawal approval from Little River Reservoir)
- Conditions associated with Application for a Water Withdrawal Approval under the Nova Scotia *Environment Act*
- Conditions associated with *Fisheries Act* Authorization under Canada's *Fisheries Act* (if required)
- Environmental monitoring to follow up on effectiveness of the Erosion and Sediment Control Plan

5.3 Fish and Fish Habitat

Fish and Fish Habitat was selected as a VC because of the importance of freshwater habitat as an ecosystem component and the associated regulatory protection afforded to it. Project activities can interact with the environment in such a way that they directly or indirectly adversely affect freshwater populations through loss or alteration of habitat and/or direct mortality of fish. For the purposes of the assessment, the Fish and Fish Habitat VC includes fish and fish habitat, which are defined under the federal *Fisheries Act* as follows:

- Fish includes: (i) parts of fish, (ii) shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and (iii) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals
- Fish habitat means waters frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas

Freshwater fish and fish habitat can be affected by Project-related changes similarly to Surface Water Resources (Section 5.2), and Wetlands and Vegetation (Section 5.4) through effects such as the direct removal of riparian vegetation (affecting water quality via reduced shade or increased nutrient/energy inputs), alterations to stream flow, the introduction of sediments and contaminants, direct injury or death from in-water work, and water usage that may result in changes in water levels in surrounding watercourses. Therefore, residual effects predicted for surface water and vegetation and wetlands were used to inform potential Project effects on fish and fish habitat.

The Assessment Area for Fish and Fish Habitat includes the Little River Secondary Watershed (ID 1FA-2) which includes Little River Reservoir, Beaver Dam Lake and MacIntyre Lake covering an area of 38.7 km^2.

A significant adverse residual effect on Fish and Fish Habitat is one that, following the application of avoidance, mitigation, and offset measures, results in a harmful alteration, disruption, or destruction (HADD) of fish habitat or a change in fish abundance, health, growth, or survival that is likely to cause a measurable change in fish populations beyond the range of natural variability.

5.3.1 Regulatory Context

The key federal and provincial acts and regulations that apply to fish and fish habitat in Nova Scotia are listed below and followed by brief descriptions:

- The federal *Fisheries Act* (R.S.C., 1985, c.F-14)
- the *Species at Risk Act* (S.C., 2002, c.29)
- the Nova Scotia *Endangered Species Act* (c.2, s.99)
- Nova Scotia Activities Designation Regulations – Water Withdrawal (N.S. Reg. 124/2014)

These key acts and regulations are supported by federal, provincial and non-governmental policies and guidelines including:

- the Fisheries Protection Policy Statement (DFO 2013a)
- Watercourse Alterations Standard (NSE 2015)
- Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Aquatic Life (CCME WQG-PAL) (CCME 1999)

Fish and fish habitat are protected under federal and provincial legislation. DFO's Fisheries Protection Policy Statement (DFO 2019a) provides guidance on fish and fish habitat protection provisions. The federal *Fisheries Act* protects fish and fish habitat and addresses national interests in marine and fresh waters with the goal of protecting the long-term sustainability of aquatic resources. Section 34.4 of the *Fisheries Act* prohibits the destruction of fish by any means other than fishing. Section 35 protects fish habitat from HADD. HADD of fish habitat is defined under the *Fisheries Act* policies as "any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish". Works can be authorized by and carried on in accordance with conditions established by the Minister of Fisheries, Oceans and the Canadian Coast Guard (Fisheries Minister) (section 35(2)(b)). Any such work requires a *Fisheries Act* Authorization with an appropriate offsetting of residual adverse effects after avoidance and mitigation steps have been taken. Sections 36(3) and (4) of the Act prohibit the deposition of deleterious substances into waters frequented by fish in Canada unless authorized by regulation.

The federal SARA provides protection for SAR in Canada. The legislation 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. SAR and their habitats are protected under SARA, which prohibits: 1) the killing, harming, or harassing of endangered or threatened SAR (sections 32 and 36), and 2) the destruction of critical habitat of an endangered or threatened SAR (sections 58, 60 and 61). SAR species are listed in Schedule 1 of SARA. Species identified in Schedule 1 with the potential to occur in the PDA are considered in this EARD.

The CCME WQG-PAL has established accepted water quality guidelines for various parameters. These Guidelines are often used to inform project-specific discharge criteria during the regulatory permitting process.

With respect to provincial regulatory requirements, alterations to watercourses such as construction within streams, rivers, ponds and lakes and flow alterations either through an increase or decrease in watercourse discharge require approval or notification in accordance with the Activities Designation Regulations of the *Environment Act*. The NS ESA provides protection for plant and animal species considered to be Endangered, Threatened or Vulnerable. The NS ESA applies to species, sub-species and populations that are native to NS, however not to marine fishes. The designation under the NS ESA follows the recommendations of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Species Status Advisory Committee.

5.3.2 Existing Conditions

5.3.2.1 Approach and Methods

A characterization of the existing conditions includes a high-level discussion of the influences of past and present physical activities on fish and fish habitat, leading to the current conditions. An understanding of the existing conditions for the VC within the spatial area being assessed is a key requirement in the prediction of potential Project effects provided in Section 5.3.3.

Fish and aquatic habitat field assessments were conducted on Landrie Lake, Little River Reservoir, Little River, and the inflow to Landrie Lake from August 7 to 9, 2024. A follow-up assessment was conducted at the outlet of Landrie Lake (Seacoal Brook) on August 18, 2024. Fish and fish habitat information were collected using a digital collection device and Field maps for ArcGIS software (ERSI, California, USA). The software programming was developed by Stantec and based on requirements for habitat assessment within Atlantic Canada. The methods used to assess the reservoirs and connecting streams are described below.

Detailed lake habitat classifications and fish population studies were conducted on Landrie Lake and Little River Reservoir where lake habitat was characterized from a boat. Habitat characterization included a description of substrate type, riparian habitat, shoreline stability, total cover and the amount of aquatic vegetation. A fish presence/absence survey was conducted with the use of gill nets and minnow traps. Two gill nets were used: one with a mesh size of 1.5 inches and the other had three panels of 1.5, 2.5 and 3.0 inch mesh sizes. Minnow traps were baited with cat food in mesh bags to attract fish but not alter the fish weight. Gill nets were set for approximately an hour in deeper water and minnow traps were left overnight in the shallows along the shoreline. Caught fish were identified, measured for length, and weight, and then released.

Stream habitat classification and fish populations studies were conducted along the in flows and outflows of Landrie Lake and Little River Reservoir. Stream habitats were characterized by defining habitat types. Segments were described based on substrate type, bank stability, riparian vegetation, embeddedness, aquatic vegetation and cover. Photos looking upstream and downstream were taken within each stream segment at representative location. A fish population study was completed using a backpack electrofisher on the outflow of Little River Reservoir and the inlet to Landrie Lake. Caught fish were identified, measured for length and weight, and then released.

5.3.2.2 Description of Existing Conditions

5.3.2.2.1 Fish Habitat

Watercourses and waterbodies present within the PDA were assessed and summarized below, these watercourses and waterbodies are shown in the Mapbook in Appendix B.

Little River Reservoir – Little River Reservoir covers an area of 0.55 km^2. At the time of assessment, the deepest point of the reservoir was 8.5 meters (m). The reservoir is divided into two areas by a railroad. The southern area was assessed with the use of a boat, while the northern area was assessed from the shore. Approximately 1 km of representative shoreline was evaluated for habitat assessments. The predominant riparian habitat transitioned from bare land to patches of grass, followed by mixed forest. The visible substrate near the shore was predominantly organics and cobble, with protective cover mainly consisting of aquatic vegetation and submerged large woody debris.

Outlet of Little River Reservoir – Flow discharges south to Little River through two 1.5 m diameter culverts. A fish habitat assessment was conducted on a 162 m section of the Little River downstream from Highway 104. The watercourse consists predominantly of long run habitats and short riffles. The wetted width ranged from 5.4 m to 6.5 m, and channel depths ranged from 0.02 m to 0.54 m. The substrate was predominantly cobble, with lesser amounts of gravel and small boulders. The riparian vegetation mainly consisted of shrubs and mixed forest. At the time of survey water levels were lower due to the dry season. Fish passage into Little River Reservoir is unlikely due to the barriers at the outlet of the reservoir.

Seacoal Brook (Inlet to Landrie Lake) – A fish habitat assessment was conducted on a 450 m section of the Seacoal Brook before it drains into Landrie Lake (Appendix B Mapbook Page 1). This section of the watercourse encompasses the area where water from Little River reservoir was previously discharged. The inflow consists predominantly of slow flowing riffles and pools. The wetted widths raged from 2.10 m to 4.75 m. The substrate was predominantly small boulders and cobble in the riffle habitats, and finer sediments and organics in the pools. The riparian vegetation consisted of grass banks within mixed forest. The water level in the inlet was low due to the dry season. Debris piles and dry braided channels are present from periods of significantly higher water flow.

WL8 Channel – A low gradient channel is present within wetland WL8 (Appendix B Mapbook Page 5) which originates at the base of the former above ground water transmission line and flows into WL8. At the time of the assessment an outlet from WL8 was not identified. The WL8 channel is approximately 1 m wide and 0.4 to 0.5 m deep. Substrates are organic with stable vegetated banks consisting of wetland grasses. Near the southern portion of the wetland the channel becomes more diffuse and flows into a ponded water section associated with the wetland.

Landrie Lake – Landrie Lake covers an area of 2.67 km^2. At the time of assessment, the deepest point of the studied area was 7.4 m. Approximately 750 m of representative shoreline was evaluated for habitat assessments. The predominant riparian habitat was grass, followed by mixed forests. The visible substrate along the shorelines was predominantly organic material and cobble, with protective cover mainly consisting of emergent and submerged aquatic vegetation.

Seacoal Brook (Outlet from Landrie Lake) – Seacoal Brook is the outlet from Landrie Lake. Directly below the Landrie Lake outlet, the watercourse flows through large boulders and over bedrock for approximately 75 m before dropping down a cascade into a pool. The cascade, large boulders, and dam are a barrier to fish passage, making it unlikely for fish to travel to Landrie lake. There is a standing pool below the Landrie lake dam, likely fed by water seeping through the dam. This pool flows into the Seacoal Brook; however, at the time of assessment there was no above ground water flow out of the pool.

5.3.2.2.2 Fish Communities

Little River Reservoir – A total of 26 fish were caught from the Little River Reservoir. Fish species caught include the American eel (*Anguilla rostrata*), Banded killifish (*Fundulus diaphanus*), Common shiner (*Luxilus cornutus*), and White perch (*Morone americana*). Total catch per fishing method is shown in Table 5.3.1. No fish were caught in the in the Little River but five American eels were spotted and avoided capture.

Table 5.3.1 Abundance of Fish Captured in the Little River Reservoir

Species	Minnow Trap	Gill Net
American eel (*Anguilla rostrata*)	1	0
Banded Killifish (*Fundulus diaphanus*)	4	0
Common Shiner (*Luxilus cornutus*)	2	0
White Perch (*Morone americana*)	4	15

Landrie Lake – A total of 174 fish were caught from Landrie Lake (Table 5.3.2). Fish species caught include Banded Killifish, Common Shiner, and White perch. The inlet to Landrie Lake was fished and 10 brook trout we captured.

Table 5.3.2 Abundance of Fish Captured in the Landrie Lake

Species	Minnow Trap	Gill Net
Banded Killifish (*Fundulus diaphanus*)	137	0
Common Shiner (*Luxilus cornutus*)	19	0
White Perch (*Morone americana*)	0	18

5.3.2.2.3 Aquatic Species at Risk

One aquatic SAR/SOCC is known to inhabit the Little River and Landrie Lake systems: American Eel (Table 5.3.3; COSEWIC 2012, DFO 2022a). In Nova Scotia, eels are found in almost all lakes and rivers that flow to the sea (COSEWIC 2012). American eel adults move downstream in late summer or autumn to marine waters and migrate to the Sargasso Sea to spawn (COSEWIC 2012). As young eels grow, they drift toward the continental shelf and eventually move into inshore waters, migrating to brackish waters or back to freshwater habitats. There has been a general decline in eel abundance over time. Based on habitat characteristics, American eel are likely to occur in the Little River and Landrie Lake river systems.

Table 5.3.3 Aquatic Species at Risk and/or Species of Conservation Concern that may occur in the RAA

Species	Conservation Status			
	SARA	COSEWIC	NS ESA	ACCDC S-Rank
American eel	• No Status (Special Concern)	• Threatened	• NA	• S3N

5.3.3 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Fish and Fish Habitat is provided in Table 5.3.4. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.3.4 Potential Effects, Effect Pathways and Measurable Parameters for Fish and Fish Habitat

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in Fish Habitat	• Use of industrial equipment in or near water • Alteration of riparian vegetation • Sedimentation • In-water infrastructure • Entry of deleterious substances • Obstruction or interference to fish passage • Changes in streamflow and reservoir water levels	• Areal extent of altered instream or riparian habitat (m^2) • Water quality, including total suspended solids (TSS) (mg/L); dissolved oxygen (mg/L); water temperature (°C); pH; deleterious substances
Change in Fish Health and Survival	• Use of industrial equipment in or near water • Sedimentation • Impingement or entrainment from water withdrawal activities • In-water infrastructure • Entry of deleterious substances	• Abundance (numbers of fish) • Mortality (numbers of fish)

5.3.4 Mitigation and Management Measures

The following mitigation measures specific to Fish and Fish Habitat have been identified for the Project:

- Instream construction will be limited to the lower biological risk period between June 1 – September 30, as required, work outside this window will occur through a letter of advice, *Fisheries Act* authorizations, or in consultation with DFO.
- Where direct or indirect effects to fish habitat are unmitigated, a *Fisheries Act* Authorization Application will be filed with DFO, including a habitat offsetting plan to mitigate the loss of fish habitat.
- A SWWA will be secured from NSECC prior to operations of the Little River Reservoir withdrawal. Withdrawal of water from Little River Reservoir will occur under the conditions of the site-specific SWWA.
- A site-specific HSM will be completed on Little River to estimate required EMF based on channel morphology, hydraulic function and habitat requirements of aquatic species specific to Little River. This will be completed in support of the required SWWA.
- The Little River Reservoir outlet will be modified and operated to maintain the EMF, a continuous flow to the downstream environment to sustain the ecosystem.
- A Nova Scotia Watercourse Alteration Approval will be obtained for work within watercourses and the construction of the intake in Little River Reservoir and the outfall into Landrie Lake.
- A notification will be made to NSECC via the Watercourse Alteration Program for temporary watercourse crossings, if required.
- A Certified Watercourse Alteration Installer will carry out or directly supervise all in-water work.
- In-water work will be isolated from flowing water (e.g., by using a cofferdam) to contain or reduce suspended sediment, where possible. Clean, low permeability material and rockfill will be used to construct cofferdams, as required. Fish rescues will be carried out before in-water worksites are isolated.
- If required, all pipeline crossings will be constructed according to NSECC Watercourse Alteration Standards, including but not limited to:
  - Pipeline crossings will cross perpendicular to the watercourse.
  - The pipeline will be installed at least 1 m below the thalweg of the watercourse.
  - All activities below the high-water mark (bankfull) will be carried out in isolation of flow, where feasible.
  - Cofferdams will be of sufficient height to hold back a 1:2-year return rainfall event.
  - Cofferdams will be manufactured cofferdam systems or constructed of bags filled with pea gravel faced with plastic.
  - Turbidity and TSS levels downstream will not exceed levels directly upstream by more than 25 mg/L or 10% of background, whichever is greater.

- The intake screen will be designed in accordance with the DFO Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 1995)
- A site-specific Erosion and Sediment Control Plan will be developed for areas of vegetation clearing and trenching within riparian zones and in-water work prior to construction. The sediment and erosion control measures will be adapted to suit the field conditions associated with the specific construction activities as construction proceeds.
- Work will be conducted in a manner to protect watercourses and wetlands from siltation and disturbance in accordance with Best Management Practices or as otherwise agreed upon with the regulator.
- Work will be performed so that materials such as sediment, fuel or other hazardous materials do not enter watercourses and waterbodies through implementation of erosion and sediment control measures and hazardous materials management practices.
- If rutting is observed leading up to a watercourse crossing, brush matting or log corduroy will be installed at the approaches.
- No washing, fueling or maintenance of vehicles or equipment will occur within 100 m of a watercourse or wetland without secondary containment.
- Hydraulically applied seed mixes will include a tackifier to reduce nutrients and seeds in site runoff prior to re-vegetation.
- Weather forecasts will be considered when planning construction and operation activities that may be affected by adverse conditions, such as receipt of materials and supplies, and product deliveries, particularly deliveries of products and diesel fuel. Where required, these activities will be scheduled for periods of favorable weather conditions
- Where the Project involves work below the high-water mark the shorelines will be assessed for erosion, with areas of erosion stabilized.
- A minimum EMF will be maintained in watercourses and waterbodies where water is diverted during construction or extracted during commissioning and operation.

Environmental management practices outlined in Section 2.9 will also be implemented to avoid or reduce potential effects on Fish and Fish Habitat.

