Toqlukuti'k Wind and Hydrogen Project

Environmental Assessment Registration Document

Prepared for: Toqlukuti'k Wind and Hydrogen Ltd.

strum CONSULTING

24 July 2025

EXECUTIVE SUMMARY

Toqlukuti'k Wind and Hydrogen Ltd (TQK) is proposing the development of a large-scale onshore wind farm to generate green electricity, water electrolysis facilities to produce green hydrogen, and Haber-Bosch production facilities to produce green ammonia, located in the Isthmus of Avalon region of NL. Ammonia will be transported to ammonia storage sites via pipelines, with storage facilities located near potential marine terminals and respective operator for transshipment to vessels. This development is designed to facilitate the production and transportation of green ammonia for international markets, with an option to supply green hydrogen for local off take. TQK is currently in the design stage and detailed engineering and the siting of facilities will be refined as the design process progresses.

TQK is a joint venture between Copenhagen Infrastructure Partners (CIP) and ABO Energy Canada Ltd. CIP, through its Energy Transition Fund (CI ETF I), acquired a majority stake in TQK in December 2024 from ABO Energy, who will stay actively engaged in the TQK Project as minority shareholder and co-developer.

The Project will consist of:

- Onshore wind turbines located within the wind reserve lands with a capacity between 2,500 MW and 3,200 MW
- Industrial facilities with an installed electrolyzer capacity between 2,000 and 2,5000 MW
- Ammonia production capacity between 4,400 and 5,550 tonnes per day
- Water supply intakes, pumping facilities, and transportation pipelines
- Ammonia storage and associated transport pipelines
- Associated electrical and logistics infrastructure, including access roads, medium and high voltage transmission lines, substations, and backup power generation.

Purpose of Environmental Assessment Registration Document

The Project is required to be registered with NLECC and evaluated through the provincial EA process pursuant with the NL EPA (2002) and its associated EA Regulations (2003). Part 34 of the EA Regulations indicates an EA requirement for Projects involved in electrical power generation greater than 1 MW. Additional triggers that require a project to be registered include the development of greater than 10 km cumulative of trails or roads, development within 200 m of a scheduled salmon river, or if greater than 50 ha of clearing is to occur. Registration is completed through the submission of a formal Environmental Assessment Registration (EAR) document.

TQK acknowledges that given the scale of the Project and the wide-ranging interactions that the Project will have with the biophysical and socioeconomic environment, it is anticipated that the NL government may require the proponent for this Project to complete an Environmental Preview Report or Environmental Impact Statement through the EA process.

Valued Components

The following VCs were identified based on the experience of the Project team and through engagement with Indigenous groups, local communities, regulators, stakeholders, and the public. A preliminary interactions assessment is present within the EA Registration for the VCs based on existing field studies and current Project data availability.

- Atmosphere
- Climate Change
- Geology and Hydrogeology
- Waterbodies and Watercourses
- Fish and Fish Habitat
- Vegetation and Habitat
- Wetlands
- Mammals
- Bats
- Avifauna
- Land and Resource Use
- Heritage and Cultural Resources
- Communities
- Economy, Employment, and Business

Next Steps: TQK's Engagement and Assessment Plans

Preliminary desktop surveys have been conducted across the entire Project Area, and preliminary field studies have been conducted within TQK Central and TQK South. Future baseline studies will occur alongside detailed project engineering to further understand the potential for Project interactions and define potential mitigations where effects cannot be avoided. A Project layout will be developed taking into consideration the constraints outlined within this document and informed by existing and future studies.

TQK is committed to open, honest, and ongoing communication with communities, Indigenous groups, government officials, organizations, and residents. Engaging stakeholders early in the planning process fosters trust and provides ample opportunity for meaningful feedback. It also helps to ensure broad understanding of the Project's scope, underlying technology, and both local and global implications.

TQK believes early and genuine engagement leads to better outcomes for everyone. TQK began its consultation and engagement process in late 2021, during the early stages of exploring wind-to-hydrogen opportunities as part of a broader entry into an emerging market. Engagement with Indigenous groups, stakeholders, and the public will continue throughout the entire lifecycle of the Project.

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ACRONYMS LIST

˚C	Celsius
ABO	ABO Energy Canada Ltd.
ACAC	Arnold's Cove Area Chamber of Commerce
ACCDC	Atlantic Canada Conservation Data Centre
ACOA	Atlantic Canada Opportunities Agency
ACSS	Atlantic Canada Shorebird Survey
AHJ	Authority Having Jurisdiction
ARU	Autonomous recording unit
ASU	Air Separation Unit
ATV	All-terrain vehicle
BAF	Bull Arm Fabrication
BAFS	Bull Arm Fabrication Site
BESS	Battery and energy storage systems
BOD	Board of Directors
CAAQS	Canadian Ambient Air Quality Standards
CACC	Clarenville Area Chamber of Commerce
CanREA	Canadian Renewable Energy Association
CCG	Canadian Coast Guard
CCME	Canadian Council of Ministers of the Environment
CCOHS	Canadian Centre for Occupational Health and Safety
CEA	Cumulative effects assessment
CEO	Chief Executive Officer
CEPA	Canadian Environmental Protection Act
CHFCA	Canadian Hydrogen and Fuel Cell Association
CI ETF I	Copenhagen Infrastructure Energy Transition Fund I
CIP	Copenhagen Infrastructure Partners
CLRA NL	Construction Labour Relations Association of Newfoundland and Labrador
CNA	College of the North Atlantic
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSS	Central substation
cVCE	Confined vapour cloud explosion
CWA	Canadian Wildlife Act
CWIM	Canadian Wetland Inventory Map

CWS	Canadian Wildlife Service
dBA	Decibels
DEI	Diversity, equity, and inclusion
DEM	Digital Elevation Model
DFO	Fisheries and Oceans Canada
DWT	Dead weight tonnes
EA	Environmental Assessment
EAR	Environmental Assessment Registration
ECCC	Environment and Climate Change Canada
EDI	Electrodeionization unit
EIS	Environmental Impact Study
ELC	Ecological land classification
EMI	Electromagnetic interference
EOI	Expression of interest
EPA	Environmental Protection Act
EPC	Engineering, procurement, and construction
EPP	Environmental Protection Plan
EPR	Environmental Preview Report
ERT	Emergency Response Team
ESA	Endangered Species Act
ETC	Electricity Transformation Canada
FAQ	Frequently asked questions
FFAW-Unifor	Fish, Food and Allied Workers Union
FID	Final Investment Decision
FRI	Forest Resource Inventory
FWAL	Freshwater aquatic life
GCDWQ	Guidelines for Canadian Drinking Water Quality
GHGs	Greenhouse gases
GIS	Geographic Information Systems
GPS	Global Positioning System
GW	Gigawatts
H_2	Green hydrogen
ha	Hectares
HADD	Harmful alteration, disruption or destruction
HNL	Hospitality Newfoundland and Labrador
HSE	Health, safety, and environment
HV	High voltage

IAA	Impact Assessment Act
IAAC	Impact Assessment Agency of Canada
IBA	Important Bird Area
IMTT	Intel-Matex Tank Terminals
ITC	Canadian Clean Hydrogen Investment Tax Credit
km	Kilometers
kt	Kilotonne
kV	Kilovolt
LAA	Local Assessment Area
LCOA	Levelized Cost of Ammonia
LCOH	Levelized Cost of Hydrogen
LCOH/LCOA	Levelized Cost of Hydrogen/Ammonia
LiDAR	Light Detection and Ranging
LPG	Liquefied petroleum gas
LSD	Local Service District
MASW	Multichannel Analysis of Surface Waves
MBCA	Migratory Birds Convention Act
MET	Meteorological tower
MFN	Miawpukek First Nation
MGGA	Management of Greenhouse Gas Act, SNL 2016, c M-1.001gcd
MHA	Member of the House of Assembly
MOU	Memorandum of Understanding
MOU	Memorandum of Understanding
MUN	Memorial University of Newfoundland
MV	Medium Voltage
MW	Megawatt
N_2	Nitrogen
NAFO	North Atlantic Fisheries Organization
NARL	North Atlantic Refining Ltd.
NB	New Brunswick
NDA	Non-disclosure agreement
NH_3	Green ammonia
NL	Newfoundland and Labrador
NL APCR	Newfoundland and Labrador Air Pollution Control Regulations
NLBBA	Newfoundland Breeding Bird Atlas
NLECC	Newfoundland and Labrador Environment and Climate Change
NLFFA	Newfoundland and Labrador Fisheries, Forestry, and Agriculture

NLIET	Newfoundland and Labrador Industry, Energy, and Technology
NLOA	Newfoundland and Labrador Outfitters Association
NLWRMD	Newfoundland & Labrador Water Resource Management Division
NS	Nova Scotia
O_2	Oxygen
OEEMP	Outfitter Environmental Effects Monitoring Plan
OEM	Original Equipment Manufacturer
OUIO	Owner Used Inspection Organization
p-AEL	Pressurized alkaline electrolyzers
PAO	Provincial Archeology Office
PC	Point count
PEM	Proton Exchange Membrane Electrolysis
PM	Particulate matter
PPWSA	Public Protected Water Supply Area
PRISM	Program for Regional and International Shorebird Monitoring
PtX	Power-to-X
PV	Photovoltaic
QA/QC	Quality Assurance / Quality Control
QENR	Qalipu Environment and Natural Resources
QFN	Qalipu First Nation
QRA	Quantitative Risk Assessment
RAA	Regional Assessment Area
RCMP	Royal Canadian Mounted Police
RED	Renewable Energy Directive
RFNBO	European Renewable Fuel of Non-Biological Origin
RFO	Ready for occupancy
RFP	Request for Proposals
ROW	Right of Way(s)
RSA	Rotor swept area
S-Rank	Subnational rank
SA	Service air
SAR	Species at risk
SARA	Species at Risk Act
SMR	Steam methane reformers
SOCC	Species of Conservation Concern
SPMT	Self-propelled modular transporter
SPV	Special purpose vehicle