5.3.5 Residual Environmental Effects

Pathways that affect fish habitat as outlined in Section 5.3.3 are primarily related to the construction below the high-water mark, changes in stream flow and water levels that may affect fish passage, and available habitat during water withdrawal.

The residual effects on fish habitat quantity are closely linked to the results of the assessment of Project effects on Surface Water Resources (Section 5.2). For Surface Water Resources, changes to surface water quantity in Little River Reservoir are anticipated during the operation phase. A reinstatement of withdrawal from Little River Reservoir will require a separate SWWA where the Utility will be required to complete a water balance analysis to demonstrate that: the natural storage in the system will not degrade

in the long term or experience short-term significant drops in water levels; other water users and approval holders can continue their pattern of use without causing the flow to drop below the required EMF; and wetlands or other sensitive areas will not be adversely affected.

Effects on habitat within Landrie Lake are excluded from this assessment because the Landrie Lake Water Utility operates under Water Withdrawal Approval 2005-046169-02, issued pursuant to Part V of the *Environment Act*, which authorizes the withdrawal of up to 36 million litres (L) per day. A renewal application for this approval has been submitted and is currently under regulatory review. As such, potential effects associated with water withdrawal are regulated separately and are outside the scope of this EARD, which is limited to the transmission of water from Little River Reservoir to Landrie Lake.

5.3.5.1 Change in Fish Habitat

Pathways that affect fish habitat as outlined in Section 5.3.3 are related to use of industrial equipment in or near water, alteration of riparian vegetation, sedimentation, construction / installation of in-water infrastructure, entry of deleterious substances, obstruction or interference to fish passage, changes in streamflow and reservoir water levels. Those works include the use of heavy machinery to conduct vegetation clearing, excavating and grading near watercourses/waterbodies, waterline construction, excavating and construction associated with the installation of the water intake or outlet structures and impingement / entrainment or reductions in flow from the withdrawal of water.

The Project has been designed to avoid loss of fish habitat through careful planning of the placement of infrastructure and shifting locations of activities away from waterbodies/watercourses. The water pipeline is currently designed to avoid crossing watercourses; however, work within 30 m of watercourses will occur and in water work will be required in Little River Reservoir and Landrie Lake. In these locations the application of best practices in accordance with DFO's "Measures to Protect Fish and Fish Habitat", DFO standards and codes of practices and other standard mitigation will be employed to reduce the potential for effects.

During construction, the primary interaction between the Project fish and fish habitat will be construction of the intake structure for the pumping station. The intake will feature a 40-m long 1050 mm HDPE pipe (subject to final design) connecting the new wet well to a pre-engineered intake screen. The intake pipe will be sized to meet the station's maximum flow requirements, supported by evenly spaced concrete ballasts to prevent flotation. The intake screen will be designed in accordance with DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines to protect freshwater fish which reside in Little River Reservoir.

During operation and maintenance, the primary source of interaction between the Project and freshwater fish and fish habitat will be through water withdrawal. Changes in downstream flow may occur during operations from water withdrawal from Little River Reservoir. Flow alterations of less than 10% of the flow relative to an unaltered flow regime have a low probability of detectable negative effects to ecosystems including those that support fisheries (DFO 2013b). Cumulative flow alterations that result in flows less than 30% of the Mean Annual Flow (MAF) have a heightened risk of effects to aquatic ecosystems (DFO 2013b). An evaluation of sustainable yield will be conducted during the surface water withdrawal permit application. This evaluation of sustainable yield will consider the required EMF in Little River. A site-

specific fish habitat simulation model (HSM) will be completed to assess EMF requirements at a species level. Water levels in Little River reservoir will also be assessed as part of the surface water withdrawal application. It is understood that in addition to NSECC, DFO will also be reviewing the surface water withdrawal application wherein effects on fish habitat will be further considered as part of that permitting process.

The effects of decommissioning activities on fish habitat are anticipated to be similar to construction. For the purposes of assessment, it is assumed that the intake structure and pipes will be removed or decommissioned, however the water level control systems will remain in place.

LLWU will mitigate effects to fish habitat quantity through the mitigation described in Section 5.3.4 above and be compliant with applicable approvals under the *Activities Designation Regulations* and/or *Fisheries Act*. LLWU's goal is to avoid or mitigate loss to fish habitat, to the extent practically feasible. Where avoidance is not feasible, the application of best practices in accordance with DFO's "Measures to Protect Fish and Fish Habitat", DFO standards and codes of practices and other standard mitigation will be employed to reduce the potential for effects. Where residual adverse effects remain, these will be counterbalanced by offsetting through a required authorization pursuant to the *Fisheries Act*, as required by DFO. The Fish Habitat Offsetting Plan, if required, will take into account input from consultation and engagement and will be developed and implemented in consultation with DFO and in consideration of the "Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the *Fisheries Act*" (DFO 2019a).

5.3.5.2 Change in Fish Health and Survival

Pathways that affect fish health and survival as outlined in Section 5.3.3 are related to work in or near water and includes use of industrial equipment in or near water, sedimentation, impingement or entrainment from water withdrawal activities, construction / installation of in-water infrastructure, and the release of deleterious substances. Those works include the use of heavy machinery to conduct vegetation clearing, excavating and grading near watercourses/waterbodies, waterline construction, excavating and construction associated with the installation of the water intake or outlet structures and the release of sediment during construction.

The Project has been designed to avoid these pathways to the extent practicable through shifting the placement of infrastructure away from waterbodies/watercourses. Where avoidance is not feasible, mitigation (Section 5.3.4) will be used to reduce the potential for effects during in or near water works. When working near water, interactions for fish and fish habitat are well known and documented, and DFO's *Measures to Protect Fish and Fish Habitat* and codes of practice will be followed. Key mitigation will include sediment and erosion control, the design of the intake structure, and preventing the introduction of deleterious substances.

The timing of construction could influence the environmental effects of the Project on fish health and survival (i.e., in-water work or sedimentation which may affect spawning adults, incubating eggs, or juveniles). In water work will be conducted to respect DFO timing windows in Nova Scotia which define the low flow period between June 1 and September 30 as the preferred timing window to avoid sensitive life stages (DFO 2019b).

Removal of riparian vegetation during construction could affect fish health due to changes in shade, protective cover, and/or external nutrient/energy inputs (Zalewski et al. 2001). Changes in fish habitat may affect predation rates; however, these changes are unlikely to substantially alter water quality or affect primary and secondary productivity upon which fish rely as food sources given the limited area of riparian disturbance (Zalewski et al. 2001).

Water withdrawals can impinge and entrain fish, affecting their health and survival. Young, small-bodied fish with poor swimming (avoidance) ability are more susceptible to impingement and entrainment than are larger adult fish (DFO 1995). The intake will be designed in consideration of site-specific parameters, including resident fish species and associated life stages. Design of intakes will be in accordance with the Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995), DFO End-of-Pipe Screen Size Tool (Di Rocco and Gervais 2024), and/or the "Interim Code of Practice: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater" (DFO 2022b), as applicable.

5.3.5.3 Summary

DFO's "Measures to Protect Fish and Fish Habitat" (DFO 2019a), standard mitigation measures, and best management practices will be followed for work in or near water to mitigate effects to freshwater fish and fish habitat, to the extent practically feasible. Fish habitat that may be lost as a result of the Project will be counterbalanced through implementation of a Fish Habitat Offsetting Plan, to be developed in consultation with DFO. If required, the Offsetting Plan will be submitted as part of a *Fisheries Act* Authorization for the Project, to mitigate the loss of fish habitat in the Assessment Area. The Offsetting Plan will include a follow-up monitoring commitment to confirm that the required offset is achieved, and contingency measures that can be implemented if the offsetting is not as successful as planned.

Unregulated water withdrawal can affect downstream flow rates and water levels which subsequently change the volume of water available for fish. The Little River reservoir outlet will be modified and operated to maintain a continuous flow to the downstream environment to sustain fish habitat and water levels in Little River Reservoir will be managed to limit water level fluctuations. Further assessment of downstream flow rates and water levels within the reservoir will be conducted as part of the provincial surface water withdrawal application.

Localized changes in riparian vegetation and cover, and alterations to the shorelines are anticipated where work is required within the riparian zone. These effects will be temporary and residual effects will be localized to the PDA.

Project-related residual effects on fish and fish habitat are not anticipated to result in a measurable change from baseline conditions and effects are likely to be short-term in nature (i.e., during the construction phase). Therefore, the residual environmental effects on Fish and Fish Habitat are predicted to be not significant for the Project.

5.3.6 Follow-up and Monitoring Programs

Follow-up and monitoring are intended to verify the accuracy of predictions made in the EARD and subsequent permitting to assess the implementation and effectiveness of mitigation.

Follow-up and monitoring to be implemented includes:

- Conditions associated with Application for a Water Withdrawal Approval under the Nova Scotia *Environment Act*
- Conditions associated with *Fisheries Act* Authorization under Canada's *Fisheries Act* (if required)
- Environmental monitoring to follow up on effectiveness of the Erosion and Sediment Control Plan

5.4 Vegetation and Wetlands

Vegetation and Wetlands is selected as a Valued Component (VC) because of the potential for interactions between Project activities and vegetation and wetlands. Vegetation and wetlands have environmental, aesthetic, recreational, and socio-economic value to the people of Nova Scotia. This VC will focus on loss of vascular plant and lichen Species at Risk (SAR) and Species of Conservation Concern (SOCC) and loss of wetlands, including wetland area and function. SAR and SOCC (defined below) provide a gauge of the effects of a project on the vegetated environment due to the sensitivity of many of these plants to disturbance, and because of the intrinsic value of these plants and their habitats (vegetation communities) for biodiversity. SAR and SOCC are often associated with rare or unusual microsites.

A significant adverse environmental effect on rare and sensitive flora occurs when the population of a species is sufficiently affected to cause a decline in abundance and/or change in distribution beyond which natural recruitment would not return the population to its former level within several growing seasons. A significant adverse environmental effect on wetlands occurs when there is a permanent net loss of wetland area, or loss of important wetland function at a landscape level (i.e., one that would result in a significant effect on another VC that relies upon wetlands), that is provided by a wetland that cannot be avoided or mitigated.

5.4.1 Regulatory Context

Species at Risk (SAR) are those species listed on Schedule 1 of the federal *Species at Risk Act* (SARA) as being either endangered, threatened, or vulnerable or under the Nova Scotia *Endangered Species Act* (NS ESA). There is both federal (SARA) and provincial (NS ESA) legislation for the protection of SAR.

Species of Conservation Concern (SOCC) are rare species that are not protected by SARA or the NS ESA, and include those that are identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as being either endangered, threatened, or of special concern and those ranked as S1, S2, or S3 by the Atlantic Canada Conservation Data Centre (AC CDC, AC CDC 2025).

The occurrence of rare species (i.e., SAR or SOCC) within wetlands is also of concern with respect to provincial wetland policy and the permitting process.

Plant communities of conservation concern have not been similarly classified under provincial legislation or policy. Therefore, the identification of "uncommon plant communities" is based on general knowledge of the distribution of vegetation within the province and the occurrence of species assemblages. For the purposes of this assessment, an uncommon plant community is defined as an area that supports an assemblage of native vascular plants which are not commonly encountered within the province, and which occur as a result of unique natural processes and/or environmental conditions. Examples of uncommon plant communities within the province may include those associated with karst topography, old growth forests, eastern white cedar (*Thuja occidentalis*) stands, rich riparian forests, and alkaline fens.

Wetlands in Nova Scotia are protected by the provincial *Environment Act*, where "wetland" is defined as:

> *land commonly referred to as a marsh, swamp, fen or bog that either periodically or permanently has a water table at, near or above the land's surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation and biological activities adapted to wet conditions.*

The Nova Scotia Wetland Conservation Policy (GNS 2011) provides context to legislation, regulations and operational policies designed to protect and guide management of wetlands in Nova Scotia. The policy establishes a specific goal of no loss of Wetlands of Special Significance and no net loss in area and function for other wetlands. The government considers the following to be Wetlands of Special Significance (NSE 2011):

Appendix A	All salt marshes
Appendix B	Wetlands that are within or partially within a designated Ramsar site, Provincial Wildlife Management Area (Crown and Provincial lands only), Provincial Park, Nature Reserve, Wilderness Area or lands owned or legally protected by non-government charitable conservation land trusts
Appendix C	Intact or restored wetlands that are project sites under the North American Waterfowl Management Plan and secured for conservation through the Nova Scotia Eastern Habitat Joint Venture
Appendix D	Wetlands known to support at-risk species as designated under the federal *Species At Risk Act* or the Nova Scotia *Endangered Species Act*
Appendix E	Wetlands in designated protected water areas as described within Section 106 of the *Environment Act*

Any project with the potential to alter a wetland (filling, draining, flooding or excavating), including direct and indirect effects, requires an Approval from NSECC, pursuant to the Activities Designation Regulations, prior to starting the work. If alterations exceed two hectares of any wetland, the Project is also subject to registration under the Environmental Assessment Regulations. However, the Project is not anticipated to alter 2 ha of a wetland.

5.4.2 Existing Conditions

5.4.2.1 Approach and Methods

Vegetation within the PDA was evaluated using available desktop information and field surveys. The following information sources were reviewed prior to conducting field surveys: existing AC CDC data (AC CDC 2025), aerial and satellite imagery (including LiDAR), provincial forestry data and wetland mapping, the provincial Significant Species and Habitats Database and Boreal Felt Lichen Habitat Modelling (NSDNR 2018).

A two-day field survey occurred on June 26 and 27, 2024 to capture the majority of rare or sensitive vascular plant species potentially present in the PDA that was presented at that time. Field surveys focused on documenting the distribution and abundance of any Species at Risk (SAR) and Species of Conservation Concern (SOCC) observed within the PDA, describing the dominant vegetative communities, and obtaining information on other important features (e.g., rare or unique habitats, concentrations of invasive plants). The extent of the PDA has changed since field surveys were conducted and some wetland areas within the updated PDA have been interpreted from satellite imagery and LiDAR (light detecting and ranging) hillshade data.

A review of provincial wetland mapping identified two wetlands within the pipeline PDA. Field surveys completed in June encountered seven unmapped wetlands and one of the two mapped wetlands within the pipeline PDA was not a wetland. Boundaries of wetlands within this area were delineated following principles outlined in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and the Northcentral and Northeast Regional Supplement (U.S. Army Corps of Engineers 2012) by two trained wetland delineators. Delineation data forms with vegetation plots and soil pits were not completed during 2024 field surveys but will be completed in advance of wetland permitting. A functional assessment of wetlands within the PDA was conducted following the Wetland Ecosystem Services Protocol – Atlantic Canada (WESP-AC) method (NBDELG 2018). As part of the functional assessment, surveys for plant and animal SAR and other SOCC were recorded within wetlands during the surveys.

Wetland delineations and functional assessment were not completed for wetlands adjacent to Landrie Lake or Little River Reservoir (outside the PDA) as the change in lake level as a result of the Project is assumed to be within the historical lake level fluctuations. As outlined in Section 2.4 (Pipeline Operation), the reservoir will be operated to maintain the highest possible supply level. As part of the NSECC Surface Water Withdrawal Approval (SWWA) process prior to operation of the transfer pipeline, water extraction volumes and corresponding reservoir levels will be evaluated, including potential effects on wetlands adjacent the Little River Reservoir. Wetland delineations and functional assessments will be completed at that time, which will provide baseline data for future monitoring. NSECC mapped wetlands are illustrated on Figure 5.3 (above).

5.4.2.2 Description of Existing Conditions

Vegetation

A total of 168 vascular plants were identified within the PDA and surrounding surveyed area (Appendix D). There were no vascular plant SAR or SOCC observed during field surveys, and none recorded within the PDA by the AC CDC (2024). However, two uncommon species, American beech (*Fagus grandifolia*) and northern ground-cedar (*Diphasiastrum complanatum*) were observed. These species are ranked S3S4 (AC CDC 2025) indicating their populations are vulnerable-to-apparently secure in Nova Scotia, which does not meet the criteria for SOCC. The remainder of observed plants are ranked S4 or lower and are considered apparently-secure to secure, and common in Nova Scotia. No invasive plant species were recorded during the field surveys. No well-known plants of cultural value (e.g., black ash) were noted during surveys; however, it is possible that some plants of cultural value were recorded but their cultural values are not known to the observers. A Mi'kmaq Ecological Knowledge Study (MEKS) was prepared, which included a site visit (Section 6). There were no predicted Boreal Felt Lichen Habitat Model polygons within or near the PDA. Due to the previous disturbance throughout most of the PDA, the habitats encountered were not considered to have high potential to support lichen SAR. Therefore, lichen surveys were not completed for this Project.

Many of the plant communities encountered within the PDA are common within the province. There is no evidence of karst topography, eastern white cedar-dominated forest stands, or alkaline fens. There are no confirmed old growth stands currently within the PDA and the possibility of previously disturbed areas maturing to eligible old growth forest in the near future is low. It is possible that mid to late successional forest stands near or within undisturbed areas of the PDA could eventually mature into eligible old growth forests under the provincial old growth policy, if they were to meet the age of onset for eligible FEC forest types (NSDNRR 2022). The area surrounding Seacoal Brook is riparian habitat but is not notably species rich. Overall, many of the plant communities encountered are common in Nova Scotia or are already disturbed by the previous pipeline.

Wetlands

Within the pipeline route a total of eight wetlands were encountered during field surveys (Appendix B); following PDA changes, seven of these wetlands are within the proposed PDA. Each field-delineated wetland has been classified by class and type according to the Canadian Wetland Classification System (CWCS) (Table 5.4.1). Most of the delineated wetlands are within or adjacent to the existing pipeline route. These wetlands have been previously disturbed by pipeline activities and are now compacted, and previously cleared sections are regenerating. Only one delineated wetland (WL1) occurs within the undisturbed area and is now outside of the current proposed PDA.

All wetlands within the PDA are located within a provincially protected watershed, the Port Hawkesbury Designated Water Supply Area; therefore, these are all considered to be WSS under Section 106 of the *Environment Act*. However, no assessed wetlands were identified as WSS for high wetland function using WESP-AC (Appendix E).

Table 5.4.1 Wetland Types and Area in the PDA

Wetland ID	Wetland Class and Type[1]	Total Wetland Area (ha)	Area within PDA (ha)	Provincially Identified WSS	WESP Identified WSS
WL1	Mixedwood Treed Swamp	0.06	0	Y	N
WL2	Graminoid Marsh	2.64	0.08	Y	N
WL3	Mixedwood Treed Swamp	3.82	0.11	Y	N
WL4	Deciduous Treed Swamp	0.11	0.11	Y	N
WL5	Graminoid Marsh	0.10	0.07	Y	N
WL6	Mixedwood Treed Swamp	0.27	0.03	Y	N
WL7	Mixedwood Treed Swamp	0.36	0.08	Y	N
WL8	Complex – Marsh & Mixedwood Treed Swamp	2.53	0.48	Y	N

Note:
1. Wetland classes and types were field identified.

Descriptions of Wetland Classes

Treed Swamp

Treed swamp wetlands are generally dominated by at least 30% woody vegetation cover comprised of trees or tall shrubs and may occur on organic or mineral soils influenced by minerotrophic groundwater (NWWG 1997). The water table is typically at or near the soil surface and they are not as wet as marshes, fens, or bogs. Swamps are the most abundant class in the PDA.

Mixedwood treed swamps are the most common subtype found within the PDA. The overstory primarily comprised red maple (*Acer rubrum*), yellow birch (*Betula allegahnensis*), black spruce (*Picea mariana*) white spruce (*Picea glauca*) and eastern larch (*Larix laricina*). The shrub layer often comprised regenerating trees from the tree layer as well as other species such as balsam fir (*Abies balsamea*) or alders (*Alnus incana* and *A. alnobetula*). The herb layer often contains many fern species such as cinnamon fern (*Osmundastrum cinnamomeum*) while the bryophyte layer is most often dominated by *Sphagnum* spp.

Marsh

Marshes typically have shallow, but fluctuating water levels and are typically dominated by graminoid species including grasses, sedges (*Carex* spp.), cattails (*Typha* spp.), or rushes (*Juncus* spp.), and may include some shrub cover. The fluctuating water levels and changes in water depth and duration of flooding often result in distinct zones of vegetation (NWWG 1997). While marshes are often associated with high species diversity, many of the marshes within the PDA are a result of beaver activity creating large pools of water and increasing the abundance of graminoid cover. The post disturbance communities found in these marches are relatively simple and dominated by blue-joint reed grass (*Calamagrostis canadensis*).

5.4.3 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Vegetation and Wetlands is provided in Table 5.4.2. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.4.2 Potential Effects, Effect Pathways and Measurable Parameters for Vegetation and Wetlands

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in SAR or SOCC	Vegetation clearing and ground disturbance within the PDA may result in direct (e.g., physical disturbance) and indirect (e.g., hydrological changes to habitats) effects on plant SOCC	Changes to vascular plant or lichen SAR or SOCC (number of individuals or populations)
Change in Wetland Area or Function	Vegetation clearing, ground disturbance, and infilling within the PDA during construction, and vegetation maintenance during operation and maintenance may change wetland area or function, either directly due to disturbance, or indirectly due to edge effects or changes in hydrology.	Loss of wetland area (ha)

In the absence of mitigation, the Project may interact with the vegetation and wetlands resulting in a change in SOCC and wetland area or function as a result of the following activities:

- Clearing and grubbing during the construction phase of the Project will remove plant species (and potentially SAR and SOCC) and vegetation communities, disturb soils, and alter wetland function where wetlands are intersected and topography, soils or vegetation are altered near wetlands.
- Construction activities can introduce invasive plant species brought in by machinery and construction equipment or spread existing invasive plant species.
- Construction of the pipeline RoW could result in the fragmentation of plant communities and the creation of edge effects in intact forest stands.

- Construction activities such as infilling can lead to direct loss of wetland within the pipeline RoW and potential temporary and long-term disturbance to wetlands adjacent or bordering the RoW.
- Construction-related changes in hydrology such as impoundment can lead to indirect loss of wetland area and change in wetland function near the RoW.
- Sedimentation of wetlands or watercourses could alter soil conditions or smother, wetland or aquatic habitats that support plant species of conservation interest.
- During the operational phase of the Project, the maintenance of the pipeline RoW will inhibit the natural succession of plant communities on the RoW throughout the life of the Project.
- Vegetation control during the maintenance phase of the Project could affect wetlands and vegetation.
- During operation of the pipeline, water withdrawals may have an effect on wetlands along the shoreline of Little River Reservoir. Though natural fluctuations in water levels occur in lacustrine systems, the increase in fluctuation could lead to prolonged drying of vegetation and soils during the growing season and may negatively impact many of the wetlands (Johnston 1989).

5.4.4 Mitigation and Management Measures

The following mitigation measures specific to Vegetation and Wetlands have been identified for the Project:

- Clearing and grubbing will be confined to necessary areas within the PDA.
- All equipment will arrive at the site clean and free of soil or vegetative debris to avoid introduction of invasive species.
- Vehicles and equipment will be operated on previously disturbed areas and outside of wetland buffers, wherever feasible.
- Best management practices will be followed to protect watercourses and wetlands from erosion and siltation.
- Natural regeneration will be allowed when possible, and when not possible, a native seed mix will be used for revegetation, if available.
- Grading will be reduced within wetland boundaries and temporary workspace will not be located within the boundaries of wetlands, unless required for site-specific purposes.
- Grading in upland areas will be directed away from wetlands, where possible.
- Storage of hazardous products and fueling and servicing of equipment will occur more than 100 m from watercourses, waterbodies, and wetlands.
- Vegetation management will be restricted to necessary areas.
- Travel through wetlands will be restricted for inspection or maintenance activities.
- Herbicides will not be used in wetlands and their buffers, as herbicide use is not permitted in the protected watershed. Mechanical or hand clearing will be used when required.
- Temporarily disturbed areas will be returned to pre-construction conditions.

- During construction within the pipeline RoW, wetland soils will be stored separately from upland soils and will be replaced in wetland areas following construction activities.
- During construction, soil piles will be covered to discourage colonization by weedy vascular plant species.
- If invasive species are noted within or near the PDA during construction or operation, the extent of the species will be assessed and a plan for removal and/or control will be developed.
- A SWWA will be secured from NSECC prior to operations of the Little River withdrawal. Withdrawal of water from Little River Reservoir will occur under the conditions of the site-specific SWWA.
- Wetland alteration permits will be obtained from NSECC for any permanent loss of wetland area or function as a result of the Project. Compensation for direct or indirect wetland area loss (i.e., habitat offsetting) will be arranged through the provincial wetland permitting process.

Design mitigation and standard best management practices outlined in Section 2.8 will be implemented to avoid or reduce potential effects on Vegetation and Wetlands.

5.4.5 Residual Environmental Effects

The Project can result in a loss of Vegetation and Wetlands. However, with the application of mitigation measures listed above in Section 5.4.4, the potential effects on vegetation and wetlands are expected to be temporary and potentially reversible in temporary work areas. Within areas of the PDA requiring permanent access there will permanent loss of Vegetation and Wetlands.

Avoidance and mitigation measures outlined above will be completed to the extent feasible; however, effects on vegetation and wetlands may still occur because of the uncertainty of success of reclamation techniques, and unforeseen natural events or processes.

5.4.5.1 Change in SOCC

Construction of the RoW includes clearing and grubbing which can result in the direct loss of plant individuals and communities. Clearing will remove trees and shrubs and damage other remaining understory vegetation. Grubbing will completely remove vegetation and some soil from the RoW. This will result in residual effects to plant communities within the RoW and indirect effects to adjacent plants and vegetation communities through edge effects. However, no SAR or SOCC were observed in the PDA; therefore, the potential for loss of SAR and SOCC is unlikely.

The nearest predicted boreal felt lichen (*Erioderma pedicellatum*) habitat polygon occurs approximately 670 m from the PDA and provincial guidance requires further surveys if polygons occur within 100 m of project activities (NSDNR 2018). Given the predictive model's low level of confidence, further confidence can be drawn from the lack of observed suitable boreal felt lichen habitat within the PDA. Boreal felt lichen occurs in wet coniferous forests with north or east facing slopes, occurring primarily on balsam fir (*Abies balsamea*) trees (COSEWIC 2002). These habitats were not observed within the PDA and given the previous disturbance history of most of the PDA, boreal felt lichen is unlikely to occur or be disturbed by Project activities.

Though no invasive species were observed within the RoW, machinery entering the site can introduce invasive species to the area. However, mitigation measures are expected to reduce the risk of introducing or spreading invasive species.

During operation and maintenance, natural regeneration of temporarily disturbed areas will commence and reduce the area fragmented by the RoW. Vegetation management will be mechanical and will be restricted to the PDA; plant communities outside the RoW are expected return to their pre-construction state. The Project will result in a low amount of new fragmentation as temporarily disturbed work areas will revegetate. However, the linear disturbance will maintain edge effects within the surrounding plant communities. Edge effect results from changes in abiotic factors such as light availability, humidity, wind, and temperature, which can change which plants are able to grow and thrive in an area. However, this effect is already present within historical RoW, as much of the area was cleared and soils were compacted. New disturbance related effects will be more prevalent in intact plant communities.

5.4.5.2 Change in Wetland Area or Function

Construction of the RoW includes clearing and grubbing which can result in the direct loss of wetland habitat. Clearing will remove trees and shrubs and damage other remaining understory plants. Grubbing will completely remove wetland vegetation and some soil, from the RoW. Machinery working on site will compact remaining soil layers which can result in a change in wetland hydrology. Previous disturbance has occurred when constructing and decommissioning the previous pipeline RoW which likely led to the creation of wetlands in the RoW as a result of previous changes in hydrology.

Within the PDA, a total of 0.97 hectares of wetland will be directly affected by the Project. This impact is expected to be restricted to a single event during construction. Although wetlands within the PDA will be restored following construction, some loss of wetland area and function is expected. All permanently lost wetland within the RoW due to access requirements, or changes in grade that prevent wetland recovery, will be compensated for according to a wetland compensation plan developed in during wetland alteration permitting. The successful completion of a wetland alteration permit and subsequent compensation will result in no net loss of wetland area and function. Wetlands altered by project construction may have indirect effects on surrounding areas of wetland through changes in hydrology caused by construction. These potential effects will be reduced by mitigation techniques under the wetland alteration permitting process.

While all of the identified wetlands are considered WSS due to their presence in the protected watershed, no assessed wetlands were identified as WSS for high wetland function using WESP-AC. The Nova Scotia Wetlands Conservation Policy objectives include no loss in WSS; however, exceptions include alterations deemed to provide necessary public function, based on Environmental Assessment and wetland alteration approvals, as appropriate. As the proponent is tasked with protecting the watershed it manages, it is their best interest to protect the integrity of wetlands within the protected watershed. However, certain wetlands (likely created during previous pipeline construction) cannot be avoided, and the chosen route is the best option identified (including avoiding or reducing environmental effects by following a previously disturbed alignment). With mitigation measures in place (including wetland offsetting), no loss of wetlands with high ecological value is anticipated and no net loss of wetland habitat (after offsetting) is predicted. Monitoring and adaptive management will support this understanding.

Sedimentation of wetlands or watercourses from construction activities could alter soil conditions or smother wetland or aquatic habitats that support plant species of conservation interest. However, mitigation measures are expected to reduce the risk of this occurring. No SOCC were identified along the PDA.

During operation of the Project there will be vegetation management along the RoW. Mechanical cutting will occur within wetlands along the RoW, which will be managed as shrub, forb, graminoid, or other wetland types without trees and large shrubs. With mitigation, this disturbance will result in a change in wetland area and function that will be adverse but low magnitude occurring at regular (or slightly irregular) intervals (i.e., depending on the growth rate of the vegetation), and is reversible. The outfall at Landrie Lake is not anticipated to result in adverse effects to wetlands.

In other areas such as shoreline wetland areas of Little River Reservoir, changes to wetland hydrology are possible, as the change in reservoir level as a result of the Project is assumed to be within the historical reservoir level fluctuations, as the reservoir will be operated to maintain the highest possible supply level. As part of the NSECC SWWA process prior to operation of the transfer pipeline, water extraction volumes and corresponding reservoir levels will be evaluated, including potential effects on wetlands adjacent the Little River Reservoir. Should monitoring of wetlands during operations result in the loss of wetlands, wetland compensation will be required.

5.4.5.3 Summary

The Project is not expected to impact vascular plant and lichen SAR and SOCC as none were observed within the PDA. The project is expected to directly impact 0.97 ha of wetlands along the pipeline, and the operations (water withdrawal) may affect wetlands along the shoreline of Little River Reservoir. However, with the implementation of the mitigation measures outlined above, including wetland offsetting, if required, no net loss of wetland area or function is expected. Therefore, the residual environmental effects on vegetation and wetlands are predicted to be not significant for the Project, as effects on rare and sensitive flora are not anticipated, and effects on wetlands will be either avoided or mitigated.

5.4.6 Follow-up and Monitoring Programs

Prior to construction, further field surveys may be warranted and will be completed during the permitting process and will provide the following information.

- Wetland delineation with three-parameter upland and wetland plots as seen on the Nova Scotia wetland delineation form completed within a year prior to the expected start of alteration, to meet permitting requirements
- A wetland monitoring plan will be developed and submitted to NSECC as part of the wetland alteration permit for the Project

5.5 Wildlife and Wildlife Habitat

Wildlife and Wildlife Habitat was selected as a VC because of potential Project interactions with wildlife (birds, mammals, herpetiles) and associated habitats, particularly with respect to species of conservation interest. Provincial and federal legislation addresses protection of many wildlife species, including species at risk and migratory birds. Additional detail on wildlife habitat, including descriptions of plant community composition and structure, is available in Vegetation and Wetlands (Section 5.4).

A significant adverse residual effect on Wildlife and Wildlife Habitat is one that, following the application of avoidance and mitigation measures, causes or further contributes to the exceedance of a conservation-based threshold or threatens the long-term persistence or viability of species of management concern, or species of cultural or traditional importance.

5.5.1 Regulatory Context

Wildlife species that are protected federally under SARA are listed in Schedule 1 of the Act. Those species listed as “Endangered” or “Threatened” in Schedule 2 or 3 of SARA may also be considered as Species at Risk, pending regulatory consultation.

Certain wildlife species are also protected under the NS ESA. Species identified as seriously at risk of extinction in Nova Scotia are identified by a provincial status assessment process through the Nova Scotia Endangered Species Working Group. Once identified, they are protected under the NS ESA. The conservation and recovery of species assessed and legally listed under the NS ESA is coordinated by the Wildlife Division of the NSDNRR.

The MBCA provides protection for migratory birds on federal, provincial, and private lands. Most migratory species that are native or naturally occurring in Canada are protected. Species and species groups are further defined in Section 2 of the Act. These protections include a prohibition on depositing harmful substances in areas frequented by migratory birds, and a prohibition on disturbing, destroying, taking, or possessing migratory birds, their nests, and eggs.

Recent changes to the MBCA have updated and clarified the long-standing Migratory Bird Regulations with regards to the protections afforded to the nests of migratory bird species, The new regulations, known as the Migratory Bird Regulations, 2022, establish a list of species (Schedule 1) that continue to have year-round protection for their nests, unless the nests are determined to be abandoned. It also establishes the protocol and waiting period for determining a Schedule 1 species’ nest to be abandoned. All species protected under the MBCA continue to have their nests protected when they contain a live bird or a viable egg, but the protection does not continue outside the nesting period for species not listed on Schedule 1.

5.5.2 Existing Conditions

5.5.2.1 Approach and Methods

Information regarding wildlife in the vicinity of the PDA has been obtained from field surveys and through published sources including a review of the AC CDC database (AC CDC 2024, Appendix F); the Maritime Breeding Bird Atlas (MBBA; MBBA 2024), eBirds (Cornell University 2024), Important Bird Areas mapping (Bird Studies Canada 2024), and the provincial Significant Species and Habitats Database and other data available from the Provincial Landscape Viewer (GNS 2024a).