SSAC	Species Status Advisory Committee
sur	Central substation
TCAR	Newfoundland & Labrador Tourism, Culture, Arts, Recreation
TDS	Total dissolved solids
TOR	Terms of reference
TQK	Toqlukti'ik Wind and Hydrogen Ltd.
TRL	Technology Readiness Level
TSP	Total suspended particulate
TSS	Total suspended solids
U.S.	United States of America
UTM	Universal Transverse Mercator
uVCE	Unconfined vapour cloud explosion
VC	Valued components
VCM	Vegetative community model
Vol-%	Volume percent
WARL	Wind Application Recommendation Letter
WER	Wilderness and Ecological Reserves Act
WHMIS	Workplace Hazardous Material Information System
WISE	Women in Science and Engineering
WLA	Wildlife Act
WTG	Wind turbine generator

1.0 INTRODUCTION

Toqlukuti'k Wind and Hydrogen Ltd. ("TQK") is proposing the Toqlukuti'k Wind & Hydrogen Project (the "Project") along the Isthmus of Avalon in Newfoundland and Labrador (NL). The Project will encompass the development, construction, operation, decommissioning, and reclamation of wind farms and industrial facilities for green hydrogen (H_2) and green ammonia (NH_3) production, including air separation, water treatment, and ammonia storage systems.

The Project is required to be registered with the Newfoundland and Labrador Department of Environment and Climate Change (NLECC) pursuant to the Newfoundland and Labrador *Environmental Protection Act* (S.N.L. 2002, c.14.2) (EPA) and its associated Environmental Assessment (EA) Regulations (2003). Part 34 of the EA Regulations (2003) indicates a requirement for electrical power generation greater than 1 megawatt (MW) to be registered for EA.

1.1 Proponent Information

TQK is a joint venture between Copenhagen Infrastructure Partners (CIP) and ABO Energy Canada Ltd. CIP, through its Energy Transition Fund (CI ETF I), acquired a majority stake in TQK in December 2024 from ABO Energy Canada Ltd. CIP will act as the project's equity sponsor and strategic partner, providing financing, oversight, and commercial direction. ABO Energy Canada Ltd. will remain the designated lead for regulatory affairs, stakeholder engagement, and project execution through the development and permitting phases

CIP is a leading global investor specializing in greenfield renewable energy projects, focusing on offshore and onshore wind, solar photovoltaic (PV), and energy-from-waste, among others. Founded in 2012 and headquartered in Copenhagen, Denmark, CIP has expanded globally with offices around the world. CIP has a strong track record in developing and managing large-scale renewable energy projects worldwide. Notably, they are pioneering offshore wind development in the U.S. with Vineyard Wind 1, the country's first commercial-scale offshore wind project. In Canada, CIP and ABO Energy have demonstrated a strong and effective partnership through the co-development of the Buffalo Plains Wind Project in Alberta – one of the largest wind energy projects in the country. As of December 2024, CIP has acquired a majority stake in the Project. CIP's involvement with the Project aligns with its commitment to advancing sustainable energy solutions and supporting Canada's transition to a carbon-neutral future.

ABO Energy Canada's parent company, ABO Energy GmbH & Co. KGaA (herein collectively referred to as ABO Energy), is a globally successful renewable energy company that was founded in 1996 and is headquartered in Wiesbaden, Germany. With office locations in 14 countries worldwide, ABO Energy has developed and realised over 6.4 gigawatts (GW) of wind, solar, battery, and green hydrogen projects. In addition to development and construction, ABO Energy has long-term operations and maintenance agreements with over 2.5 GW of renewable energy projects across eight countries. Additionally, ABO Energy has built a strong project pipeline with 32 GW Wind, Solar, Battery & Storage Systems, and 20 GW in hydrogen.

ABO Energy became established in Canada in 2017 with the opening of an office in Calgary, Alberta. ABO Energy permitted Canada's largest wind development to date, the 514 MW Buffalo Plains Wind Farm in Alberta. In 2023, an office was established in St. John's, NL, and is a registered business in NL.

TQK retained Strum Consulting to prepare the Project's EA Registration Document. Strum is an independent multi-disciplinary team of consultants with extensive experience undertaking EAs throughout Atlantic Canada, including the successful approval of several wind EAs in Nova Scotia and the first Atlantic Canadian green hydrogen plant at Point Tupper, Nova Scotia.

Contact information for the Proponent and their consultant is included in Table 1.1.

Table 1.1: Proponent and Consultant Contact Information

Proponent Information		
Project Name	Toqlukuti'k Wind and Hydrogen Project	
Proponent Name	Toqlukuti'k Wind and Hydrogen Limited	
Mailing and Street Address	Suite 301, 354 Water Street St. John's, NL A1C 1C4	
Project Directors	Bart Lavis Project Interim Director Toqlukuti'k Wind and Hydrogen Limited. Head of PtX Development, North America [CIP Molecule Technologies] bala@cip-mt.com	Akshay Sharma Sabnis Project Deputy Director Toqlukuti'k Wind and Hydrogen Limited. Head of Strategic Projects & M&A ABO Energy GmbH & KGaA akshay.sabnis@aboenergy.com
Proponent Contact Information for the EA Registration	Darcy Kavanagh Environmental and Regulatory Coordinator ABO Energy Canada Email: darcy.kavanagh@aboenergy.com Phone: 902.329.7442	
Consultant Information		
Name of Consultant	Strum Consulting	
Mailing and Street Address	Strum Consulting #E120 – 120 Torbay Road St. John's, NL A1A 2G8	
EA Contact	Casidhe Dyke Senior Environmental Scientist Environmental Assessment and Approvals Email: cdyke@strum.com Phone: 709.738.8478	

1.2 Overview of the Undertaking

In early 2023, ABO Energy, operating under TQK, participated in the Crown Land Call for Bids for Wind Energy Projects and was one of the four original successful bidders, as announced in August 2023. Following this announcement, TQK was issued a Wind Application Recommendation Letter (WARL), which established an 18-month reserve period and granted TQK exclusive rights to pursue the development of the Wind Reserve Lands area, spanning approximately 107,645 hectares (ha). The Crown land reserve period has since been extended to August 31, 2025, and any further extension is subject to ongoing review by the Department of Industry, Energy, and Technology (NLIET).

With this reserved Crown land, TQK is proposing the Project in the Isthmus of Avalon region of NL. The Project is a composition of a large-scale onshore wind development – and potentially PV systems – to generate green electricity, water electrolysis facilities to produce green hydrogen, and Haber-Bosch production facilities to produce green ammonia. The produced ammonia will be transported to ammonia storage sites via pipelines, with storage facilities located near potential marine terminals and respective operators for transshipment to vessels. The marine terminal construction/upgrade and operations are not a part of this EA registration as all facilities are intended to be owned and operated by a third party. The Project is designed to facilitate the production of green ammonia for international markets, with an option to supply green hydrogen to a local offtake. The Project is currently in the design stage and engineering and siting of facilities will be refined as the Project progresses.

The centralized green hydrogen and green ammonia production facilities (the "Industrial Facilities") will be powered by between 2,500 MW and 3,200 MW of onshore wind located within the Wind Reserve Lands (Table 1.2).

Table 1.2: Proposed Turbine Counts and Capacities

Description	TQK North	TQK Central	TQK South
Turbine count (#)	402	33	80
Installed capacity (MW)*	2,492	204.6	496

*= considering 6.2MW WTG as base case

The electricity produced will be collected through medium voltage lines into substations distributed along the wind farms. From there, it will be transported via high voltage transmission lines [230 to 345 kilovolt (kV)] to the central substation at the Industrial Facilities, where it will be used to produce green hydrogen and convert it to green ammonia.

At the Industrial Facilities, an installed electrolyzer capacity of between 2,000 and 2,500 MW will convert water and electricity to hydrogen which will be fed to a Haber-Bosch plant together with nitrogen (N_2), to produce ammonia. The installed production capacity of the ammonia plant will be within 4,400 and 5,550 tonnes per day.

TQK has applied to NLIET for approval of the updated project configuration and generation capacity described in this EA registration. This includes changes to wind farm layout, introduction of optional photovoltaic components, and a revised project area aligned with current study zones. TQK acknowledges that this proposed configuration remains under NLIET review and that final Crown land approvals will be contingent on the outcomes of this review.

2.0 PROPOSED UNDERTAKING

2.1 Rationale for the Undertaking

TQK has proposed the development of a large-scale Power-to-X (PtX) project, a project that converts renewable energy into various products or "X". The goal of the Project is to support both domestic and international decarbonization objectives through the production of green hydrogen and green ammonia. In this case, the Project will generate renewable electricity primarily sourced from onshore wind turbines with potential supplementary input from PV systems. This electricity will power the centralized electrolysis facility that will convert water into green hydrogen, which will then be combined with nitrogen in a Haber-Bosch synthesis plant to produce green ammonia. The ammonia will be transported to storage tanks, from where a third party will eventually offload it onto marine vessels for international export. In parallel, the Project is designed with flexibility to supply green hydrogen to local or regional consumers, depending on emerging demand.