Field surveys included a dedicated breeding bird survey and incidental observations of other wildlife. A one-day breeding bird survey was conducted along the linear pipeline corridor targeting breeding songbirds. Incidental bird observations were also recorded during the vegetation and wetland field programs, with a focus on SAR/SOCC. Evidence of breeding activity was gathered using the same criteria used by the MBBA. Additional focus during this survey was given to identifying the nest cavities and breeding locations of Pileated Woodpeckers (*Drycopus pileatus*). Of the 18 species of migratory bird identified on Schedule 1 of the Migratory Bird Regulations 2022, Pileated Woodpecker is the only species with some potential to nest within the Assessment Area.

5.5.2.2 Description of Existing Conditions

5.5.2.2.1 Significant Habitats

A review of the AC CDC (2024) report Important Bird Areas Database, and the Provincial Landscape Viewer (GNS 2024a) identified only one wildlife-related significant or managed habitat. Landrie Lake is identified as a significant habitat (site#RI347) for Common Loon (*Gavia immer*) nesting habitat. Common Loon is a common bird species in Nova Scotia and is not considered at risk.

There are no Important Bird Areas in the vicinity of the Project, with the nearest IBA located over 35 km to the west. A review of eBird records indicates the area is not a hotspot for birds. The only bird AC CDC record in the vicinity of the Project is an Osprey (*Pandion haliaetus*) recorded in eBird in late April 2024.

No Critical Habitat for wildlife SAR has been identified in the vicinity of the Project (ECCC 2024b).

5.5.2.2.2 Birds

The project lies entirely within the 10 km X 10 km square 20PR35 of the MBBA (2024). A total of 75 species of bird were recorded in the square from 140 hours of effort totalling 217 records over the Atlas period of 2006 to 2010 (Table 5.5.1). Bird SAR within this list include Common Nighthawk (*Chordeiles minor*), Barn Swallow (*Hirundo rustica*), and Evening Grosbeak (*Coccothraustes vespertinus*).

The AC CDC (2024) data request identified records of 35 rare or protected bird species within 5 km of the PDA, which includes pelagic birds and other birds unlikely to be found near the PDA (Section 5.5.2.2.4).

Terrestrial Field surveys were completed along the proposed pipeline route June 26 and 27, 2024, during suitable survey conditions, with a focus on breeding birds the morning of June 26. A total of 42 bird species were detected during the breeding bird survey or identified incidentally over the 2 days of terrestrial field surveys (Table 5.5.1; Mapbook Appendix B). The most common breeding species observed included Red-eyed Vireo (*Vireo olivaceus*), American Redstart (*Setophaga ruticilla*), and Least Flycatcher (*Empidonax minimus*). Olive-sided Flycatcher was the only SAR species recorded. Olive-sided Flycatcher was reclassified as Special Concern by COSEWIC (2018) and the SARA status was changed from Threatened to Special Concern in 2023; however, is still listed as Threatened under the NS ESA.

Olive-sided Flycatcher is a medium-sized songbird that is typically found along forest edges, and near forest opening, especially in wet areas (COSEWIC 2018). Habitat for the species within the PDA is likely limited to disturbed areas (e.g., previously disturbed forest corridors, clearings near watercourses). There was one observation of Olive-sided Flycatcher recorded singing during the breeding bird survey.

No Barn Swallow nesting was evident on the existing pump house.

Of note was a pair of Osprey nesting on a transmission line pole immediately adjacent to the RoW, east of Highway 104. The nest appeared well developed, and likely has been in use for many years.

Table 5.5.1 Species List from Square 20PR35 of the Second Maritimes breeding Bird Atlas (2006-2010)

Common Name	Scientific Name	Breeding Status	COSEWIC[1]	SARA[2]	NS ESA[3]	AC CDC[4]
Canada Goose	*Branta canadensis*	Possible				SUB,S4N,S5M
Wood Duck	*Aix sponsa*	Confirmed				S5B
American Black Duck	*Anas rubripes*	Confirmed				S5B,S5N
Ring-necked Duck	*Aythya collaris*	Confirmed				S5B
Common Merganser	*Mergus merganser*	Confirmed				S5B,S4N
Ring-necked Pheasant	*Phasianus colchicus*	Confirmed				SNA
Ruffed Grouse	*Bonasa umbellus*	Confirmed				S5
Spruce Grouse	*Canachites canadensis*	Probable				S4
Common Loon	*Gavia immer*	Confirmed	NAR			S4B
American Bittern	*Botaurus lentiginosus*	Possible				S3S4B,S4S5M
Great Blue Heron	*Ardea herodias*	Probable				S4B,S4S5M
Osprey	*Pandion haliaetus*	Possible				S4S5B,S5M
Bald Eagle	*Haliaeetus leucocephalus*	Confirmed	NAR			S5
Sharp-shinned Hawk	*Accipiter striatus*	Probable	NAR			S5
American Goshawk	*Accipiter atricapillus*	Possible	NAR			S3S4
Spotted Sandpiper	*Actitis macularius*	Probable				S3S4B,S5M
American Woodcock	*Scolopax minor*	Possible				S5B
Rock Pigeon	*Columba livia*	Confirmed				SNA
Mourning Dove	*Zenaida macroura*	Confirmed				S5
Barred Owl	*Strix varia*	Probable				S5
Common Nighthawk	*Chordeiles minor*	Possible	SC	SC	Threatened	S3B
Ruby-throated Hummingbird	*Archilochus colubris*	Probable				S5B
Belted Kingfisher	*Megaceryle alcyon*	Probable				S4S5B

Table 5.5.1 Species List from Square 20PR35 of the Second Maritimes breeding Bird Atlas (2006-2010)

Common Name	Scientific Name	Breeding Status	COSEWIC[1]	SARA[2]	NS ESA[3]	AC CDC[4]
Downy Woodpecker	*Dryobates pubescens*	Probable				S5
Hairy Woodpecker	*Dryobates villosus*	Probable				S5
Northern Flicker	*Colaptes auratus*	Confirmed				S5B
Pileated Woodpecker	*Dryocopus pileatus*	Probable				S5
Merlin	*Falco columbarius*	Confirmed	NAR			S5B
Alder Flycatcher	*Empidonax alnorum*	Possible				S5B
Blue-headed Vireo	*Vireo solitarius*	Possible				S5B
Red-eyed Vireo	*Vireo olivaceus*	Probable				S5B
Canada Jay	*Perisoreus canadensis*	Probable				S3
Blue Jay	*Cyanocitta cristata*	Confirmed				S5
American Crow	*Corvus brachyrhynchos*	Confirmed				S5
Common Raven	*Corvus corax*	Confirmed				S5
Tree Swallow	*Tachycineta bicolor*	Confirmed				S4B
Barn Swallow	*Hirundo rustica*	Confirmed	SC	T	Endangered	S3B
Black-capped Chickadee	*Poecile atricapillus*	Confirmed				S5
Boreal Chickadee	*Poecile hudsonicus*	Possible				S3
Red-breasted Nuthatch	*Sitta canadensis*	Confirmed				S4S5
Winter Wren	*Troglodytes hiemalis*	Possible				S5B
Golden-crowned Kinglet	*Regulus satrapa*	Possible				S5
Ruby-crowned Kinglet	*Corthylio calendula*	Possible				S4B,S5M
Swainson's Thrush	*Catharus ustulatus*	Possible				S4B,S5M
Hermit Thrush	*Catharus guttatus*	Possible				S5B
American Robin	*Turdus migratorius*	Confirmed				S5B,S3N
European Starling	*Sturnus vulgaris*	Confirmed				SNA

Table 5.5.1 Species List from Square 20PR35 of the Second Maritimes breeding Bird Atlas (2006-2010)

Common Name	Scientific Name	Breeding Status	COSEWIC[1]	SARA[2]	NS ESA[3]	AC CDC[4]
Cedar Waxwing	*Bombycilla cedrorum*	Confirmed				S5B
Black-and-white Warbler	*Mniotilta varia*	Possible				S5B
Nashville Warbler	*Leiothlypis ruficapilla*	Possible				S4B,S5M
Mourning Warbler	*Geothlypis philadelphia*	Confirmed				S4B,S5M
Common Yellowthroat	*Geothlypis trichas*	Possible				S5B
American Redstart	*Setophaga ruticilla*	Possible				S5B
Northern Parula	*Setophaga americana*	Confirmed				S5B
Magnolia Warbler	*Setophaga magnolia*	Probable				S5B
Yellow Warbler	*Setophaga petechia*	Possible				S5B
Yellow-rumped Warbler	*Setophaga coronata*	Possible				S5B
Savannah Sparrow	*Passerculus sandwichensis*	Probable				S4S5B,S5M
Fox Sparrow	*Passerella iliaca*	Probable				S3S4B,S5M
Song Sparrow	*Melospiza melodia*	Confirmed				S5B
Lincoln's Sparrow	*Melospiza lincolnii*	Possible				S4B,S5M
Swamp Sparrow	*Melospiza georgiana*	Possible				S5B
White-throated Sparrow	*Zonotrichia albicollis*	Confirmed				S4S5B,S5M
Dark-eyed Junco	*Junco hyemalis*	Probable				S4S5
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Probable				S3B
Red-winged Blackbird	*Agelaius phoeniceus*	Probable				S4B
Common Grackle	*Quiscalus quiscula*	Confirmed				S5B
Brown-headed Cowbird	*Molothrus ater*	Probable				S2B
Pine Grosbeak	*Pinicola enucleator*	Probable				S3B,S5N,S5M
Purple Finch	*Haemorhous purpureus*	Probable				S4S5B,S3S4N,S5M
Red Crossbill	*Loxia curvirostra*	Probable				S3S4

Table 5.5.1 Species List from Square 20PR35 of the Second Maritimes breeding Bird Atlas (2006-2010)

Common Name	Scientific Name	Breeding Status	COSEWIC[1]	SARA[2]	NS ESA[3]	AC CDC[4]
Pine Siskin	*Spinus pinus*	Probable				S3
American Goldfinch	*Spinus tristis*	Probable				S5
Evening Grosbeak	*Coccothraustes vespertinus*	Probable	SC	SC	Vulnerable	S3B,S3N,S3M
House Sparrow	*Passer domesticus*	Probable				SNA

Notes:

[1] Species of conservation concern in Canada assessed by COSEWIC as Endangered (EN), Threatened (TH), or Special Concern (SC); not at risk species = NAR, Data Deficient = DD (Government of Canada 2024b).

[2] Species at risk in Canada listed under Schedule 1 the federal *Species at Risk Act* as Endangered (EN), Threatened (TH), or Special Concern (SC); species not listed = NL (Government of Canada 2024b).

[3] Species at risk in Nova Scotia listed under the provincial *Endangered Species Act* (NS ESA) as Endangered (EN), Threatened (TH), or Special Concern (SC; GNS 2024b).

[4] Species ranked as Critically Imperiled (S1), Imperiled (S2), or Vulnerable (S3) by the Atlantic Canada Conservation Data Centre (AC CDC 2024), where:

S1: Critically Imperiled – Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences). May be especially vulnerable to extirpation.

S2: Imperiled – Imperiled in the province because of rarity due to very restricted range, very few populations (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.

S3: Vulnerable – Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer).

S4: Apparently Secure – Uncommon but not rare; some cause for long-term concern due to declines or other factors (80+ occurrences).

S5: Secure – Common, widespread, and abundant in the province.

S#S#: A numeric range rank (*e.g.*, S2S3) is used to indicate any range of uncertainty about the status of the species or community.

SH: Possibly Extirpated (Historical) – Species or community occurred historically in the province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become SH without such a 20-40 year delay if the only known occurrences in a province were destroyed or if it had been extensively and unsuccessfully looked for. The SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.

SU: Unrankable – Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

B: Breeding – Conservation status refers to the breeding population of the species in the province.

N: Nonbreeding – Conservation status refers to the non-breeding population of the species in the province.

M: Migrant – Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the province.

Table 5.5.2 Species List from Breeding Bird Survey or Incidental Observations on June 26-27, 2024

Common Name	Scientific Name	Highest Breeding Status	COSEWIC[1]	SARA[2]	NS ESA[3]	AC CDC[4]
Ring-necked Duck	*Aythya collaris*	Probable				S5B
Osprey	*Pandion haliaetus*	Confirmed				S4S5B,S5M
American Woodcock	*Scolopax minor*	Observed				S5B
Rock Pigeon	*Columba livia*	Observed				SNA
Mourning Dove	*Zenaida macroura*	Possible				S5
Barred Owl	*Strix varia*	Observed				S5
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Observed				S5B
Hairy Woodpecker	*Dryobates villosus*	Observed				S5
Northern Flicker	*Colaptes auratus*	Observed				S5B
Pileated Woodpecker	*Dryocopus pileatus*	Observed				S5
Olive-sided Flycatcher	*Contopus cooperi*	Possible	SC	SC	Threatened	S3B
Alder Flycatcher	*Empidonax alnorum*	Possible				S5B
Least Flycatcher	*Empidonax minimus*	Possible				S4S5B,S5M
Blue Jay	*Cyanocitta cristata*	Observed				S5
Common Raven	*Corvus corax*	Observed				S5
Black-capped Chickadee	*Poecile atricapillus*	Confirmed				S5
Golden-crowned Kinglet	*Regulus satrapa*	Possible				S5
Ruby-crowned Kinglet	*Corthylio calendula*	Possible				S4B,S5M
Veery	*Catharus fuscescens*	Observed				S4B
Swainson's Thrush	*Catharus ustulatus*	Possible				S4B,S5M
Hermit Thrush	*Catharus guttatus*	Confirmed				S5B
American Robin	*Turdus migratorius*	Probable				S5B,S3N
Cedar Waxwing	*Bombycilla cedrorum*	Possible				S5B

Table 5.5.2 Species List from Breeding Bird Survey or Incidental Observations on June 26-27, 2024

Common Name	Scientific Name	Highest Breeding Status	COSEWIC[1]	SARA[2]	NS ESA[3]	AC CDC[4]
Blue-headed Vireo	*Vireo solitarius*	Possible				S5B
Red-eyed Vireo	*Vireo olivaceus*	Possible				S5B
Northern Parula	*Setophaga americana*	Possible				S5B
Yellow Warbler	*Setophaga petechia*	Possible				S5B
Magnolia Warbler	*Setophaga magnolia*	Possible				S5B
Yellow-rumped Warbler	*Setophaga coronata*	Possible				S5B
Black-throated Green Warbler	*Setophaga virens*	Possible				S5B
Blackburnian Warbler	*Setophaga fusca*	Possible				S4B,S5M
Bay-breasted Warbler	*Setophaga castanea*	Possible				S3S4B,S4S5M
Black-and-White Warbler	*Mniotilta varia*	Possible				S5B
American Redstart	*Setophaga ruticilla*	Probable				S5B
Ovenbird	*Seiurus aurocapilla*	Possible				S5B
Common Yellowthroat	*Geothlypis trichas*	Possible				S5B
Song Sparrow	*Melospiza melodia*	Possible				S5B
Swamp Sparrow	*Melospiza georgiana*	Possible				S5B
Dark-eyed Junco	*Junco hyemalis*	Possible				S4S5
Red-winged Blackbird	*Agelaius phoeniceus*	Confirmed				S4B

Table 5.5.2 Species List from Breeding Bird Survey or Incidental Observations on June 26-27, 2024

Common Name	Scientific Name	Highest Breeding Status	COSEWIC[1]	SARA[2]	NS ESA[3]	AC CDC[4]
Common Grackle	*Quiscalus quiscula*	Observed				S5B
American Goldfinch	*Spinus tristis*	Possible				S5

Notes:

[1] Species of conservation concern in Canada assessed by COSEWIC as Endangered (EN), Threatened (TH), or Special Concern (SC); not at risk species = NAR, Data Deficient = DD (Government of Canada 2024b).

[2] Species at risk in Canada listed under Schedule 1 the federal *Species at Risk Act* as Endangered (EN), Threatened (TH), or Special Concern (SC); species not listed = NL (Government of Canada 2024b).

[3] Species at risk in Nova Scotia listed under the provincial *Endangered Species Act* (NS ESA) as Endangered (EN), Threatened (TH), or Special Concern (SC; GNS 2024b).

[4] Species ranked as Critically Imperiled (S1), Imperiled (S2), or Vulnerable (S3) by the Atlantic Canada Conservation Data Centre (AC CDC 2024), where:

S1: Critically Imperiled – Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences). May be especially vulnerable to extirpation.

S2: Imperiled – Imperiled in the province because of rarity due to very restricted range, very few populations (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.

S3: Vulnerable – Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer).

S4: Apparently Secure – Uncommon but not rare; some cause for long-term concern due to declines or other factors (80+ occurrences).

S5: Secure – Common, widespread, and abundant in the province.

S#S#: A numeric range rank (*e.g.*, S2S3) is used to indicate any range of uncertainty about the status of the species or community.

SH: Possibly Extirpated (Historical) – Species or community occurred historically in the province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become SH without such a 20-40 year delay if the only known occurrences in a province were destroyed or if it had been extensively and unsuccessfully looked for. The SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.

SU: Unrankable – Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

B: Breeding – Conservation status refers to the breeding population of the species in the province.

N: Nonbreeding – Conservation status refers to the non-breeding population of the species in the province.

M: Migrant – Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the province.