The need for the Project is driven by both global and domestic imperatives. Canada has committed to achieving net-zero greenhouse gas emissions by 2050, supported by policy instruments such as the Canadian Hydrogen Strategy and the Clean Hydrogen Investment Tax Credit (ITC). NL's vast untapped wind and water resources, combined with large tracts of undeveloped Crown land and relative proximity to Europe, make it an ideal jurisdiction to develop scalable PtX infrastructure. Demand for green fuels, particularly hydrogen and ammonia, is accelerating globally, with Western Europe expressing significant interest in secure, long-term imports of renewable fuels.

Provincially, the importance of renewable energy development is underscored in key policy frameworks, including NL's Renewable Energy Plan and Hydrogen Development Action Plan. These documents outline the Province's commitment to leveraging its natural resource base to support clean energy exports, attract private investment, and drive long-term economic development, particularly in rural regions. The TQK Project aligns directly with these priorities, offering a scalable PtX solution that supports both international fuel demand and provincial economic and environmental objectives.

In early 2022, ABO Energy (then ABO Wind) identified a unique opportunity to develop a wind and green hydrogen project in NL and began engaging with First Nations and local communities. ABO Energy submitted a response to the Request for "Nominating Crown Lands for Wind Energy Projects" in September 2022, which was the formal application to express interest in developing a wind energy project on Crown land. Then, in December 2022, ABO Energy submitted a response to a Request for Proposals (RFP) by Braya Renewable Fuels (Braya) for the provision and potential production of green hydrogen for Braya's facility in Come By Chance. ABO went on to be selected by Braya and earned an exclusive letter of support in early 2023.

In August 2023 the Newfoundland and Labrador Department of Industry, Energy, and Technology (NLIET) announced that TQK was one of four successful companies, selected through the Call for Bids process. This granted TQK the exclusive right to pursue the development of their project.

The Project is expected to produce between 920 and 1,300 kilotonnes of green ammonia per year. As the power used for hydrogen and ammonia production will be primarily sourced from renewables, the resulting carbon dioxide (CO_2) footprint will be very low. As a result, the Project is expected to meet the eligibility criteria for both the European Renewable Fuel of Non-Biological Origin (RFNBO) standard and the top-tier classification under Canada's Clean Hydrogen ITC program. Fossil fuel-based power generation may be required to provide backup power and reduce reliance on battery storage. Any such generation will remain within the maximum allowable CO_2 emissions defined under both the RFNBO and ITC frameworks.

2.2 Regulatory Framework

Projects in NL are evaluated through both federal and provincial EA legislation to determine the applicability of the *Impact Assessment Act* (IAA) and the NL EPA to the proposed project. Additionally, once through the applicable EA processes, projects are required to obtain federal, provincial, and municipal permits prior to the commencement of construction.

The federal (IAA includes The Physical Activities Regulations (2019) known as the "Project List", which define projects and activities subject to the IAA. Certain industries such as mining, nuclear, offshore wind development, and oil and gas are included on the Project List, while land-based wind energy developments, like this proposed Project, are not. Sections 52 and 53 of these regulations include provisions for marine terminals designed to handle ships larger than 25,000 deadweight tonnes. While this Project is anticipated to use vessels exceeding that capacity for the marine transportation of ammonia, ammonia will be shipped through terminals owned and operated by a third party. As such, while a discussion of marine terminals occurs in Section 2.5 and 2.6, any required construction or upgrades to marine terminals are outside the scope of this Project and will be addressed by the terminal owner/operator through a separate EA process.

The Project is required to be registered with NLECC and evaluated through the provincial EA process pursuant with the NL EPA (2002) and its associated EA Regulations (2003). Part 34 of the EA Regulations indicates an EA requirement for Projects involved in electrical power generation greater than 1 MW. Additional triggers that require a project to be registered include the development of greater than 10 km cumulative of trails or roads, development within 200 m of a scheduled salmon river, or if greater than 50 ha of clearing is to occur. Registration is done through the submission of a formal Environmental Assessment Registration (EAR) document.

TQK acknowledges that given the scale of the Project and the wide-ranging interactions that the Project will have with the biophysical and socioeconomic environment, it is anticipated that the NL government may require the proponent for this Project to complete an Environmental Preview Report or Environmental Impact Statement through the EA process.

2.3 Project Areas

2.3.1 Study Area

The Project is located on land parcels in eastern NL. In order to guide the EAR, a Study Area was developed that encompasses the Wind Reserve Lands, Project related infrastructure, and adjacent lands that are ecologically related (Drawing 1, Appendix A). The Study Area is further subdivided into three main sections to better represent Project components and geographic boundaries (Drawing 1):

- TQK North: centred at 48.084155°N, 54.207464°W, west of Clarenville, NL
- TQK Central: centred at 47.7678069°N, 53.9372704°W on the Avalon Isthmus, and encompasses the Municipalities of Sunnyside, Come By Chance, Arnold's Cove, and Southern Harbour.
- TQK South: centred at 47.5933011°N, 53.8430055°W, east of Fair Haven, NL, north of Long Harbour, and includes the Municipality of Chance Cove.

Project components are distributed throughout the Study Area. Component locations, including optionality, are summarized in Table 2.1 and outlined in Section 2.4.

Table 2.1: Project Components Summary Table

Project Component		Study Area Section		
		TQK North	TQK Central	TQK South
Industrial Facilities	Power-to-X Plant	-	X	-
	Ammonia Storage and Desalination	-	X	-
	Water Supply and Pumping Stations	-	X	-
	Pipelines	-	X	-
	Effluent Discharge	-	X	-
	Central Substation	-	X	-
	Back Up Power Generation	-	X	-
	Access Roads	-	X	-
Renewable Energy Sources	Wind Farms	X	X	X
	Wind Farm Substations	X	X	X
	Access Roads	X	X	X
	High Voltage Transmission Lines	X	X	X
	Medium Voltage Collectors	X	X	X
	Photovoltaics	X	X	X
Temporary Facilities	Equipment Storage and Laydown Areas	X	X	X
	Construction Camps	X	X	X
	Batch Plants and Quarries	X	X	X
	Access Roads	X	X	X

2.3.2 Project Area

The proposed area for the PtX facility has been strategically selected for its proximity to Braya and nearby deepwater port infrastructure, enabling efficient access to both domestic offtake opportunities and international export routes.The identification of installation sites suitable for wind turbine placement were developed using a variety of factors including regulatory, guidance-based, and internally defined setbacks from sensitive features, buildings, protected areas, waterbodies, and terrain with steep slopes. Table 2.2 provides a list of setbacks that were considered when selecting wind turbine generator (WTG) locations:

Table 2.2: Summary of Applied Setbacks for WTG Placement, based on NL Land Use Atlas

Setback Category	Applied Setbacks (m)
Federal Lands	200
Crown Titles	100
Primary Roads	600
Municipal Boundaries[1]	100
Federal and Provincial Parks	100
Provincial Natural Areas	100
Provincial Protected Areas	100
Waterbodies[2]	100

Setback Category	Applied Setbacks (m)
Transmission Lines	500
Water Resources Management Areas	150
Protected Public Water Supply Areas	150
Sensitive Wildlife Areas	100
Watercourses	100
Resource Roads	5
Outfitter Buffers[1]	100
Towers	500
Cellular Towers	500
Buildings (Residential)	1000
Buildings (Commercial)	500
Slope over 15%	These features were avoided all together.
Provincial Wetland Data[3]	
Wetlands (Canvec 1:10000 Map Series)[4]	

[1] Only areas with "full surface restrictions" per the Land Use Atlas
[2] Waterbodies: CanVec series, in this case from the 1:50,000 Provincial (NL) version of "Lakes, Rivers and Glaciers in Canada": https://open.canada.ca/data/en/dataset/9d96e8c9-22fe-4ad2-b5e8-94a6991b744b
[3] Provincial Wetland Data: dataset was received upon request from FFA. Not publicly available. Derived from aerial photo interpretation
[4] Wetlands (CanVec 1:1000 Map Series): Derived from the Topographic Data of Canada, CanVec Series "Wooded Areas, Saturated Soils, and Landscape in Canada" used in the national 1:10,000 topographic map series: https://open.canada.ca/data/en/dataset/80aa8ec6-4947-48de-bc9c-7d09d48b4cad

Through optimization of Project infrastructure within the constrained lands, TQK identified 27,329 ha of land (the Project Area) within which it intends to further assess for feasibility to develop the Project. This Project Area includes the infrastructure footprint, necessary laydown and construction areas, as well as associated buffers and additional lands where uncertainty of a final infrastructure footprint exists. The buffers utilized were calculated from the midpoint of the infrastructure, not in addition to infrastructure width (e.g., 600 m x 600 m substations have a buffered area with a radius of 1500 m from the center point, not 1500 m in addition to the 600 m x 600 m polygon). There are also rights of ways (ROW) that would be needed for construction and/or safety reasons included within the Project Area (Drawings 2, 3, and 4).

Table 2.3 outlines the strategy used to establish a Project Area.

Table 2.3: Footprint Strategy to Determine the Project Area

Component	Strategy
Wind Turbines	350 m radius from center point
Access Roads	50 m from the centerline to each side
MV Collector Transmission Lines	50 m from the centerline to each side
HV Transmission Lines	100 m to 120 m from the centerline to each side
Wind Farm Substations	1500 m radius from center point
Pipelines	15 m from the centerline to each side
Pumping Stations	Multiple options presented (no additional buffer)
Construction Camps	Multiple options presented (no additional buffer)
Industrial Facilities	No additional buffer
Central Substation	No additional buffer

This buffer approach was adopted to provide flexibility during early siting and to reflect a worst-case scenario for spatial influence. The buffers are included to enable movement of the components, in order to address findings or input during the EA or further engineering.

As Project planning and detailed design progresses, these buffers will be refined and reduced to reflect the finalized infrastructure footprint. The buffers around the components are not directly connected to the setbacks.

2.4 Project Components

The Project is organized into two primary components: the Industrial Facilities, currently planned for TQK Central, which include the core infrastructure required for the PtX process; and the Renewable Energy Sources, which consist of the major power generation elements and are distributed across TQK North, Central, and South.

2.4.1 Industrial Facilities

2.4.1.1 Power-to-X Plant

The PtX Plant will be composed of several key components and facilities, with the primary systems being the electrolyzers and the ammonia synthesis units. Each component is described in the following sections.

2.4.1.1.1 Security

The PtX Plant will be a restricted area with access for authorized personnel only. Therefore, the perimeter of the plant will be fenced, including a 24/7 monitored security gate.

2.4.1.1.2 Administration

The Industrial Facilities will also include an administrative building to house the day-to-day plant administrative operations. This building will contain offices, meeting rooms, sanitation facilities, and staff amenities such as breakrooms.

2.4.1.1.3 Control Room and Laboratory

All PtX Plant operations will be monitored and operated from the central control room. The laboratory will cater to the majority of the day-to-day quality assurance/quality control (QA/QC) for plant operations.

2.4.1.1.4 PtX Plant Substation

The PtX Plant substation will be designed to step down medium voltage to the appropriate levels required across the Industrial Facilities and will facilitate the distribution of power to the respective feeders within the motor control center.

Additionally, a backup power generator system will be included, equipped with fuel storage sufficient to cover a minimum of 24 hours of operation (or until a resupply can be sourced off-site).

2.4.1.1.5 Water Purification Unit

The water purification design will be heavily dependent on the intake water quality (and type). At this stage, the assumed water source is to be from nearby ponds. Currently, the following water purification steps are foreseen:

- Ultrafiltration
- Reverse osmosis
- Electro deionization (or alternatively deionzation by mixed bed resins)

The final design of the water intake system will be informed by site-specific water quality data, flow rate requirements, and ecological considerations. TQK acknowledges that the design of any end-of-pipe intake structures will be subject to DFO review to prevent impingement and entrainment of fish.

In the case that water resources from identified ponds are insufficient, use of sea water may be considered. A separate site allocation for the initial water purification steps of sea water shall be placed adjacent to ammonia storage on a separate site (Section 2.4.1.2.). The equipment will largely be tanks and/or basins that could be placed outside and multiple modular skids for pumps and filtration units which typically will be placed indoors.

2.4.1.1.6 Electrolyzers

The electrolyzer is one of the main components in the production of green hydrogen and green ammonia. There are several different electrolyzer types available, however in this case the preliminary Project expectation is to select either the pressurized alkaline electrolyzers (p-AEL) type or proton exchange membrane electrolysis (PEM) type.

An electrolyzer unit typically includes:

- Module control
- Final power transformation and rectifying
- Final feed water polish (guard)
- Electrolysis stacks
- Gas/liquid separation, liquid recirculation, and cooling

Footprint requirements for the electrolysis unit vary dependent on vendor selection. Generally, electrical equipment and electrolysis stacks will be located indoors in temperature-controlled rooms/containers. The remaining equipment may be located indoors or outdoors depending on vendor selection and further optimization during Project development.

2.4.1.1.7 Hydrogen Purification and Compression

The Hydrogen Purification and Compression components consist of:

- DeOXO reactor
- Cooling (condensation of water vapor) and knockout
- Drying with a desiccant
- Compressor units for hydrogen storage

The purification equipment should be located as close to the electrolyzer as possible and most commonly would be installed in a building or container solution. The compressors will be installed in a separate building (compressor house) to protect the equipment and minimize noise emissions.

2.4.1.1.8 Hydrogen Storage

Hydrogen storage is required for buffering the hydrogen supply to the ammonia synthesis plant for periods where there are drops in power supply. The current design caters to aboveground pressurized storage vessels arranged horizontally and separated by safety barriers, in open air conditions. Final selection of storage type, size, and pressure range will be subject to optimization in later design stage(s).

The plant layout will incorporate minimum safety distances around the hydrogen storage area. The final safety distances will be assessed in a Quantitative Risk Assessment (QRA) based on recognized software and aligned with industry standards. The QRA will form a key part of the Project's overall Health Safety, and Environment (HSE) permitting process.

2.4.1.1.9 Air Separation Unit

The Air Separation Unit (ASU)is one of the main feed supply units of the ammonia production. The ASU includes:

- Air compressor(s) and filters
- "Cold box" heat exchanger
- Cryogenic distillation tower

The cryogenic distillation tower is typically insulated and located inside an external shell; the height of the tower is typically between 50-55 m.

2.4.1.1.10 Ammonia Synthesis

The ammonia synthesis is one of the main components of the ammonia production. The main equipment for this section includes the reactor unit(s) and compressor units. The majority of the ammonia synthesis components are expected to be placed outdoors. The reactor units are typically 20-30 m tall cylindrical vessels. The compressors will be located in building(s) to protect the equipment and to minimize noise emissions.

2.4.1.1.11 Flare Stacks

The PtX Plant will have a flare for intermittent and on-demand flaring for pressure release during operations and potentially for vapor returns from ship loading operations. Typically flare stacks are 80 m to 120 m in height. Flared gases will consist of hydrogen, nitrogen, and ammonia gas mixtures (i.e., non-soot combustibles). Flare gas mixtures will be ignited using a pilot flame fueled by hydrogen with natural gas/ liquefied petroleum gas (LPG) back-up. An assist gas may also be applied in cases where flaring involves ammonia-containing gasses, ensuring complete combustion. In the unlikely event that the pilot flame fails, the system will be designed to ensure safe dispersion of unignited gasses, minimizing environmental and safety impacts. The final design will be detailed during the EA process.

2.4.1.1.12 Air Cooling

Considering the climatic conditions and water resources, the preliminary project assumption for the cooling system design is air cooling. In certain locations it will be through direct air cooling (DAC), but otherwise the mainstay is expected to be based on closed loop circuit(s) transferring unit duties to a centralized cooling area where air coolers will dissipate the waste heat to the surroundings.

2.4.1.1.13 Plant Utilities

The plant utilities may include the following:

- Instrument and service air units.
- Drinking water storage.
- Chemical storage(s) including but not limited to:
    - Disinfectant/biocide
    - Clarification & flocculation

    - Antiscale & dichlorination
    - Cleaning & pH balancing acids & caustics
    - Ion exchange regeneration chemicals
    - Cooling and steam waters conditioning
    - Electrolyte top ups
- Emergency response materials

All utilities shall be placed indoors to protect them from the elements. The final design will be detailed during the EA process.

2.4.1.1.14 Stormwater/Rainwater Basin(s)

Rainwater and surface runoff within and around the Industrial Facilities will be directed to engineered collection basins or stormwater detention ponds. These will be designed to capture potential contaminants carried by stormwater before it reaches the surrounding environment. The size of the basin(s) will be determined based on site-specific catchment areas and historical peak precipitation data to ensure adequate containment capacity.
Final design of the stormwater management system has not yet been completed. As such, the configuration and specifications of any detention ponds or related infrastructure remain subject to further engineering. The Project will coordinate with the Water Resources Management Division in advance of any construction to ensure compliance with applicable regulatory requirements.

2.4.1.1.15 Workshops

The Industrial Facilities will include workshops for maintenance and fabrication work. These would typically feature a barn-like structure with open spaces and high ceilings including gantry cranes installed for heavy equipment shifting. These buildings will require compressed air [service air (SA)], water supply, and drainage systems with, at minimum, an oil trap and human sanitation facilities.

2.4.1.1.16 Warehouse

A warehouse will be located near the Industrial Facilities to provide storage for:

- Dry goods
- Equipment spares
- Charge spares: catalysts, desiccants, ion exchange polymers, etc.
- Chemical spare inventory

2.4.1.1.17 Staging Area

This is a space designated for handling equipment. It will allow for the safe relocation, rotation (e.g., from vertical to horizontal orientation), and temporary laydown of components prior to installation or transport.

2.4.1.2 Ammonia Storage

Preliminary analysis indicates that three storage tanks, each with a capacity of approximately 45,000 to 60,000 tonnes, will be required. The ammonia will be stored at atmospheric pressure and -33°C. To manage boil-off, compressors will recirculate evaporated ammonia back into the tanks as liquid. Redundant systems will be applied, but in the rare event that both systems fail, excess vaporized ammonia will be safely directed to a flare system.

The ammonia storage will be located on a separate plot of land (not the same as the main PtX Plant), closer to the potential export location. This design will include:

1. Small office and shelter space for staff.
2. Parking lot.
3. Space for atmospheric ammonia storage tanks and refrigeration unit(s). Tanks will have double walls to contain contents in case of leakage/rupture of inner tank. A tertiary dike/berm may also be considered to surround the tank yard.
4. Roads, piperacks, and others:
   a. A major road following along the full circumference inside of the fence, with a road width of 10 m and 5 m shoulders on each side. These specifications will allow for easy access across the whole site for large crane loads, and ensure there is at least a 20 m distance by default between plant components and the outer fence.
   b. Minor roads between units with a road width of 8 m and 4 m shoulders on each side.
   c. Piperacks will typically be designed specifically for the given project in question and thus come in all sizes and shapes.
   d. Electrical connection to the MV system.