5.5.2.2.3 Other Wildlife

Other wildlife were noted during terrestrial field surveys, and included the following common species:

- North American beaver (*Castor canadensis*)
- white-tailed deer (*Odocoileus virginianus*)
- red squirrel (*Tamiasciurus hudsonicus*)
- spring peeper (*Pseudacris crucifer*)
- green frog (*Lithobates clamitans*)
- common gartersnake (*Thamnophis sirtalis*)
- wood frog (*Lithobates sylvaticus*)
- pickerel frog (*Lithobates palustris*)

5.5.2.2.4 Species at Risk and Species of Conservation Concern

From the AC CDC (2024) data, the PDA and surrounding area within 5 km has the potential to support 11 federally (SARA) and provincially (NS ESA) listed wildlife SAR (8 birds, 1 mammal, 1 reptile and 1 insect), and an additional 17 SOCC (17 birds). Given the limited extent of the project footprint and limited habitats affected, not all listed species are expected to interact with the Project. Species discussed are limited to those SAR observed during field studies, or with a high likelihood of interaction given the habitat types in the PDA.

Listed bats (little brown myotis (*Myotis lucifugus*), Northern myotis (*Myotis septentrionalis*) and Tri-colored bat (*Perimyotis subflavus*)) were identified as location-sensitive species with records of observations or hibernaculum located within the study area. A review of The Nova Scotia Abandoned Mine Openings Database (GNS 2021) identified eight abandoned mine openings associated with past coal mining operations located north of Little River Reservoir, approximately 1 km from the pump house and pipeline. Based on information gathered from a July 2008 site visit, the mine openings are flooded or ponded, and so are unlikely to provide hibernacula for bats.

Wood turtle (*Glyptemys insculpta*), also a location sensitive SAR with records within the 5 km study area, would not be expected to be present near the PDA, due to the lack of habitat.

No important habitats for endangered bats, wood turtle, or monarch were noted in the field by field biologists. Table 5.5.3 lists the bird SAR and SOCC from AC CDC (2024).

Table 5.5.3 ACCDC List of Bird SAR and SOCC Observed within 5 km of site (including pelagic birds)

Common Name	Scientific Name	Most Recent Record	Total Records	COSEWIC[1]	SARA[2]	NS ESA[3]	AC CDC[4]
Horned Grebe	*Podiceps auritus*	2010	1	Special Concern	Special Concern		S3N,SUM
Great Cormorant	*Phalacrocorax carbo*	2008	4				S2S3B,S2S3N
Surf Scoter	*Melanitta perspicillata*	2010	1				S2N,S4M
Barrow's Goldeneye - Eastern Population	*Bucephala islandica pop. 1*	2020	3	Special Concern	Special Concern		S1N,SUM
Red-breasted Merganser	*Mergus serrator*	1990	1				S3B,S4S5N,S5M
Black-headed Gull	*Chroicocephalus ridibundus*	2010	1				S3N
Black-legged Kittiwake	*Rissa tridactyla*	2022	3				S2S3B
Common Tern	*Sterna hirundo*	2008	1	Not at Risk			S3B
Long-eared Owl	*Asio otus*	2007	2				S2S3
Common Nighthawk	*Chordeiles minor*	1973	4	Special Concern	Special Concern	Threatened	S3B
Olive-sided Flycatcher	*Contopus cooperi*	2020	3	Special Concern	Special Concern	Threatened	S3B
Barn Swallow	*Hirundo rustica*	2010	1	Special Concern	Threatened	Endangered	S3B
Canada Jay	*Perisoreus canadensis*	2013	1				S3
Boreal Chickadee	*Poecile hudsonicus*	1998	1				S3
Northern Mockingbird	*Mimus polyglottos*	2006	1				S1B
Pine Warbler	*Setophaga pinus*	2008	2				S2S3B,S4S5M
Wilson's Warbler	*Cardellina pusilla*	2022	3				S3B,S5M
Canada Warbler	*Cardellina canadensis*	1969	1	Special Concern	Threatened	Endangered	S3B
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	2006	1				S3B
Rusty Blackbird	*Euphagus carolinus*	2019	1	Special Concern	Special Concern	Endangered	S2B
Brown-headed Cowbird	*Molothrus ater*	2022	3				S2B
Baltimore Oriole	*Icterus galbula*	2013	2				S2S3B,SUM
Pine Grosbeak	*Pinicola enucleator*	2008	2				S3B,S5N,S5M

Table 5.5.3 ACCDC List of Bird SAR and SOCC Observed within 5 km of site (including pelagic birds)

Common Name	Scientific Name	Most Recent Record	Total Records	COSEWIC[1]	SARA[2]	NS ESA[3]	AC CDC[4]
Pine Siskin	*Spinus pinus*	2008	1				S3
Evening Grosbeak	*Coccothraustes vespertinus*	2010	4	Special Concern	Special Concern	Vulnerable	S3B,S3N,S3M

Notes:

[1] Species of conservation concern in Canada assessed by COSEWIC as Endangered (EN), Threatened (TH), or Special Concern (SC); not at risk species = NAR, Data Deficient = DD (Government of Canada 2024b).

[2] Species at risk in Canada listed under Schedule 1 the federal *Species at Risk Act* as Endangered (EN), Threatened (TH), or Special Concern (SC); species not listed = NL (Government of Canada 2024b).

[3] Species at risk in Nova Scotia listed under the provincial *Endangered Species Act* (NS ESA) as Endangered (EN), Threatened (TH), or Special Concern (SC; GNS 2024b).

[4] Species ranked as Critically Imperiled (S1), Imperiled (S2), or Vulnerable (S3) by the Atlantic Canada Conservation Data Centre (AC CDC 2024), where:

S1: Critically Imperiled – Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences). May be especially vulnerable to extirpation.

S2: Imperiled – Imperiled in the province because of rarity due to very restricted range, very few populations (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.

S3: Vulnerable – Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer).

S4: Apparently Secure – Uncommon but not rare; some cause for long-term concern due to declines or other factors (80+ occurrences).

S5: Secure – Common, widespread, and abundant in the province.

S#S#: A numeric range rank (*e.g.*, S2S3) is used to indicate any range of uncertainty about the status of the species or community.

SH: Possibly Extirpated (Historical) – Species or community occurred historically in the province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become SH without such a 20-40 year delay if the only known occurrences in a province were destroyed or if it had been extensively and unsuccessfully looked for. The SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.

SU: Unrankable – Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

B: Breeding – Conservation status refers to the breeding population of the species in the province.

N: Nonbreeding – Conservation status refers to the non-breeding population of the species in the province.

M: Migrant – Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the province.

5.5.3 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Wildlife and Wildlife Habitat is provided in Table 5.5.4. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.5.4 Potential Effects, Effect Pathways and Measurable Parameters for Wildlife and Wildlife Habitat

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in Habitat Availability	• Construction and operation could affect habitat availability through vegetation clearing and sensory disturbance.	• Area (ha) of potential habitat directly disturbed by the Project, including any defined critical or core habitat for SAR. Habitat loss due to reduced habitat effectiveness (e.g., sensory disturbance) will be addressed qualitatively.
Change in Mortality Risk	• Mortality risk could change for some species during construction because of interactions with clearing, trenching, and vehicles; and during operations as a result of increased human access and activity associated with RoW maintenance and increased access by recreational users.	• Change in direct mortality risk (e.g., through destruction of active nest, den or vehicle/wildlife collisions) or indirect mortality risk (e.g., increased human access, predation rates due to edge effects) to be assessed qualitatively.

Activities and components could potentially interact with wildlife and wildlife habitat through:

- Direct loss or alteration of habitat as a result of vegetation clearing and construction of the pipeline and above-ground infrastructure
- Indirect loss or alteration of habitat as a result of sensory disturbance during construction, operation and decommissioning, in particular the operation of heavy equipment during construction activities
- Direct mortality of wildlife as a result of interactions with equipment and infrastructure

5.5.4 Mitigation and Management Measures

The following mitigation measures specific to Wildlife and Wildlife Habitat have been identified for the Project:

- The Project will use previously disturbed areas for Project infrastructure and workspaces to the extent practicable. Project design includes following the former pipeline corridor.
- Vegetation clearing will be limited to areas required for construction and safe operations.
- Travel of vehicles will be confined to existing roads and trails, and the cleared RoW to avoid disturbing vegetated areas to the extent practicable.

- Vegetation clearing will be completed outside the migratory bird nesting period of April 12 to August 27 (Zone C3; ECCC 2024c). Where activities may result in risk of harm to migratory bird nests during this period (e.g., limited vegetation clearing) or during the nesting period for other species (i.e., raptors), a qualified biologist will complete a pre-activity nest survey in accordance with federal guidelines (ECCC 2023).
- If an active bird nest is found during construction, beneficial management practices will be followed, including applying an appropriate setback and timing restriction, and NSDNRR and/or Canadian Wildlife Service will be consulted, as appropriate.
- As there is an osprey nest located on a transmission line pole immediately adjacent the RoW, NSDNRR will be consulted to determine if special mitigation is warranted for this nest to reduce potential for disruption of osprey nesting at this location and may include relocation of the nest to a location away from the alignment if other mitigation measures are deemed to be ineffective.
- Vegetation clearing will be completed outside the core maternity roosting period for bats of May 1 to August 31. If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to determine bat occupancy before removal.
- During the trenching stage of construction, trenches that may remain open for longer periods and are at a risk of trapping wildlife such as deer outside of construction hours will include ramps at the ends to allow animals to escape.
- Vegetation maintenance along the RoW during operation will be performed outside the breeding season of migratory birds.
- Approved noise arrest mufflers will be used on equipment where practical to reduce potential environmental effects of noise.
- Use full cut-off lighting during construction to reduce attraction to migrating birds.
- Personnel will report wildlife incidents to their supervisor which will be reported to NSDNRR and/or Canadian Wildlife Service, as appropriate.
- Personnel will not feed, harass, or hunt wildlife at the work site while working on the Project.
- Food and other wildlife attractants will be stored in odour-proof containers.
- Construction crews will be trained on wildlife awareness.
- Food waste will be stored and disposed of in a manner to avoid attracting wildlife.

In addition, environmental management practices outlined in Section 2.9 will be implemented to avoid or reduce potential effects on Wildlife and Wildlife Habitat.

5.5.5 Residual Environmental Effects

5.5.5.1 Change in Habitat Availability

Most of the 3 km length of the PDA is within previously disturbed habitat from the past construction and decommissioning of an aboveground water transmission line; therefore, much of the PDA can be classified as edge habitat consisting of early successional forest. For much of its length, the RoW parallels electrical transmission line and rail lines on one (north) side, and it crosses a major highway 1 km from the pumphouse. The edge habitat is adjacent to largely mature mixedwood forest habitat on the south side of the RoW (except near the highway). Only the last approximately 320 m of the 20 m wide RoW passes through mature forest adjacent a watercourse and therefore resulting in a relatively low amount of new fragmentation. Other habitats used by wildlife that are located along the RoW include treed swamp and marshes, largely created by beaver activity. As discussed in Section 5.4, impacts to wetlands adjacent to the RoW will be largely temporary (during construction) as they will not be drained or infilled, except for any required travel corridors for operations and maintenance and portions of treed swamps may not be permitted to develop trees due to ongoing vegetation maintenance. Few bird SAR and SOCC were encountered during bird surveys and therefore impacts to their habitats, which is limited along the RoW, is not anticipated to have a measurable effect on their populations in the region. SAR and SOCC requiring more open habitats (such as Common Nighthawk and Killdeer) may benefit during Project operation.

Any disruption in the nesting of osprey historically located on a transmission line pole immediately adjacent to the RoW and within 150 m of the highway would be temporary (one season). Alternate nesting sites are available, should it be determined that the existing nest be removed or relocated, at the direction of NSDNRR.

While there will be a direct and indirect loss or alteration of wildlife habitat, most of that habitat is edge habitat in proximity of other linear anthropogenic corridors (transmission lines, rail lines, trails and roads). Long-term maintenance of vegetation will maintain an early successional habitat within much of the PDA. Following construction there will be limited indirect effects on habitat availability due to occasional maintenance along the RoW.

5.5.5.2 Change in Mortality Risk

Identified mitigation related to potential mortality of birds and bats through the disturbance of potential active nests and maternal roost trees will eliminate or greatly reduce the risk of mortality of these wildlife species during construction and maintenance activities. Clearing of vegetation has the greatest risk of mortality to migratory birds and bats, and so the proponent intends to complete vegetation clearing outside the breeding periods of these species. The remaining open habitat following clearing and grubbing can still be used by some migratory birds. If it not practicable to clear outside the breeding season nest sweeps would be conducted prior to construction activities; such sweeps which are most effective in such simple habitats.

No wildlife SAR or SOCC are anticipated to be killed as a result of the Project.

Mitigation addressing the risk of wildlife becoming entrapped in open trenches will reduce the potential for mortality risk to common terrestrial animals such as white-tailed deer.

5.5.5.3 Summary

With the implementation of mitigation and environmental protection measures as described in this assessment, it is not anticipated that there will be substantial interaction between the Project and Wildlife and Wildlife Habitat. The loss or conversion of habitats along the RoW are not expected to result in a substantive effect on wildlife populations. Mitigation will be in place to reduce the potential risk of mortality during construction and operation. The residual environmental effects on Wildlife and Wildlife Habitat are predicted to be not significant. Prediction confidence in the assessment of wildlife and wildlife habitat is high due to the quality of collected field data and established mitigation and protection measures.

5.5.6 Follow-up and Monitoring Programs

A dedicated follow-up and monitoring program is not proposed for Wildlife and Wildlife Habitat.

5.6 Heritage Resources

Heritage Resources is a VC in recognition of their importance to the Mi'kmaq, the public, and provincial and federal regulatory agencies responsible for the management of such resources. Heritage resources include historical, archaeological, architectural (built heritage) and palaeontological (fossil) resources. For the purposes of this EARD, heritage resources are non-renewable resources consisting of places, buildings, objects, or sediment deposits located above or below the ground. Every heritage resource is unique, and its significance lies in the story it tells and how this story contributes to human history by broadening our understanding of our shared human past. As non-renewable resources, damage to or loss of heritage resources would mean a permanent loss of the resources and the wider contextual information they may have provided. They are relatively permanent, although highly tenuous, features of the environment and can include Pre-Contact or Historic period archaeological sites and objects of significance for Mi'kmaq or other groups, built heritage resources, and naturally occurring palaeontological resources (i.e., fossils).

The Assessment Area for heritage resources is limited to the PDA, as it is only within the PDA that construction and ground-disturbing activities could interact with heritage resources.

A significant residual adverse effect is defined as a residual Project-related change to heritage resources that results in unmitigated disturbance to, or destruction of, heritage resources considered by affected Mi'kmaw communities, other communities, and/or provincial heritage regulators to be of major importance due to factors such as rarity, condition, spiritual importance, or research importance.

5.6.1 Regulatory Context

In Nova Scotia, heritage resources are regulated under the *Special Places Protection Act* (2010), the *Heritage Property Act* (2010), and the *Cemeteries and Monuments Protection Act* (2011). The regulatory management of heritage resources is the mandate of the Nova Scotia Department of Communities, Culture, Tourism, and Heritage (NSCCTH) and is administered and regulated by its Special Places division.

5.6.2 Existing Conditions

5.6.2.1 Approach and Methods

The review for heritage resources has been undertaken through the completion of historical, archaeological, built heritage, and palaeontological research. The Province of Nova Scotia provides guidance for conducting professional archaeological resource impact assessments (ARIA), such as the *Archaeological Resource Impact Assessment (Category C) Guidelines* (NSCCTH 2014) ("the Guidelines"). Consultation and engagement activities have been ongoing as part of the heritage resources component of the Project. During the background research for heritage resources, regulatory agencies and Mi'kmaq communities were contacted to gather information on potential heritage resources within the PDA.

Information on the existing conditions (i.e., known information) regarding heritage resources was gathered through a combination of documentary research, consultation, and an ARIA conducted within the PDA in 2024. The ARIA was completed in compliance with Nova Scotia's Archaeological Resource Impact Assessment (Category C) Guidelines (2014) as well as the *Special Places Protection Act*. The ARIA was conducted by a permitted professional archaeologist under a Heritage Research Permit (HRP), received from the NSCCTH following submission of a permit application.

The following sources were consulted or reviewed to gather an understanding of the general and specific history of the PDA:

- Review of relevant Maritime Archaeological Resource Inventory forms for information relating to recorded archaeological sites within a 1 km radius of the PDA
- Review of previous archaeological investigations conducted within or near the PDA through consultations with the Special Places Coordinator from the NSCCTH
- Review of historical maps and aerial photographs, maps, published sources, and historical and archival records of the PDA and adjoining properties to gain information on historical land use
- A review of the Canadian Register of Historic Places
- Engagement with the Kwilmu'kw Maw-klusuaqn Negotiation Office's Archaeological Research Division (KMKNO's ARD) to gather information pertaining to traditional or historical use of the PDA

- Review of LiDAR and base mapping of the subject property to identify environmental and physiographic features such as topography and historic water margins that would influence human settlement and resource exploitation patterns
- General knowledge of the Stantec Archaeology Team
- Consultations with local historical experts, and archaeologist, as applicable

A HRP application detailing the methodology employed for the Project's ARIA was submitted and approved by the Special Places division of NSCCTH. For information regarding archaeological resources, Special Places was contacted after obtaining the HRP permit, for the 2024 ARIA, to request a list of reports on file for previous archaeological work and studies conducted near the Project.

The field component of the ARIA involved archaeological field survey (walkover) of the entire PDA. The PDA was assessed via walkover in consideration of the Guidelines, the results of the background research, and the professional judgement of the Stantec Archaeology Team. Walking pre-defined transects (0-20 m) within the PDA, any areas of elevated potential for archaeological resources were identified and delineated as "Polygons" using handheld GIS devices with 3-5 m accuracy. Polygons are typically identified for additional archaeological mitigation, if warranted (e.g., shovel testing).

Built heritage resources are typically identified through a review of federal and provincial databases for built heritage resources. There are no built heritage resources within the PDA.

A review of published maps on the geology of the PDA provided information on the potential for there to be fossils in bedrock layers that may be encountered during construction and operation and the results from this review will be described below.

An ARIA report was submitted to NSCCTH; an acceptance letter is provided in Appendix G.

5.6.2.2 Description of Existing Conditions

The sections below describe the existing conditions for heritage resources. Archaeological resources, built heritage, and palaeontological resources were considered when describing existing conditions as part of this VC.

5.6.2.3 Cultural And Historical Background

Pre-Contact Period

The earliest period of human occupation in Nova Scotia is *Sa'qewe'l L'nu'k* (the Ancient People) or "Palaeo-Indian" period (12,000 – 8,000 BP), which saw the arrival of peoples who harvested caribou, possibly along with a variety of other fauna, following deglaciation of the region (Bonnichsen et al. 1991; Deal 2023). This period is best represented in Nova Scotia by the Debert-Belmont site complex near Truro, NS.

Sites of the following *Mu Awsami Kejihaw'k L'nu'k* (the Not so Recent People), or Archaic Period (8,000-3,000 BP), are characterized in part by distinctive ground stone tool industries. In Nova Scotia, sites of this period are known primarily from interior locations, and for the most part date only to the latter half of this period (the Late Archaic). Nevertheless, it is inferred that people were present in the province throughout this period, and that their lifeways included a focus on harvesting the resources of both coast and interior waterways. The scarcity of evidence for occupation early in the period and on the coast is thought to reflect the effects of rising sea levels, such sites now being situated in marine environments (Deal 2023; Kyte 2024).

The last phase of the Pre-Contact Period, *Kejihawek L'nu'k* (the Recent People), or Woodland/Ceramic period (3,000- 500 BP), sees the appearance of ceramic technology in the context of wide-ranging interactions with other peoples of the greater northeast. Coastal archaeological sites are more clearly documented (albeit still threatened by rising sea levels and coastal erosion) and, in some cases, include substantial shell middens, indicating the harvesting of marine shellfish. Nevertheless, both marine and terrestrial resources figured in the seasonal round during this time, with some regional variation (Nash and Miller 1987; Davis 1991).

The PDA is within an area once part of a greater Mi'kmaw territory known as *Unama'kik aq Ktaqmkuk*, meaning "foggy lands" and "land across water" meaning Cape Breton Island and Newfoundland (Confederacy of Mainland Mi'kmaq 2007). A research inquiry was submitted for the PDA with KMKNO-ARD and their review revealed two traditional sites used for ceremonial purposes within one-kilometre, but outside, of the PDA. There are no recorded Mi'kmaw archaeological sites within five-kilometres of the PDA (KMKNO-ARD 2024).

The Mi'kmaw name for Port Hawkesbury is *Walamkwekukaqnejk*, which means "where there are deep places to fish" and the name for Point East of Port Hastings is *Apatamkiaq*, which means "at the place of the turning sand." The Mi'kmaw method for naming a place is verb based, frequently reflecting the meaning of the area to the Mi'kmaq, such as resources available or the landscape features of the area. This type of naming relies on an intimate understanding and repeated use of an area (KMKNO-ARD 2024) The nearest Mi'kmaq community is located on Cape Breton Island approximately 42 km northeast of the PDA, being the Chapel Island Indian Reserve No.5 located near St. Peters, Richmond County, Nova Scotia.

During the 19th century the Mi'kmaw people were known for traveling the coastline in their birch bark canoes between Port Hastings, Port Hawkesbury, and St. Peters along the southwest of Cape Breton and Isle Madame. The area was noted to have been used by local Mi'kmaw, primarily from the Chapel Island Reserve situated on the Bras d'Or Lake. The Mi'kmaw used the St. Peters River/canal to access the bay and Lennox Passage where Mi'kmaw encampments were noted to be present during this time (KMKNO-ARD 2024). The local Mi'kmaq were known to have collected wood resources for basket making and axe handles, fished, and used their watercraft to travel to sell such goods in St. Peters and Port Hawkesbury during the turn of the 20th century (KMKNO-ARD 2024).

Historic Period

The Historic Period is defined as the period from the arrival of mostly European-derived peoples to North America, approximately 500 years ago, until the modern era. For Mi'kmaq communities, this period is referred to as *Kiskukew'k L'nu'k* (Today's People) or Contact Period (500 BP- Present), which saw the growth of European settlement in the region, and with it, a variety of changes for *Kiskukew'k L'nu'k* associated with trade, conflict, and disease (Whitehead 1991).

The first European settlement within the area occurred in 1636, when Nicholas Denys established a fur trading and fishing station at St. Peters (Ganong 1908), to the east of the PDA. In 1713 the French named this place Port Toulouse in honor of Comte de Toulouse, the illegitimate son of Louis XIV (Public Archives of Nova Scotia [PANS] 1967). The area was mostly settled by French speaking peoples engaged in the local fishery, with settlement concentrated along the coastline. By the end of the Seven Years' War (1756-1763) this part of the island was depopulated. The area was later resettled by United Empire Loyalists at the end of the American War of Independence during the late 1780s. The St. Peters Canal was constructed in 1854 and was open to the public by 1869 (PANS 1967). The community grew prosperous by the late 19th century and acted as a gateway between the Strait of Canso and the Bras d'Or Lake of Cape Breton.

The town of Port Hawkesbury is the nearest settlement on the east side of the Strait of Canso and located to the west of the PDA. The community was originally known as Ship Harbour but the name of the community was changed in 1860. Originally the town plot was laid out on the north side of Ship Harbour in the late 18th century and was first referenced as Hawkesbury in 1790 (PANS 1967). A Strait of Canso ferry service was set up in Ship Harbour in 1833. At first this was a scow service, replaced with a steam ferry by the 1860s and later by rail serviced steam ferries in the 1880s. This development of services came at the same time the town was incorporated in 1889, with the focus to build ships for the timber export trade. By 1955 the Canso Causeway was completed, and a pulp mill was constructed at Point Tupper by 1960 (PANS 1967). The closest historical settlement to the PDA is Port Richmond, which is a small community located on Inhabitants Bay, to the south of the PDA. This community was originally called Little River and was given the name Port Richmond in 1864 (PANS 1867).

A review of historical maps and land documentation revealed a total of six historic land grants located entirely or partially within the PDA. The earliest grant was issued to John Tyrell in 1834 and consisted of a 100-acre lot (Nova Scotia Department of Natural Resources 1786-1946: Crown Records Book R, Page 120). Three lots of 100 acres were granted in 1860 to William Akins Henry Paint (Crown Record #5010) and John Smith Jr. (Crown Record #1565), and Edward E. Binet (Crown Record #5173). A larger lot was issued in 1868 to Abraham Landry and consisted of 225 acres (Crown Record #7578). The final historic lot was granted in 1884 to Stephen McNeil and consisted of 180 acres (Crown Record #15125). There were no buildings or structures present in the H. Fletcher (1884) Geology Survey of Canada map or the A. F. Church (1885) map for Richmond County. The PDA appears to have seen no identifiable historical settlement. A section of the Canadian National Rail (CNR) line is present within the PDA on both maps at this time in a place called Saint Peters Junction (PANS 1967). When reviewing these maps, it became apparent that there were several rail lines that interacted with the PDA at different times; at least one of these rail beds is now submerged beneath the Landrie Lake.

Modern developments within the PDA were reviewed in aerial photographs dating to 1940 (NSDNR 1940, 1953 and 1969). Landrie Lake is situated to the west and Little River to the east and the 1940 and 1953 photos show how they appeared prior to flooding. The town of Port Hawkesbury constructed the water utility and electrical corridor during the 1950s and 1960s (NSDNR 1969). The current shorelines of the reservoirs at Little River and Landrie Lake, do not reflect the original shorelines in the past. An old spur of the Canadian National Railway rail line to Point Tupper was flooded out due to construction of the water utility and the Canadian National Railway was realigned at this time. The current water levels at Landrie Lake and Little River were altered when both Sea Coal Brook and the Little River were dammed and do not reflect past shorelines. The shorelines are not in the same locations as they were in both the Pre-Contact and Historic Periods and the current shorelines do not have raided potential for settlement or use.

Results of the ARIA

The walkover of the PDA focused on two segments: the old water utility corridor from the old pumphouse on the Little River Reservoir east to Landrie Lake and the other focused on the access road from the pump house to Highway 104 at the west end of the PDA. The water utility section ends at a short section of Sea Coal Brook which empties into Landrie Lake, and a small drainage located along the access road. The access road was scoped out of the EA as the access road will have minimum disturbance regarding regrading, gravel resurfacing, and a culvert replacement.

The archaeological survey or walkover of the old water utility corridor was completed on June 13 and 25, 2024. The access road corridor was walked on June 14, 2025. The section of the PDA within the water utility corridor was found to have low potential for archaeological resources. Although historic and modern impacts have occurred to the landscape and has altered it, general conditions encountered during the walkover did not indicate potential for past use or occupation.

The access road portion of the PDA has seen past impact due to construction of the access road. The current Little River, a minor watercourse that was dammed to create the reservoir, does not reflect the past shorelines. The access road was found to follow the contours in the high terrain within the landscape, which was found to be sloped, undulating, and rocky with poor soil development. Berms and water diversion ditches were noted along sections of the access road, as was as an older section of rail bed.

Overall, the PDA was found to have low archaeological potential due to either sloping, saturated, or rocky conditions or a combination of these conditions encountered during the walkover. The generally unfavourable ground conditions are also reflected by the general lack of historical use of the PDA noted during the background research. There were no areas of elevated archaeological potential suitable for shovel testing identified during the walkover that warrant avoidance. The current water levels at Landrie Lake and Little River were altered when both Sea Coal Brook and the Little River were dammed and do not reflect past shorelines. It is recommended that the water utility and access road will not require any future additional mitigation.

5.6.2.4 Archaeological Resources

A review of the NSCCTH Maritime Archaeological Resource Inventory online database indicates that there are sixteen registered archaeological sites within a 5 km radius of the PDA, including thirteen sites within the BjCh and three within the BjCi Borden grid reference blocks. There are no registered pre-contact archaeological sites within 5 km of the PDA. Twelve registered historic period sites, including sites BjCh-01 through BjCh-12, are a series of mid-19th century homestead features in three discrete locations near an old rail line in Port Richmond, where settlement was concentrated along the coast during the 1860s and located to the southeast of the PDA. The first location includes Murry Cove, including sites Croake 1 and Croake 2 (BjCh-01 and BjCh-02 respectively), sites at MacKay Point (BjCh-03), including Murry Cove 1 through 4 (BjCh-07, BjCh-08, BjCh-09, & BjCh-12, respectively) and sites Oliver Cove 1 and Oliver Cove 2 (BjCh-10 and BjCh-11, respectively). The second location consists of three sites at MacNamara Cove, MacNamara 1 through 3 (BjCh-04, BjCh-05 and BjCh-06, respectively). These sites were identified and registered during an ARIA for a LNG project (Davis Archaeological Consultants Ltd. [DACL] 2005).

Additional sites have been registered along the old main road along Point Tupper to the southwest of the PDA. These are also related to mid-19th century settlement sites and include the Port Road Homestead site (BjCi-03) and the Ship Point site (originally registered as BjCh-05), both identified by archaeologists during assessment work in relation to the Sable Offshore Energy Project pipeline easement surveys during the late 1990s (Washburn & Gillis 1999). The Ship Point site was later reregistered as BjCi-20 when the site was reinvestigated during a more recent ARIA carried out by Boreas Heritage Consulting Inc. (BHCI) in 2023. The J. Cash site (BjCi-06) was identified in the same general area as the preceding two sites during an assessment for the NSPI Generation Station at Point Tupper (Davis 2004).

All the sites noted above are located outside of the PDA and will not be affected by Project related activities.

5.6.2.5 Previous Archaeological Resource Impact Assessments

A research request was submitted with NSCCTH staff for past and more recent ARIA reports that were conducted near the PDA and six were provided. The first report was for an ARIA carried out by Jacques Whitford Environment Limited (JWEL) in 1991 for the Ship Point Energy from Waste Facility. An abandoned 19th century farm site was identified, shovel testing proceeded, and clearing and recording of the stone features was conducted: no other archaeological work was recommended (JWEL 1991).

An ARIA report was provided for the Statia Terminal Canada Inc Point Richmond Underground Storage Project carried out by DACL in 1999 (DACL 2000). Several mid-19th century sites were identified during the assessment and located within Murry Cove and other sites off the Port Malcom Road. These sites were readdressed and registered in 2004 during the Phase one ARIA for the Port Richmond Underground Storage Facility also carried out by DACL (DACL 2005). The registered sites are located to the southeast and located outside the PDA as detailed in Section 5.6.2.4.

An ARIA was completed out by JWEL in 2005 for the Proposed Natural Gas Pipeline for Bear Head, Richmond County to Goldbro, Guysborough County (JWEL 2006). Several sites were identified during the assessment activity but are located outside the current PDA.

DACL completed an ARIA in 2006 for the Stata Terminal Canada Inc Wharf Extension Project (DACL 2006). The assessment consisted of a marine archaeological survey and background research which resulted in a recommendation for additional survey work, yet to be completed (DACL 2006).

The most recent ARIA carried out in the vicinity of the project was completed by BHCI in 2023 for the EverWind Facility Transmission Line. Two areas of High potential were identified, including three registered sites along the old main road as detailed in Section 5.6.2.4.

5.6.2.6 Built Heritage Resources

A review of the Canadian Register of Historic Places identified no registered historic places or heritage sites located within 5 km of the PDA (Canadian Register of Historic Places 2024). The closest heritage site of note is the Fort Toulouse (1717) Archaeological Site BjCf-02, surveyed in 1973 and located at Battery Provincial Park, St. Peter's, Nova Scotia. The site was formally recognized in 1985 and is valued as a mostly undisturbed example of a French military facility established at the time the Acadians were moving into Cape Brenton from mainland Nova Scotia after the French defeat by the British in Queen Anne's War (1701-1713). The fort was built to protect the village and transportation route from the Atlantic into the Bra d'Or Lake within Cape Breton. Another heritage site of note is the St. Peters Canal (1853-1869) National Historic Site administered by Parks Canada, which was Federally recognized in 1929. The nearest registered heritage building is the Captain James Embree House (1880), located in Port Hawkesbury and associated with the man who established the first regular ferry service across the Strait of Canso. The building was registered in 1995. None of these historic places or buildings of heritage value will be impacted by the Project.

No buildings of heritage value were found during the ARIA; therefore, interactions between built heritage resources and Project activities will not be assessed further in this VC.

5.6.2.7 Palaeontological Resources

While no specific palaeontological report was prepared and no fieldwork with respect to palaeontological resources was required during assessment of the Project, the potential for palaeontological resources to be affected by Project activities is low. The PDA is located within the Sedimentary Lowlands Theme Region (Theme Region 860) (Davis and Brown 1996: 216-218). The bedrock is dominated by sedimentary rocks deposited during and after the formation of Pangaea in the late Devon and Carboniferous Periods during a period of major crustal movement. The deposits which succeeded this period consist of "…salts (Windsor Group), reddish siltstone (Canso Group), and fine sandstone (Riversdale Group)" (Davis and Brown 1996:216). These types of rocks are soft and erodible, which has formed a rolling lowland landscape which slopes toward the Chedabucto Bay and the Strait of Canso.

The landscape of Chedabucto Bay was formed due to several geological processes. The southern boundary marks the location of the Chedabucto Fault, which extends across Nova Scotia from the Bay of Fundy to Canso. The fault line, including Chedabucto Bay and the strait itself, was probably once part of a major river system which rose up on the continental shelf and flowed northwards into the Gulf of Saint Lawrence during the Triassic and Cretaceous Periods. Later tilting of the landscape and submergence had drowned the river valley (Davis and Brown 1996:216). In time these geological processes formed the Bay and strait. During the most recent glacial period, moving ice caps in Chedabucto Bay formed deposits of red-brown sandy till on top of the Carboniferous rocks across the landscape. The soils have developed for the most part from sandstones, slates, and shales, giving tills ranges in texture from sandy loam to shaly clay loam (Davis and Brown 1996:216). There are no fossils known from this type of geology and it is unlikely that any would be found; therefore, interactions between palaeontological resources and Project activities will not be assessed further in this VC.

5.6.3 Potential Effect Pathways

A summary of the Project effect pathways and measurable parameters to be assessed for Heritage Resources is provided in Table 5.6.1. Potential environmental effects and measurable parameters were selected based on the review of similar projects in NS and other parts of Canada, and professional judgement.