Storage tanks will be located as close as practicable to the marine loading area to minimize pipe length and optimize loading efficiency. The final export system design will be based on the continuous circulation of ammonia, if possible.

All best practices for storage and transportation of hydrogen and ammonia will be adhered to, and a QRA will be performed to determine the design of ammonia piping (and other systems) to meet the required safety standards.

2.4.1.3 Water Pumping Stations

Pumping stations will be located adjacent to identified freshwater ponds (to be confirmed following additional studies) which will serve as the water source for the water purification unit.

The pumps will be located inside a small structure with an estimated size of 10 m x 10 m and will be powered by a medium voltage transmission line. Adjacent to each pump station will be a parking lot with an estimated size of 10 m x 10 m. Note that some of the ponds are part of the same watershed, there may not be the need to place a pumping station in each of those ponds.

The final location and number of pumping stations is dependent on environmental studies and water source analyses to be carried out at a later stage. At this point, the layout presents ponds that are candidates to be possible water sources for the Project. The intention is to use only a selection of the presented ponds and avoid the others once additional studies inform which of the ponds are most viable.

Further details will be provided during the EA process. TQK is committed to designing all pumping stations, intake systems, and associated pipelines to minimize adverse environmental effects and will coordinate with DFO and the Water Resources Management Division throughout the EA and permitting process.

2.4.1.4 Pipelines

2.4.1.4.1 Water Pipelines

The water pipelines will connect the PtX Plant with the water sources suitable and required for the Project.

Pipeline routings may include the following components running in parallel:

- Base assumption considers aboveground installation on raised plinths.
- Access road for maintenance and to the pumping stations.
- Medium voltage transmission line to power pumps and control instrumentation at the pumping stations.
- Fiber optic cabling for control and safety systems communications.

The routing of the pipelines is subject to on-site studies and further development of the Project's engineering documents.

If it is determined that one of the identified ponds is not suitable or not required as a water source, the pipeline and pumping station for that pond will not be pursued.

2.4.1.4.2 Ammonia Pipelines

For ammonia pipelines, only those connecting the PtX plant to the selected ammonia storage option will be required. Process safety best practices and other requirements identified in discussions with the appropriate regulatory bodies will be considered in following iterations of the routings. For example, pipelines crossing roads could either be designed aboveground at a sufficient height so that traffic could pass through underneath, or underground provided that the ground conditions allow for it and enough space is available for the crossing.

2.4.1.5 Effluent Discharge

Wastewater generated by the Project will be managed through two separate treatment systems to ensure compliance with all applicable discharge standards.

The sanitary wastewater treatment systems currently being considered is a septic system with field recipient (Section 2.4.1.1). As such the public requirements state the system shall be setback 30 m (100 ft) from any surface waterbodies and shall require a minimum of 30 cm (1 ft) of "natural suitable soil above bedrock or water table".[1]

TQK is reviewing options related to location and receiving environment for both process and sanitary effluent discharge and is committed to coordinating with DFO and the Water Resources Management Division throughout the EA and permitting process. Further details will be included during the EA process following detailed engineering.

2.4.1.6 Central Substation

There will be a high voltage electrical substation, the Central Substation (CSS), close to the PtX Plant with the goal of receiving power from the wind farm substations and distributing power to facility equipment such as electrolyzers and auxiliary services. The CSS will occupy approximately 45 ha within the PtX Plant footprint.

The central substation will have the following main components:

- High voltage switchyard: Including high voltage electrical equipment such as power transformers, circuit breakers, disconnectors, busbars, and high voltage connections.
- High voltage transmission line connection: Dedicated to connecting high voltage overhead powerlines with the central substation.
- Synchronous condensers: To support the system with voltage stability and reactive power needs.
- Medium voltage collector connection: Dedicated to potential incoming medium voltage collectors from wind farms.
- Industrial buildings: Housing control rooms, medium voltage switchgears, and an auxiliary services room.

- Administration building: Dedicated to full time operation and maintenance teams. A septic system compliant with the regulated requirements will be located within this area.
- Parking area.
- Battery and energy storage system: To support energy, grid, and process needs during stress times (e.g., low wind).
- Laydown area: To place materials and spare parts during maintenance.

[1] Source: So You Need A Septic System Jan 2011.pub

2.4.1.7 Back Up Power Generation

It may be advantageous to continue the operation of the ammonia plant in periods with low wind resources. A preliminary estimate shows that 200 MW to 250 MW of power is required to keep the ammonia plant in operation at minimum capacity.

If only parts or no electricity can be supplied by the grid, a back-up power system such as combined cycle gas turbines or diesel generators will be included in order to keep the ammonia plant in minimum operation and to supply power for critical use.

If grid power is available for ammonia plant operations, back-up power will only be required for emergency situations (e.g. grid power outages). In this situation, the capacity of the back-up power system will be smaller, and the duration of usage will be significantly shorter.

2.4.2 Renewable Energy Sources

2.4.2.1 Wind Farms

Wind Turbine Models

The PtX Plant will be powered by wind energy generated from up to 515 WTG located throughout the Study Area as follows:

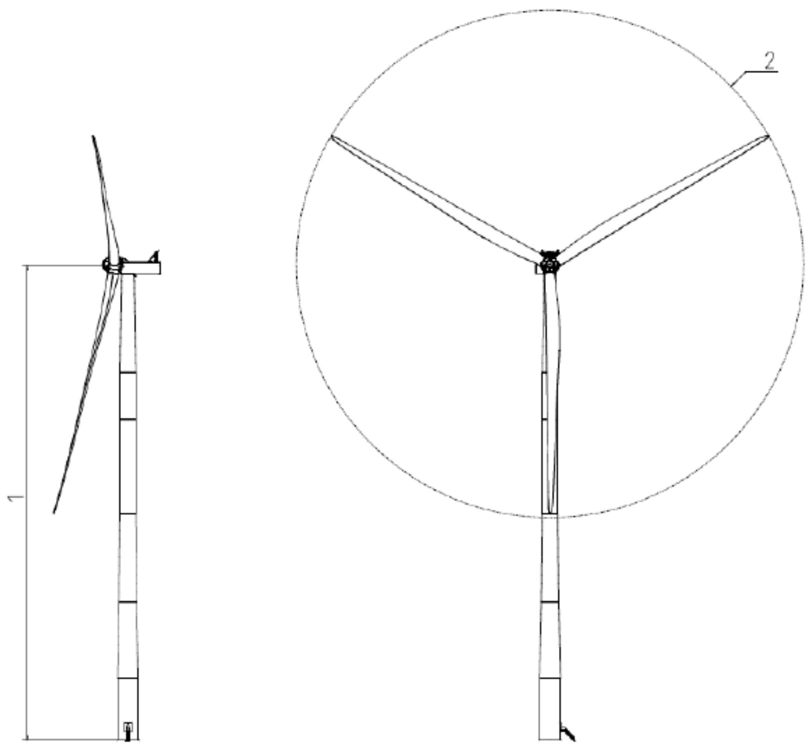
- TQK North: up to 402 WTG
- TQK Central: up to 33 WTG
- TQK South: up to 80 WTG

At this early stage of the Project, no binding decision or commitment has been made regarding WTG selection. This approach allows for flexibility in selecting the optimal solution for the Project's economics, taking into account factors such as climatic and geotechnical conditions, original equipment manufacturer (OEM) capabilities, WTG options, and market availability. Depending on the chosen model, WTGs may also be equipped with cold climate operation modes and anti-icing systems and will be marked/lighted according to NavCanada and Transport Canada requirements.

To date, turbine models from Vestas (V162/V172), Nordex (N163/N175), and Enercon (E175) seem most suitable for the Project. The WTG model that was used for the preliminary designs, layouts, and ongoing assessments was the Vestas V162 with a rated power of 6.2 MW, a hub height of around 119 m, and a blade length of 81 m. At this stage, it is reasonable to assume rotor diameters in the range of 162 m to 182 m, hub heights between 112 m and 138 m (including foundation), and rated powers ranging from 6.2 MW to 8 MW per turbine (Table 2.4, Figure 2.1). TQK is continually assessing potential market developments and evaluating suitable WTG models, including those with rotor diameters exceeding 170 m, while still ensuring they remain compatible with the site at the time of contract signing.

Table 2.4: Potential Turbine Specifications for TQK WTGs

Hub Height	Hub height: 112 -138m
Rotor Diameter	Rotor diameter: 162 - 182m
Blade Length	Blade length: 79 - 91 m
Total Rated Power	Total rated power: 6.2 - 8 MW



1: Hub heights: See Performance Specification 2: Rotor diameter: 162/172 m

Figure 2.1: Diagram and dimensions of potential TQK WTGs

Foundation

The foundation design will depend on the outcome of detailed geotechnical assessments at the exact turbine locations, which will be finalized based on further assessments. Current calculations are assuming gravity foundations with a depth of around 3.2 m and a diameter of up to 27 m. Currently, it is estimated that a combination of three different foundation designs for up to 515 WTG: aboveground gravity foundations, buried gravity foundations, and rock anchor foundations.

Gravity foundations can be mounted on the ground or buried depending on the necessary site preparations. If ground-mounted, the height needs to be added to the WTG tower height. If ground conditions require it, a rock anchor foundation could be used. Steel anchors with a length of up to 13.6 m can be drilled into the rock to ensure stability. Rock anchor foundations require less concrete than gravity foundations (>650 m³) and are potentially the most economical solution.

Other foundation types, such as deep foundations using piles or pre-cast systems, are considered technically viable but are not currently anticipated, based on preliminary assessments of soil and bedrock quality. Detailed foundation designs will be determined as the Project progresses.

2.4.2.2 Wind Farm Substations

Energy produced by the wind farms will be elevated from medium voltage to high voltage at electrical substations so that it can be efficiently transported over long distances via high voltage transmission lines, ultimately reaching the CSS near the PtX Plant. Preliminary studies indicate the need for seven medium to high voltage electrical substations to be associated with the wind farms whose individual dimensions are approximately 600 m x 600 m.

To account for site constraints not fully identified at this early stage of the Project, the buffered area for each substation consists of a radius of 1500 m from the center point of the substation. Leading to an overall estimated footprint of 36 ha each.

Where the buffered area overlaps with WTG locations, high voltage transmission lines, and medium voltage collectors, will be jointly studied to determine the most convenient arrangement.

The seven wind farm substations will be distributed as follows:

- Five wind farm substations in TQK North
- Two wind farm substations in TQK South

Final substation locations and designs will be detailed during the EA.

Each of the seven wind farm substations will include the following main components:

- <u>High voltage transmission line connection</u>: Dedicated to connecting high voltage overhead powerlines with the substation.
- Parking area.
- <u>Administration building</u>: Dedicated to full time operation and maintenance teams. A septic system compliant with the public requirements will be located within this area.
- <u>Industrial buildings</u>: Will house control rooms, medium voltage switchgears, and an auxiliary services room.
- <u>High voltage switchyard</u>: Including high voltage electrical equipment such as power transformers, circuit breakers, disconnectors, busbars, and high voltage.
- <u>Battery and energy storage systems (BESS)</u>: To support the energy and grid needs during stress times (e.g., low winds).
- <u>Medium voltage collector connection</u>: Dedicated to incoming medium voltage collectors from surrounding wind facilities.

- Roads: Internal roads will be constructed within each substation to support access during both construction and operations. These roads will be restricted to authorized personnel and located entirely within the fenced substation area.

2.4.2.3 Access Roads

Preliminary access road design was developed based on the potential use of Vestas V162-6.2 MW WTGs with a hub height of 119 m. As outlined in Section 2.4.2.1, alternative turbine models are under active review given ongoing technological advancements. This may result in adjustments to road design parameters, such as turning radii and transport clearances, during future design stages.

Straight Sections

The minimum drivable road width (road platform with sufficient bearing capacity) will range from 5.0 m to 7.0 m, depending on road gradient and transportation scenarios. An additional ~1.5 m clearance on each side is required for safety and component overhang (Figure 2.2). This results in a minimum total road clearance width of approximately 8.0 m to 10.0 m.

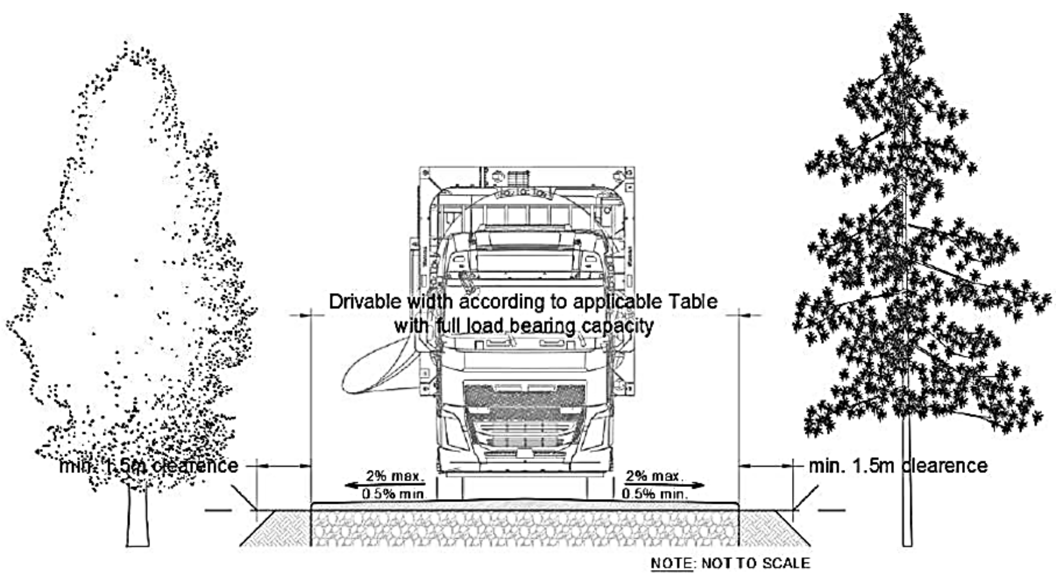


Figure 2.2: Indicative Access Road Width and Cross-Section

Turns

Significantly larger road area is required for turning maneuvers due to the swept path and overhang of large components, particularly blades. Figure 2.3 below provides an indicative example for Vestas V162-6.2 MW blades. Actual swept path values will be determined during detailed design based on the chosen transportation vehicle and specific site conditions.

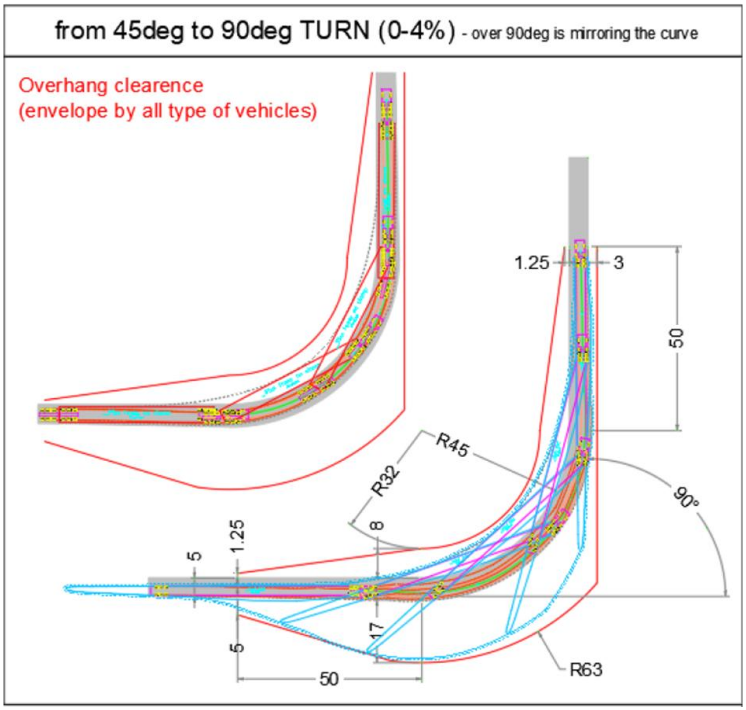


Figure 2.3: Indicative Turning Radius for V162 Turbines

Lay-Bys

To facilitate smooth transport logistics and minimize congestion along extended access roads, lay-bys will be included where necessary. The precise locations and spacing of lay-bys will be finalized in coordination with the turbine supplier and the transport contractor. Each lay-by will be designed to align with the transverse and longitudinal profile of the site access road, including proper transition sections at entry and exit points to ensure safe and efficient vehicle maneuvering.

Roads for Crane Movement

Road corridors will be planned to accommodate internal movements of cranes where possible. In straight sections, the corridor width will reach approximately 15 m to 20 m, ensuring sufficient space for parallel treads and safe maneuverability. Additional widening may be required at curves, intersections, and sections of challenging terrain to facilitate smooth crane operations.

Design Standards and Specifications

Road profiles, cross slopes, and turning radii will be engineered in accordance with the specifications of the chosen turbine manufacturer to ensure safe and efficient transportation.

A transport study will further refine road alignment. Where possible, existing roads such as highways and secondary roads will be used. Where crossings or access from these roads are required, the relevant departments will be engaged to minimize impacts where possible.

To maintain flexibility in design, the current Project Area consists of 50 m on either side of the centerline. This buffered area for the roads should be sufficient to accommodate minor corrections of the routing once detailed engineering is performed. Further details will be included during the EA process following detailed engineering.

2.4.2.4 High voltage transmission lines

High voltage (HV) transmission lines will connect the wind farm substations in TQK North and TQK South to the CSS near the PtX Plant, in TQK Central. The routing of the transmission lines will also enable the Project to have potential access to a point of interconnection with the NL Hydro Island Interconnected System at the existing Sunnyside Substation, the NL Hydro Come by Chance substation, or other similar NL Hydro interconnection points.

The HV overhead transmission line routing (base case of 345 kV) consists of a minimum ROW of 60 m, with compatible vegetation in the border zone, as depicted in Figure 2.4 below.

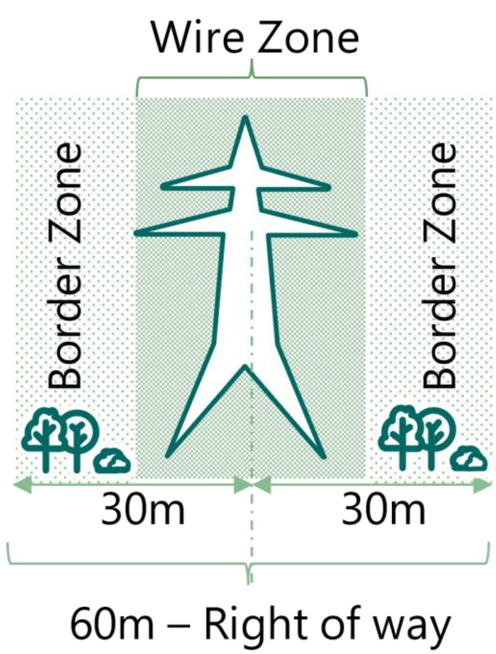


Figure 2.4: Representation of the Minimum ROW for a 345 kV line

The proposed 345 kV structures are steel lattice towers with associated foundations. The depth and design of the foundations will be determined following geotechnical surveys. Each tower will have up to four circuits to provide improved transmission capability in terms of load, electrical losses, and voltage profile. Figure 2.5 shows the preliminary design of the towers.