Table 5.6.1 Potential Effects, Effect Pathways and Measurable Parameters for Heritage Resources

Potential Effect	Effect Pathway(s)	Measurable Parameter(s)
Change in Heritage Resources	• Construction resulting in surficial or subsurface ground disturbance	• Presence or absence of a heritage resource

Potential interactions with heritage resources could occur during activities that involve surface and subsurface ground disturbance. The following activities during construction have the potential to interact with heritage resources:

- Site preparation and grubbing
- Pipeline installation

As the operation and maintenance activities (e.g., vegetation control) will take place within the PDA that will already have been disturbed during construction activities, it is not anticipated that there will be additional interactions between heritage resources and the operation and maintenance phase. This phase will not be considered further in this assessment.

5.6.4 Mitigation and Management Measures

The following mitigation measures specific to Heritage Resources have been identified for the Project:

- Develop and implement a Heritage Resources Accidental Discovery Plan in the unanticipated event that heritage resources are discovered during Project development.
- Consultation Work with NSCCTH's Special Places Coordinator and/or the paleontological staff at the Nova Scotia Museum to develop appropriate mitigation should any significant heritage resources be discovered during Project activities.

In addition, environmental management practices outlined in Section 2.9 will be implemented to avoid or reduce potential effects on Heritage Resources.

5.6.5 Residual Environmental Effects

As noted in Section 5.6.2, the PDA was characterized as exhibiting low potential for sub-surface heritage resources. With the implementation of the mitigation described in Section 5.6.4 (i.e., implementation of a Heritage Resources Accidental Discovery Plan in the unanticipated event that heritage resources are discovered during Project development), residual adverse environmental effects on archaeological resources are not anticipated. There is no anticipated interaction between built heritage and paleontological resources. Project-related residual effects on heritage resources are therefore predicted to be negligible and not significant. Prediction confidence in the assessment of heritage resources is high due to the quality of collected field data and established mitigation and protection measures.

5.6.6 Follow-up and Monitoring Programs

A dedicated follow-up and monitoring program is not proposed for Heritage Resources.

6 Potential Impacts and Benefits to the Mi'kmaq of Nova Scotia

Aboriginal and Treaty rights are recognized and affirmed in Section 35(1) of the *Constitution Act, 1982*, which provides constitutional protection for these rights in Canada. The Supreme Court of Canada has held that the federal and provincial Crown (i.e., the Government of Canada and the Government of Nova Scotia) each have a legal duty to consult and, where appropriate, accommodate Indigenous groups when contemplating conduct that may adversely impact potential or established Aboriginal or Treaty rights (e.g., the issuance of a permit that enables the Project to proceed). This section describes certain aspects of the Mi'kmaq of Nova Scotia and the potential Project-related impacts to Aboriginal and Treaty Rights through potential changes in Mi'kmaq land and resource use. As detailed in Section 3.1, the Mi'kmaq have been engaged regarding the proposed Project. A summary of Mi'kmaq engagement is provided in Table 3.1.1 and comments and concerns in Table 3.4.1.

A Mi'kmaq Ecological Knowledge Study (MEKS) was completed by Membertou Geomatic Solutions for the proposed Project (MGS 2025). The MEKS follows the MEKS Protocol (2nd Edition) (Assembly of Nova Scotia Mi'kmaq Chiefs n.d.) that was developed by the Assembly of Nova Scotia Mi'kmaq Chiefs and describes the process, procedures and results that are expected of a MEKS. The purpose of the MEKS is to:

- Determine historic and current Mi'kmaq land and resource use near the Project
- Provide an inventory of species of significance to the Mi'kmaq near the Project
- Provide an analysis of potential effects of the Project on Mi'kmaq land and resource use
- Provide recommendations for further action or mitigation

MEKS information is gathered by three means, including literature and archival research, interviews, and field sampling. For the literature and archival research, various archival documents, maps, oral histories and published works are reviewed for information regarding the past or present Mi'kmaq occupation of the PDA and MEKS "Study Area" (i.e., within 5 km of the PDA). Results of the MEKS will be considered during pre-construction planning. The assessment of potential impacts to the Mi'kmaq of Nova Scotia focuses on the interactions among changes to related biophysical and socio-economic VCs and change in conditions, attributes, sites, lands, resources, or structures of relevance for the Mi'kmaq. The interrelationship among various related biophysical and socio-economic VCs plays an important role in how changes to the environment may affect the conditions and material circumstances for the Mi'kmaq. For example, changes in surface water quality may influence fish health, which could in turn affect country foods and Mi'kmaq health conditions. The identification of potential impacts, therefore, relies on the assessments provided for the biophysical and socio-economic VCs, provided in Section 5.

Traditional use activities were reported to occur in the vicinity of the PDA, including trout fishing and mushroom gathering, with mackerel and rabbit harvesting also favoured activities in the Study Area (MGS 2025).

A change in traditional use could potentially occur as a result of potential Project-related change to the terrestrial habitat. As noted in Section 5, adverse environmental effects are anticipated to be minimal, with most effects limited to the PDA or within a 1-km buffer. Given that the PDA has been previously developed and additional clearing and grubbing will be limited, direct effects to wildlife habitat will be limited and associated effects to traditional land use are also anticipated to be limited. Mitigation measures to eliminate or reduce adverse effects on biophysical resources will also serve to reduce adverse effects on Mi'kmaq land and resource use.

Restricted access to the PDA during construction could constrain land use opportunities. Restricted access to the PDA will primarily occur during the construction phase. Since the pipeline will be buried, no long-term effects are anticipated for hunting and gathering activities.

LLWU will continue to engage with the Mi'kmaq of Nova Scotia to understand potential concerns and mitigate adverse effects. Based on the results of the MEKS, LLWU will apply additional mitigation, where needed, to eliminate or reduce adverse effects to the Mi'kmaq of Nova Scotia.

7 Other Undertakings in the Area and Cumulative Effects

Under section 12 of the Nova Scotia *Environmental Assessment Regulations*, the Minister must consider other undertakings in the area of a proposed project registered as a Class 1 Undertaking. For this EA, environmental effects associated with other undertakings that may potentially act in combination with the environmental effects of the Project include nearby industrial activities such as the green hydrogen/ammonia projects (Figure 7.1). Potential environmental effects associated with these other undertakings are described below, along with a discussion of the potential for these other undertakings to act in combination with the environmental effects of the Project creating cumulative environmental effects.

The Project is located 1.92 km from the Point Tupper Industrial Park on the Strait of Canso. Existing activities in the business park include power generation, industrial waste management facilities, coal storage and handling, transshipment terminals, storage of dangerous goods and management of bulk petrochemicals. The Point Tupper Wind Farm is also located 2.93 km from the Project. The environmental effects of past and present projects or activities on VCs have been considered in the description of existing conditions as applicable for each VC.

EverWind Fuels (EWF) and Bear Head Energy (BHE) have received Minister's approval, with conditions, for the development of green hydrogen/ammonia projects at the Point Tupper Industrial Park area. The EWF Green Hydrogen/Ammonia Phase 1 Project is located 3.05 km from the Project and BHE Green Hydrogen/Ammonia Project is located 4.15 km from the Project. Potential effects associated with these projects include, but are not limited to: fugitive dust and exhaust emissions; noise and light emissions; increased raw water demand; and loss/alteration of terrestrial habitat. As described in their respective environmental assessments, mitigation and management measures will be in place for each project to eliminate or reduce adverse environmental effects (EWF 2022, BHE 2023). Adverse residual effects are not anticipated to be significant for these projects (EWF 2022, BHE 2023) and cumulative effects with the Project are not anticipated. Raw water demand from these projects has been addressed in the Project EARD and will be managed to reduce or avoid adverse effects on the aquatic ecosystems through the surface water withdrawal permitting process.

While the Project can result in adverse environmental effects (described in Section 5), these effects will be managed through the implementation of mitigation measures identified in this EARD and through subsequent permits and approvals, thereby reducing the Project's contribution to potential cumulative effects with these other undertakings. The Project is not predicted to affect any of these existing or proposed undertakings, except in a positive way (e.g., increasing access to raw water and regional support for industrial development and associated benefits). It is anticipated that other future undertakings will be required to implement similar mitigation measures and standards, further reducing potential for other undertakings to contribute additional adverse and potentially overlapping (i.e., cumulative) effects.

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Town of Port Hawkesbury; Stantec; Nova Scotia Natural Resources and Renewables; Nova Scotia Environment and Climate Change
3. Background: Service Nova Scotia NSTDB; ESRI

Legend

Project Features
- Pumping Station (Proposed)
- Pipeline Route (Approximate)
- Access Road (Existing)

Built Infrastructure
- Wind Turbine
- Church
- Fire Station
- Hospital
- School
- Community Centre
- Pumping Station
- Electrical Generation
- Highway
- Road
- Rail Road
- Track
- Transmission Line
- Pipeline
- Built Structures

Other Features
- Watercourse (NSHN)
- County Boundary
- Waterbody (NSHN)
- Wetlands (NS ECC)
- Forested Area
- Adjacent Project Development Areas
- Commercial Area
- Industrial Area
- Protected Area (Park, Nature Reserve, Wilderness Area, Land Trust)

0 1 2 km
(At original document size of 8.5x11)
1:75,000

N

Stantec

Project Location
Port Hawkesbury
Richmond County, NS

Prepared by NW on 2024-10-23
TR by GJ on 2024-10-23

Client/Project
121418143_009

Landrie Lake Water Utility
Little River Pumping Station and Transmission Project

Figure No.
7.1

Title
Other Undertakings

\\ca0213-pp\fss01\work_group\12141active\1XXX - Other PCs\1214_NB\121418143\gis_data\mapping\aprx\121418143_LandrieLakeUtility.aprx Revised: 2025-11-04 By: niwhite

8 Effects of the Environment on the Undertaking

The definition of an environmental effect often includes a change to the Project that may be caused by the environment. Environmental conditions could affect or damage Project infrastructure resulting in failures, malfunctions, or accidental events, which in turn, could result in adverse effects to the environment. Environmental effects could be related to climate and meteorological conditions (including climate change), geological events (e.g., earthquakes, landslides) and wildfire.

8.1 Climate and Meteorological Conditions

As most Project activities occur outside, climate and meteorological conditions could have important implications for the Project. The climate in a given area is generally characterized by data collected over a recent 15 to 30-year period, known as climate normals. Climate normals data are used to understand and manage climate patterns and provide a baseline for comparison to future weather and climate change.

ECCC has developed climate normals statistical summaries for weather stations all over Canada. The most recent complete dataset of climate normals from ECCC is for the 30-year period of 1981-2010. ECCC has begun preparing more recent climate normals data (1991-2020), but only some ECCC climate stations currently have this updated data.

The nearest ECCC station to the Project with climate normals data available is Deming Station, located approximately 40 kilometres south on Deming Island. The average annual climate data by month recorded at Deming Station are summarized in Table 8.1.1. The yearly average temperature is 6.1 degrees Celsius (˚C) with an extreme maximum of 31.1˚C and an extreme minimum of -25.0˚C.

Table 8.1.1 Annual Average Climate Data at the Deming Weather Station (1981 – 2010)

Month	Daily Average (°C)	Daily Maximum (°C)	Daily Minimum (°C)	Extreme Maximum (°C)	Extreme Minimum (°C)
Jan	-4.0	-0.5	-7.4	10.5	-25.0
Feb	-4.1	-0.9	-7.3	10.0	-25.0
Mar	-1.5	1.3	-4.3	11.0	-19.0
Apr	2.6	5.3	-0.2	20.0	-11.0
May	6.6	9.7	3.5	24.0	-3.5
Jun	11.1	14.3	7.9	31.1	-0.6
Jul	15.1	17.9	12.2	30.0	4.4
Aug	17.4	20.2	14.6	28.5	4.4
Sep	15.2	18.1	12.2	26.1	2.0
Oct	10.1	12.8	7.3	21.7	-4.4
Nov	5.0	7.6	2.3	19.4	-12.0

Table 8.1.1 Annual Average Climate Data at the Deming Weather Station (1981 – 2010)

Month	Daily Average (°C)	Daily Maximum (°C)	Daily Minimum (°C)	Extreme Maximum (°C)	Extreme Minimum (°C)
Dec	-0.3	2.7	-3.3	12.2	-23.5
Year (Average)	6.1	20.2	-7.4	31.1	-25

Source: ECCC 2024d

The average annual precipitation data by month collected at Deming Station are summarized in Table 8.1.2. The annual average rainfall is 1,320.8 mm, annual average snowfall is 119.7 centimetres (cm), and annual average total precipitation is 1,440.5 mm.

Table 8.1.2 Annual Average Precipitation Data at the Deming Weather Station (1981 – 2010)

Month	Rainfall (mm)	Snowfall (cm)	Precipitation (mm)	Extreme Daily Rainfall (mm)	Extreme Daily Snowfall (cm)	Extreme Daily Precipitation (mm)
Jan	85.6	30.4	116.1	59.7	26	59.7
Feb	75	28.9	103.9	60	28	65
Mar	97.6	22.4	120	87.8	22.9	87.8
Apr	128.1	10.4	138.5	114	27.9	114
May	116.6	0.7	117.3	86.9	8.9	86.9
Jun	100.4	0	100.4	55.9	0	55.9
Jul	101.8	0	101.8	95	0	95
Aug	100.9	0	100.9	90.7	0	90.7
Sep	114.8	0	114.8	103.6	0	103.6
Oct	144.2	0	144.2	100.2	2.5	100.2
Nov	142.8	5.2	148	115.6	17	115.6
Dec	113	21.6	134.6	67.3	28.2	67.3
Year	1320.8	119.7	1440.5	115.6*	28.2*	115.6*

*Maximum precipitation recorded in the year
Source: ECCC 2024d

Normal temperature and precipitation conditions are not expected to have substantive effects on the Project. NSECC's *Guide to Considering Climate Change in Project Development in Nova Scotia* (NSE 2011), notes it is important to understand the effects associated with climate change to reduce Project risks by complying with existing and future GHG reduction targets and legislation in Canada by considering their 'carbon footprint'. Future climate change could result in increased air temperatures, increased frequency and intensity of precipitation, an increase in the frequency and magnitude of storm events, and increased incidence of flooding and erosion. The Municipality of Port Hawkesbury is anticipated to experience future increases in precipitation, temperatures, number of very hot days per year, and number of frost-free days per year (Prairie Climate Centre 2019).

Potential effects of climate change associated with extreme temperatures, heavy precipitation, winds, and storms could include delay and/or interruption of Project activities; loss of electrical power; and damage to site access, infrastructure, and equipment. Extreme precipitation and associated surface water runoff could potentially cause flooding, erosion, and washout of site features including roads. These effects in turn could affect surface water resources, fish and fish habitat and wetlands. The Project will be designed to withstand instances of extreme weather. Weather forecasts will be monitored and prior to extreme weather events, appropriate preventative measures will be taken to reduce the risk of damage to the Project. This will include inspections prior to and following significant precipitation events.

8.2 Seismic Activity

Seismic activity (i.e., earthquakes) in Nova Scotia has been rare. The Geologic Survey of Canada assesses the relative hazard for the province of Nova Scotia to be low, meaning there is a one percent chance that significant damage from seismic activity will occur every 50 years) (Geologic Survey of Canada 2015). Historically, most seismic shocks recorded in Atlantic Canada are below magnitude 5 (Rast et al. 1979). Potential adverse effects on the Project from seismic activity will be an important consideration throughout the planning, engineering, and implementation of the Project.

8.3 Wildfires

Between 2016 and 2021, there were a total of six wildfires in Richmond County. There were no fires in 2016, 2018 or 2021. Collectively, wildfires in 2017, 2019 and 2020 burned a total of 2.5 ha of land in Richmond County (NRR 2021). In this same time period (2016-2021), there were a total of 935 wildfires in the province, averaging 187 wildfires a year (CCFM 2022). A total of 2,611 ha of land was burned in the province over this period (CCFM 2022).

The likelihood of a wildlife near the Project is relatively low. Nova Scotia has a forest fire control program in place to identify and control fires and reduce potential magnitude and extent of wildfires. Fire protection systems will be in place at the pumphouse station compound in accordance with applicable codes and standards. The ERP will describe emergency response measures, training requirements, roles and responsibilities, and reporting procedures in the event of a fire at or near the site.

8.4 Summary

As noted above, a variety of mitigative strategies will be employed to reduce the risk of potential effects of the environment on the Project to acceptable levels. Effects of the environment are largely addressed through Project planning and engineering design. In summary, climate and meteorological conditions (including climate change), geological events, and wildfire are not anticipated to substantially affect the operation of the Project over its proposed lifetime.

9 Other Approvals Required

In addition to the registration as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations, a summary of key environmental permits and/or approvals that may be required for the Project is provided in Section 1.5, Table 1.5.1.

10 Funding

No funding has been approved for this Project at this time.

11 Closing

The conclusions in the Report titled Little River Pumping and Transmission System Project Environmental Assessment Registration are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from Landrie Lake Water Utility (c/o Town of Port Hawkesbury) (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

\\ca0181-ppfss01\workgroup\1214\active\121418143\1_environmental\5_report\2_eard\final\/

12 References

AC CDC (Atlantic Canada Conservation Data Centre). 2024. Data Report 8192: Landrie Lake, NS. Prepared August 22, 2024.