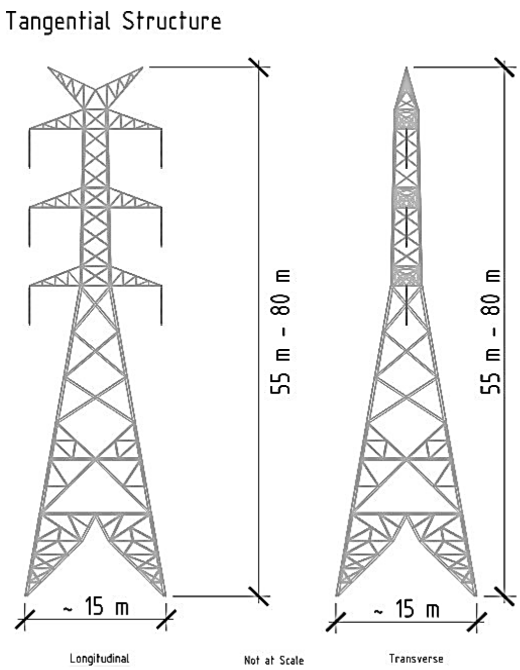


Figure 2.5: Preliminary Design of the Typical 345 kV Tower Structures

The design aims to minimize the number of towers by maximizing the span between towers. For this Project, an average span of 366 m is planned. Most of the proposed structures are tangent towers (i.e., in geometric alignment with the routing). However, the use of retention or angle retention may be required due to angular deviations. Full-tension dead-ends are used at the beginning and end of the routing sections, for example, near substation locations.

The height of the transmission towers will depend on many environmental factors, such as vegetation, topography and existing infrastructure, all of which will need to be further studied during the detailed design of the transmission corridor. Preliminary estimates indicate that the total height of the towers will be between 55 m and 80 m.

The alternative case to the 345 kV overhead powerlines is 230 kV overhead transmission lines which require more space compared to 345 kV lines as more 230 kV lines will be needed to transport the equivalent amount of energy. At this early stage of the Project, the optimal voltage level selection has not been yet defined. Further details will be included during the EA process following detailed engineering.

2.4.2.5 Medium Voltage Collectors

Energy produced by the wind turbines will be transported to high voltage wind farm substations through medium voltage collector systems. Up to a maximum of six WTGs will feed a single medium voltage collector system to then be routed to a wind farm substation which collects from all the systems in the given area.

Each medium voltage collector system requires a corridor at least 10 m wide. However, to optimize land use, multiple medium voltage collector systems were aligned in parallel to the extent possible. Additionally, given the level of limited detail available at this early stage of the Project, the Project Area consists of a 50 m buffer from the centerline of each system, to provide more flexibility in the following design phases.

The routing of the lines will follow access roads and trails to minimize additional environmental disturbance wherever possible. Concrete pads will be used as foundations for wood, aluminum or steel utility poles with a height of 9 m to12 m, depending on topography. Poles will be spaced between 50 m and 70 m apart.

For the medium voltage collection system, the proposed monopole structures are similar to that depicted below in Figure 2.6.

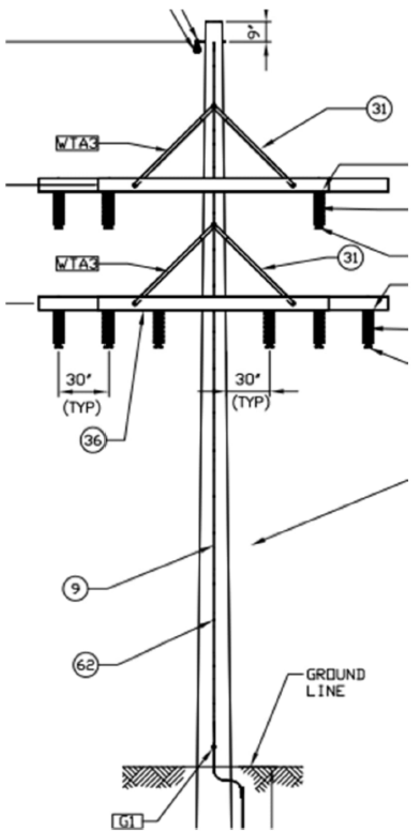


Figure 2.6: Example of MV Collector System Pole Structure

2.4.3 Temporary Facilities

2.4.3.1 Equipment Storage and Laydown Areas

Considering the Project's large capacity, extended construction schedule, and the need for handling, transporting, and distributing large components, multiple storage areas will be required to handle, transport, and distribute large components effectively.

The locations of potential storage areas have been strategically identified considering the following factors:

- Site and Layout Considerations: Potential storage areas were identified based on the wind farm layout, site restrictions, topography, hydrology, surficial geology, on-site material availability, and access road planning. Additionally, dedicated areas will be allocated for quarries within the site to provide necessary aggregate materials for road construction, crane hardstands, storage areas, and other infrastructure components.
- Intermediate Storage: While full laydown areas are planned at each WTG location, intermediate storage hubs are also being considered to address operational efficiency, security, weather protection, and specialized storage needs. An economic and environmental analysis will determine the optimal balance between these two approaches.
- Logistics & Phasing: Sequential and phased work requirements necessitate these storage areas to maintain continuous and timely deliveries of components and equipment. In parallel, areas will also be designated for concrete batching plants, ensuring a reliable supply of concrete for foundations, and other civil works.
- Load Transition Needs: These areas are planned to facilitate the potential transition of loads between transportation units and are designed for highway and off-road requirements as necessary. The integration of quarry operations within the site planning will also minimize external material sourcing, reducing transportation costs and environmental impact.

2.4.3.2 Construction Camps

The construction camp will be designed to accommodate peak workforce numbers exceeding 4000 personnel. The construction camp design incorporates the following:

- Centralized Modular Design: Multi-story, modular accommodation units will allow flexibility to adapt to varying workforce needs through the Project execution phase.
- Facilities and Services: In addition to dormitories, the camp layout incorporates:
    - Administration
    - Maintenance and house keeping
    - Food services
    - Entertainment and recreational areas
    - Utility services
        - Freshwater treatment plant for potable water supply.
        - Effluent treatment system (septic field):

        - The effluent treatment system currently being considered is a septic system with field recipient. As such the regulated requirements state the system will be setback 30 m (100 ft) from any surface waterbodies and have a minimum of 30 cm (1 ft) of "natural suitable soil above bedrock or water table".
    - Power supply: Either a substation or a power generation system including fuel storage to provide power to the camp site operations will also be located in this block.
- Parking facilities.

TQK is currently planning for the establishment of the construction camp in TQK Central, near the planned Industrial Facilities in the Come by Chance area. Potential alternative locations have been identified in Section 2.10.

2.4.3.3 Batch Plants and Quarries

The Project will require multiple quarries. The exact locations and quantities will be determined based on the results from topographical, geotechnical, and hydrological surveys. These details will be finalized in parallel with layout optimization, access road planning, and construction sequencing. Further details relating to quarries will be provided during the EA process. Designated areas will be allocated for concrete batching plants to ensure a consistent supply of concrete for foundations and other civil works. The specific number, type, and locations of these plants will be finalized during the detailed design phase, accounting for factors such as proximity to construction areas, availability of local aggregate sources, topographical suitability, and environmental sensitivity of potential locations. TQK is committed to coordinating with all applicable regulatory bodies throughout the EA and permitting process. Further details relating to concrete batch plants will be provided during the EA process.

2.5 Construction Activities

2.5.1 General Construction Activities

2.5.1.1 Site Preparation

Site preparation activities include:

- Land surveys for placement of components.
- Vegetation removal and grubbing, excavating, grading and compaction for construction.
- Installation of temporary drainage systems.
- Stabilization and dirt preparation.
- Demarcation of boundaries of environmentally sensitive features and applying appropriate buffers.
- Implementation of erosion and sedimentation control measures.

Site vegetation will be cleared using mechanical harvesters and excavators. TQK will seek to work with local commercial operators for the harvesting of merchantable timber, and all other vegetation will be disposed of onsite. Once clearing activities are completed, roots and stumps will be removed and shredded/mulched on site, and topsoil/organic matter will be left in place where appropriate. Sites will be compacted and graded to ensure level surfaces, with stabilization measures employed as required.

The following equipment is typically used during site preparation activities:

- Excavators
- Feller bunchers
- Dump trucks
- Bulldozers
- Rollers
- Graders
- Aggregate crusher
- Light trucks

In instances where the presence of rock limits removal or leveling through mechanical excavation, blasting operations may be required. Blasting services will be supplied through a certified third-party contractor.

2.5.1.2 Equipment Storage and Laydown Areas

Equipment storage and laydown areas will be constructed using similar site principles to those outlined in the Site Preparation section (Section 2.5.1.1). In instances where laydown sites require paving or concrete surfaces to ensure suitable ground bearing strength, appropriate runoff water management will be installed.