Assembly of Nova Scotia Mi'kmaq Chiefs. No date. Mi'kmaq Ecological Knowledge Study Protocol. 2nd Edition. Available at: https://novascotia.ca/abor/aborlearn/docs/mek%20protocol%20second%20edition.pdf

BHE (Bear Head Energy Inc.). 2023. Bear Head Energy Green Hydrogen and Ammonia Production, Storage and Loading Facility Project Environmental Assessment Registration Document. Prepared by Stantec Consulting Ltd. Available at: Bear Head Energy Green Hydrogen and Ammonia Production, Storage and Loading Facility | Environmental Assessment

Bird Studies Canada. 2024. Important Bird Areas Interactive Map. Available online at: https://www.ibacanada.com/mapviewer.jsp?lang=en. Accessed October 16, 2024.

Bonnichsen, R., D. Keenlyside, and K. Turnmire. 1991. Palaeo-Indian Patterns in Maine and the Maritimes. *In Prehistoric Archaeology in the Maritime Provinces: Past and Present Research, Reports in Archaeology 8*. Edited by M. Deal and S. Blair, pp. 1-36. Fredericton: Council of Maritime Premiers Committee on Archaeological Cooperation.

Boreas Heritage Consulting Inc. 2023. *Everwind Facility Transmission Line Archaeological Resource Impact Assessment Richmond and Inverness Counties*, Heritage Research Permit A2023NS039. Report on file at the Special Places division of the Nova Scotia Department of Communities, Culture, Tourism, and Heritage. Halifax, NS.

Canadian Register Historic Places. 2024. Electronic reference accessed on November 4, 2024. Accessed online at: https://www.historicplaces.ca/en/results-resultats.aspx?m=2&Keyword=grand%20falls.

Canada Department of Agriculture. 1972. *Soils of Nova Scotia.*

CCFM (Canadian Council of Forest Ministers). 2022. National Forestry Database. Available online at: http://nfdp.ccfm.org/en/data/fires.php#tab311.

CCME (Canadian Council of Ministers of the Environment). 1999. *Canadian water quality guidelines for the protection of aquatic life*. Canadian Council of Ministers of the Environment.

CCME (Canadian Council of Ministers of the Environment). 2024. Canada's Air, AQMS and CAAQS. Available online at: https://ccme.ca/en/air-quality-report#slide-1

Church, A.F. 1885. *Topographical Township Map of Richmond County, Sheet #2 Nova Scotia*. Halifax: A.F. Church & Co.

Confederacy of Mainland Mi'kmaq. 2007. *Kekina'muek: Learning about Mi'kmaq of Nova Scotia*. Donald M. Juien (Ex. Dir.) Government of Canada, Human Resources and Social Development Canada, Turo, NS. Electronic web reference accessed on November 7, 2023, <https://native-land.ca/wp-content/uploads/2018/06/Mikmaq_Kekinamuek-manual.pdf>

Cornell University. 2024. eBird Canada. Available online at https://ebird.org/region/CA. eBird Canada is a collaborative project managed by Birds Canada. Accessed October 16, 2024.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012. COSEWIC assessment and status report on the American Eel Anguilla rostrata in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 109 pp.

DACL (Davis Archaeological Consultants Ltd.). 2000. *Archaeological Resource Impact Assessment Statia Terminals Canada Inc. Pt. Richmond Underground Storage Project,* Heritage Research Permit No. A2000NS42. Report on file at the Special Places division of the Nova Scotia Department of Communities, Culture, Tourism, and Heritage. Halifax, NS.

DACL. 2005*. Phase 1 Port Richmond Underground Storage Facility: Archaeological Resource Impact Assessment,* Heritage Research Permit A2005NS54. Report on file at the Special Places division of the Nova Scotia Department of Communities, Culture, Tourism, and Heritage. Halifax, NS.

DACL. 2006. *Statia Terminals Canada Inc. Wharf Extension Project: Archaeological Resource Impact Assessment*, Heritage Research Permit A2006NS69. Report on file at the Special Places division of the Nova Scotia Department of Communities, Culture, Tourism, and Heritage. Halifax, NS.

Davis, D.S. and S. Browne. 1996. *The Natural History of Nova Scotia. Vol 2. Theme Regions*. Nimbus Publishing and the Nova Scotia Museum, Halifax.

Davis, S.A. 1991. The Ceramic Period of Nova Scotia. *In Prehistoric Archaeology in the Maritime Provinces: Past and Present Research, Reports in Archaeology 8*. Edited by M. Deal and S. Blair, pp. 1-36. Fredericton: Council of Maritime Premiers Committee on Archaeological Cooperation.

Davis, S.A. 2004. '*J. Cash Site*,' Maritime Archaeological Recourse Inventory Form, archaeological site registry Borden number BjCi-06, recorder under Heritage Research Permit A2003NS73.

Deal, M. 2023. *Archaeology and The Indigenous Peoples of the Maritimes*, Memorial University Press.

DFO (Fisheries and Oceans Canada). 1995. Freshwater Intake End-of-Pipe Fish Screen Guideline. Available Online: https://publications.gc.ca/collections/Collection/Fs23-270-2004E.pdf.

DFO. 2013a. Fisheries Protection Policy Statement. Available Online: https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/354669.pdf

DFO. 2013b. Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/017 Available Online: https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/348881.pdf

DFO. 2019a. Measures to Protect Fish and Fish Habitat. Available online at: https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html.

DFO. 2019b. Timing windows to conduct projects in or around water. Available Online: https://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/index-eng.html

DFO. 2022a. Aquatic Species at Risk Map. Available Online: https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html. Accessed March 17, 2023.

DFO. 2022b. Interim Code of Practice: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater. https://www.dfo-mpo.gc.ca/pnw-ppe/codes/cofferdams-batardeaux-eng.html.

Di Rocco, R, and R. Gervais. 2024. *SPOT: Swim Performance Online Tools*. Available Online https://fishprotectiontools.ca/.

ECCC (Environment and Climate Change Canada). 2023. Guidelines to avoid harm to migratory birds. Available online at: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html.

ECCC. 2024a. Canada's National Inventory Report – 2024 Edition. Available online at: https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html

ECCC. 2024b. Critical habitat for species at risk national dataset – Canada. Available online at: https://search.open.canada.ca/openmap/47caa405-be2b-4e9e-8f53-c478ade2ca74

ECCC. 2024c. General nesting periods of migratory birds. Available online at: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html#_zoneC_calendar.

ECCC. 2024d. Canadian Climate Normals. Available online at: https://climate.weather.gc.ca/climate_normals/

EWF (EverWind Fuels Company). 2022. EverWind Point Tupper Green Hydrogen/Ammonia Project Phase 1 Environmental Assessment Registration Document. Prepared by Strum Consulting. Available at: https://www.novascotia.ca/nse/ea/everwind-point-tupper-green-hydrogen-ammonia-project/

Fletcher, H. 1884. *Province of Nova Scotia, Island of Cape Breton, Strait of Canso, Sheet #22*. Geological Survey of Canada. Geological Map.

Ganong, William F. 1908. *Natural History of the Coast of North America (Acadia)*, Nicolas Denys, Translated and edited by Ganong, reprinted by the Champlain Society, Toronto.

Geologic Survey of Canada. 2015. Seismic Hazard Map. Available online at: https://seismescanada.rncan.gc.ca/hazard-alea/simphaz-en.php#NS

GeoNOVA. 2024. DataLocator – Elevation Explorer. Available online at: https://nsgi.novascotia.ca/datalocator/elevation/

GNS (Government of Nova Scotia). 2011. Nova Scotia Wetlands Conservation Policy

GNS. 2021. The Nova Scotia Abandoned Mine Openings (AMO) Database. Available online at: https://novascotia.ca/natr/meb/geoscience-online/about-database-amo.asp

GNS. 2024a. Provincial Landscape Viewer. Available online at https://nsgi.novascotia.ca/plv/ Accessed October 16, 2024.

GNS. 2024b. Species at Risk – Recovery Update. Available online at: https://novascotia.ca/natr/wildlife/species-at-risk/

Government of Canada. 2023a. Greenhouse Gas Reporting Program data search. Available online at: https://climate-change.canada.ca/facility-emissions/?GoCTemplateCulture=en-CA

Government of Canada. 2023b. 2030 Emissions Reduction Plan: Clean Air, Strong Economy. Available online at: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030.html

Government of Canada. 2024a. Net-zero emissions by 2050. Available online at: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html

Government of Canada. 2024b. Species at risk public registry. Available online at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html.

Government of Canada. 2025. National Water Data Archive: HYDAT. Available online at: https://www.canada.ca/en/environment-climate-change/services/water-overview/quantity/monitoring/survey/data-products-services/national-archive-hydat.html

Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise. Available online at: https://iaac-aeic.gc.ca/050/documents/p80054/119378E.pdf

IPCC (International Panel on Climate Change). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

Johnston, C.A. 1989. Human Impacts to Minnesota Wetlands. Journal of the Minnesota Academy of Science 55(1): 120-124.

JWEL (Jacques Whitford Environment Limited). 1991. *Heritage Research Permit A1991NS24. Heritage Resources Survey of Ship Point Energy from Waste Facility*, Richmond County written by Callum Thomson archaeologist with JWEL. Curator report on file at the Special Places division of the Nova Scotia Department of Communities, Culture, Tourism, and Heritage. Halifax, NS.

JWEL. 2006. *Archaeological Impact Assessment of a Proposed Natural Gas Pipeline from Bear Head, Richmond County to Goldbro, Guysborough County, Heritage Research Permit A2005NS93*, report written by Laird Niven archaeologist with JWEL. Report on file at the Special Places division of the Nova Scotia Department of Communities, Culture, Tourism, and Heritage. Halifax, NS.

KMKNO-ARD (Kwilmu'kw Maw-klusuaqn Negotiation Office's - Archaeology Research Division). 2024. Response to request for information for traditional or historic Mi'kmaq land use via dated, June 24, 2024.

Kyte, Jonathan R. 2024. *Maritime Archaeological Survey of Holland Cove Site (BcCw-13) Phase 2*, report submitted to the Nova Scotia Department of Communities, Culture, Tourism and Heritage for work caried out under Heritage Research Permit A2023NS112. Report on file at the Special Places division of the Nova Scotia Department of Communities, Culture, Tourism, and Heritage. Halifax, NS.

MBBA (Maritimes Breeding Bird Atlas). 2024. Available online at Maritimes Breeding Bird Atlas–- Atlas des oiseaux nicheurs des Maritimes (https://www.mba-aom.ca/). Accessed October 16, 2024.

Meco 2023. Water Transfer Reinstatement Application. Landrie Lake Water Utility, Point Tupper, NS. For Regulatory Review. February 27, 2023.

MGS (Membertou Geomatics Solutions). 2025. Little River Pumping Station and Transmission System Project Richmond Co., NS, MEKS. Final Report. May 2025.

Municipality of the County of Richmond. 2019. Noise By-Law #65 (Noise Control By-Law). Available online at: https://www.richmondcounty.ca/municipal-by-laws/1427-by-law-65-noise-1/file.html#:~:text=No%20person%20shall%20engage%20in,to%20which%20this%20bylaw%20applies

Nash, R.J. and V.P. Miller. 1987. Model Building and the Case of the Micmac Economy. *Man in the Northeast*, 34: 41-56.

NSCCTH (Nova Scotia Communities, Culture, Tourism, and Heritage). 2014. Archaeological Resource Impact Assessment (Category C) Guidelines. Available online: https://cch.novascotia.ca/sites/default/files/inline/documents/archaeologicalresourceimpactassessmentc.pdf

NSDNR (Nova Scotia Department of Natural Resources). 1786-1946. Crown Records Sheet #111: Crown Records Book R, Page 120, Crown Record #5010, Crown Record #1565, Crown Record #5173, Crown Record #7578, and Crown Record #15125.

NSDNR.1940-1969. Aerial photographs; 1940 (6810), 1953 (13718-13), and 1969 (30204).

NSDNR. 2006a. *Geological Map of the Province of Nova Scotia, Scale 1:50,000.* Accessed at: https://novascotia.ca/natr/meb/download/dp043.asp

NSDNR. 2006b. *Surficial Geology Map of the Province of Nova Scotia, Scale 1:50,000.* Accessed at: https://novascotia.ca/natr/meb/download/dp036.asp

NSDNR. 2017. *Ecological Land Classification of Nova Scotia.*

NSDNR. 2018. At-Risk Lichens–Special Management Practices. May 23, 2018. Available from: https://novascotia.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_BFL_At-Risk-Lichens.pdf#:~:text=The%20purpose%20of%20this%20Special%20Management%20Practice%20%28SMP%29,provides%20procedures%20to%20be%20followed%20on%20Crown%20lands.

NSDNRR (Nova Scotia Department of Natural Resources and Renewables). 2021. Nova Scotia Wildlife Statistics. Available online at: https://novascotia.ca/natr/forestprotection/stats.asp

NSE (Nova Scotia Environment). 2011. Guide to Considering Climate Change in Project Development in Nova Scotia. Available online: https://www.novascotia.ca/nse/ea/docs/Development.Climate.Change.Guide.pdf

NSE. 2015. Nova Scotia Watercourse Alterations Standard. Available Online: https://www.novascotia.ca/nse/watercourse-alteration/docs/Watercourse-Alterations-Standard.pdf

NSE. 2016. Guide to Surface Water Withdrawals in Nova Scotia. Available Online: https://novascotia.ca/nse/water/docs/guideToSurfaceWaterWithdrawalApprovals.pdf

NSECC (Nova Scotia Environment and Climate Change). 2021a. Guidelines for Monitoring Public Drinking Water Supplies

NSECC. 2021b. 1:10000 Nova Scotia Primary Watersheds. Available online at: https://data.novascotia.ca/Environment-and-Energy/1-10-000-Nova-Scotia-Primary-Watersheds/569x-2wnq/about_data

NSECC. 2021c. 1:10000 Nova Scotia Secondary Watersheds. Available online at: https://data.novascotia.ca/Environment-and-Energy/1-10-000-Nova-Scotia-Secondary-Watersheds/ynkv-x6rx/about_data

NSECC. 2022a. Proposed Ambient Air Quality Standards. 12 pp.

NSECC. 2022b. Our Climate, Our Future Nova Scotia's Climate Change Plan for Clean Growth.

NSECC. 2023. Guidelines for Environmental Noise Measurement and Assessment. Available online at: https://novascotia.ca/nse/air/docs/guidelines-environmental-noise-measurement-and-assessment.pdf

NSECC. 2024. Nova Scotia Air Zone Report 2022. Available online at: https://novascotia.ca/nse/air/docs/nova-scotia-air-zone-report-2022.pdf

NSECC. 2025. A Proponent's Guide to Environmental Assessment. Available online at: https://novascotia.ca/nse/ea/docs/environmental-assessment-proponent-guide-en.pdf

NSMNH (Nova Scotia Museum of Natural History). 2013. *Natural History of Nova Scotia*. Available online at: https://ojs.library.dal.ca/nsm/issue/view/349

Prairie Climate Centre. 2019. The Municipality of Port Hawkesbury. Available online at: file:///C:/Users/cmacfarlane/Downloads/Municipality%20Port%20Hawkesbury_v2.pdf

Province of Nova Scotia. 2009. Protected Water Areas of Nova Scotia. Accessed at: https://novascotia.ca/nse/water/docs/protected.water.areas.map.pdf

Public Archives of Nova Scotia. 1967. *Place-names and Places of Nova Scotia*. Halifax: Nova Scotia: PANS.

Rast, N., Burke, K.B.S., and Rast, D.E. 1979. The Earthquakes of Atlantic Canada and Their relationship to Structure. Journal of the Geological Association of Canada. 6(4), 173— 180.

SNC Lavalin. 2015. Noise Assessment Study. LNG International Pty Ltd. Bear Head Island Road, Richmond County, Nova Scotia

Stantec Consulting Ltd. 2023. Bear Head Energy Green Hydrogen and Ammonia Production, Storage and Loading Facility. Environmental Assessment Registration. Available at: https://novascotia.ca/nse/ea/bear-head-energy/

Straight Engineering Ltd. 2024. Landrie Lake Bathymetry

Town of Port Hawkesbury. 2002. By-Law N-1 (Noise Control By-Law). Available online at: https://townofporthawkesbury.ca/wp-content/uploads/2023/11/Noise-Control-by-law.pdf

Washburn & Gillis Associates Ltd. 1999. *Sable Offshore Energy Project Natural Gas Liquids Pipeline Archaeological Assessment 1996, 1997, 1998, 1999 Final Report*, report on file at the Special Places division of the Nova Scotia Department of Communities, Culture, Tourism, and Heritage. Halifax, NS.

Whitehead, R.H. 1991. The Protohistoric Period in the Maritime Provinces. In *Prehistoric Archaeology in the Maritime Provinces: Past and Present Research, Reports in Archaeology 8*. Edited by M. Deal and S. Blair, pp. 1-36. Fredericton: Council of Maritime Premiers Committee on Archaeological Cooperation.

Zalewski, M., Thorpe, J.E. and Naiman, R.J. 2001. Fish and riparian ecotones- A hypothesis. International Journal of Ecohydrology & Hydrobiology, 1(1), pp.11-24.