2.5.1.3 Access Roads

Access roads will be constructed using a ditch/cut and fill method where in-situ soils will be compacted to form the base of the roadbed following removal of surface material. Where suitable material is available, local aggregates may be sourced directly from within the road alignment, from nearby borrow pits, or from excavations adjacent to the roadway that have been assessed and authorized by the relevant regulatory authorities. All holes or borrow pits will be filled in with grubbing materials following completion. In instances where insufficient material can be located at or adjacent to the limits of the roadway excavation, material will be trucked to site from the closest available quarry. Material excavated from ditches that are not suitable for roadway fill will be deposited in flat waste banks.

Road construction will follow the Construction Standards for Resource Access Roads in Newfoundland and Labrador (NLFFA, 2018). Roads will be established as either primary resource roads or operational roads. Primary resource roads will include any haul roads while operational roads will include those roads used post-construction for the maintenance of infrastructure. Roads will be built to a minimum specification as outlined in the Construction Standards (Table 2.5) with primary roads being built to A, B, or C-2 specifications, and operation roads being built to C, C-1, or D specifications.

Table 2.5: Summary of Resource Road Construction Specification on Crown Land

Road Specification	A	B	C-2, C, C-1	D
Design Load	Tractor Trailer	Tractor Trailer	Tandem (Pallet) Truck	Single Axel (<=3 tonnes)
Design Speed (km/h)	55	50	30	25
Road (Surface) Width (m)	9	7.5	6.0, 5.0, 4.0	3.5-4.5
Max. Grade (%)	6	8	10	15
ROW (m)	30	20-30	20	15-20
Min. Sight Distance (m)	150	120	90	45
Max. Grade Change - Blind Hill (m)	0.6/20	0.8/20	1.0/20	N/A
Min. Ditch Depth (m)	1	0.8	0.6	0.3
Surface Material (Type and Depth)	Min. 15 cm of AASHO class A-1-B or better	Granular, no stones > 10 cm in the top 30 cm	Granular, no stones > 15 cm in the top 30 cm	Granular, no stones > 15 cm in the surface
Fill Slope	2:1	1.5:1	1.5:1	N/A
Cut Slope (Back Slope)	2:1	1.5:1	1.5:1	N/A
Stream Width Culvert to Bridge conversion point (personal judgement) (m)	3.5	3.5	3	2.5

Compaction of unpaved road surfaces will be achieved through traffic use, except in instances where immediate compaction is required to support heavy loads. In these instances, the road will be compacted using rubber tire compactors and will be completed prior to final grading. Currently no paving is anticipated for primary or operational roads.

2.5.1.4 Construction Camps

Construction camps will be constructed using modular camp structures. Modules will be transported to site using flatbed trucks and installed using cranes and other material handling equipment (i.e., telehandlers and forklifts). Modules will be installed on cleared, compact, and level ground. Parking areas will be covered with crushed gravel to improve overall drainage to the site, and steel walkways will be installed between structures for foot traffic.

The camps will include provisions for potable water supply and wastewater management, which may involve temporary connections to local systems where available or the use of self-contained water and septic units. All water and wastewater systems will be designed and operated in accordance with provincial health and environmental regulations. Full installed Construction camps will be in place only for the duration of the construction phase and will be fully or partially decommissioned upon completion, followed by appropriate site remediation and restoration activities.

Construction staff housed at the Construction Camp accommodation will be transported to and from construction sites by bus, with scheduled departures between locations daily. Construction staff and third-party service providers will be encouraged to consolidate transportation of workers to reduce total traffic volumes in the regions generated as a function of Project construction.

2.5.1.5 Logistics and Transportation

To date, TQK has identified the Bull Arm Fabrication Site (BAFS) as the preferred port location for the arrival, discharge and handling of Project equipment. The BAFS provides ample laydown space to stage Project components prior to distribution to the site laydown yards or construction sites. While the BAFS represents the ideal logistical option, no formal agreements are currently in place.

Project Cargo

International commercial vessels will be cleared through an authorized port of entry, and Project cargo will be cleared through customs prior to its discharge at Bull Arm. Project cargo will be discharged using either ships or land-based cranes for all lift-on/lift-off cargo. Larger Project cargo and modules will be discharged from roll-on/roll-off vessels using self-propelled modular transporters (SPMTs).

Vessel Volumes

The Project is anticipating that vessel traffic to support import needs during the development and construction phases will occur primarily between spring and fall, with winter vessel traffic being dependent of ice conditions and availability of ice-class vessels. The majority of vessel arrivals on an annual basis, during construction and for maintenance, will be centered around May through early-September, aligning with natural variations in weather patterns in Newfoundland. Increased variability associated with spring and fall hurricane seasons limit the viable weather-based operational windows before May and after September.

Containerized Cargo

All containerized cargo arriving from international manufacturers will be initially cleared through customs at one of the designated container terminals in Canada, prior to the onward transportation to the Project site. The closest of these sites are Halifax, NS, Saint John, NB, and Montreal, QC. Containerized cargo, after being cleared upon arrival in Canada, will be transported via road, ship or a combination of both, to the Project laydown sites. Depending on the material and timing of arrival, containerized cargo may be transported directly to the Project laydown yards, or to a central marshaling yard at the BAFS for destuffing and onward transportation.

Transportation Routes

Project cargo will be transported on Provincial roadways until reaching the Project access road network. Project cargo will be consolidated where possible to minimize the total number of transport segments on provincial roads during the construction stage of the Project. General road transportation of normal scale Project components will occur throughout the day and night for the construction stage depending on day-to-day requirements of the construction schedule. For Project components that are oversized, transportation timings will be coordinated to minimize disruption to peak travel times of local residents.

Through the course of detailed engineering design and the EA process, TQK will continue to evaluate the port site at BAFS along with other industrial ports in the region to determine the final locations for cargo handling operations. Further details associated with final port selection will be included during the EA process.

2.5.2 Industrial Facilities Construction

2.5.2.1 PtX Plant, Ammonia Storage, and Back Up Power Generation

The PtX Plant, ammonia storage, and Back Up Power Generation will be installed on concrete slabs. Poured concrete pillars will provide additional ground bearing strength as required. Excavations will be backfilled with component soil, and concrete slabs will be poured over the top and leveled for installation of infrastructure components. Concrete and aggregates will be transported to the site from nearby batch plants and quarries with slab pouring operations to occur as needed once commenced for individual slabs.

Lighter infrastructure components, steel products, containerized goods, and equipment will be transported to site using flatbed trucks, with goods originally arriving to their associated laydown areas prior to being dispatched to specific construction locations. Construction equipment will be stored on site for the duration of the construction period to minimize daily mobilization of equipment on public roads. Large modules will be transported to site using SPMTs or other equipment designed to transport oversized and over-dimensioned components. Transport of these large cargo will be scheduled at times of anticipated low traffic volumes. Construction operations are expected to occur day and night with equipment and material delivery volumes greater during daytime hours.

2.5.2.2 Central Substation

Construction of the CSS will be completed with the construction of the PtX Plant. The CSS will occupy approximately 45 ha within the PtX Plant footprint. The area will be cleared and excavated. Construction of the foundation, administration building, industrial buildings, battery storage, and parking area will require laying of concrete and general construction. Electrical infrastructure construction will include construction/installation of the medium voltage collector connection area, high voltage transmission line connection area, high voltage switchyard (including power transformers, circuit breakers, disconnectors, busbars, and high voltage connections), synchronous condensers, and a battery and energy storage system.

2.5.2.3 Pumping Stations and Pipelines

2.5.2.3.1 Pumping Stations

The sites for the pumping stations will be cleared and excavated as needed. Construction of the foundation for the pumps housing and parking area will require laying of concrete and general construction. Electrical infrastructure construction will include construction/installation of the medium voltage supply.

2.5.2.3.2 Water Pipelines

Pipelines will be installed above ground, except where potential infrastructure overlap with the Industrial Facilities, which will require below ground installation. Pipelines will be transported on flatbed trucks and installed using cranes. The pipelines will be supported by concrete foundations and elevated as needed, with increased height at specific locations to safely cross obstacles such as waterbodies.

2.5.2.3.3 Ammonia Pipelines

The ammonia produced at the PtX plant will be continuously transferred to storage via pipeline. The final pipeline configuration will be selected based on safety considerations and informed by a QRA. Technical options under evaluation include above-ground installation, buried pipeline, pipe-in-pipe systems, or a combination thereof.

2.5.3 Wind Farm Construction

2.5.3.1 WTG Construction and Erection Layout

Figure 2.7 shows a typical laydown specification as part of the layout for WTG construction and the necessary dimensions for erection of a WTG (V162 at 119 m hub height). It includes the foundation area (solid red; 28 m x 28 m during construction; foundation diameter = ~25 m), a crane pad (hatched blue; +36 m x 40.5 m), a crane boom assembly area (underlaying blue; 120 m x 7 m), and tower storage and temporary blade laydown areas (dotted blue; 25.5 m x 86 m). Most of these areas are permanent during the operational phase of the WTG, as they are required for maintenance and potential replacement of major components such as blades.

The exact dimensions may change based on the future WTG decision. Typically, OEM specifications are further refined together with the engineering, procurement, and construction (EPC) companies that will install the WTG in the future. Since the orientation of the laydown areas around each WTG is highly dependent on suitable, relatively even terrain, further detailed civil engineering needs to be conducted as a next step to determine the most economical layout. Depending on the topography and necessary earthworks, overburden and other materials will be stored temporarily around the foundation and platforms as required. Slopes (marked in brown) may be created permanently as required to level the area.

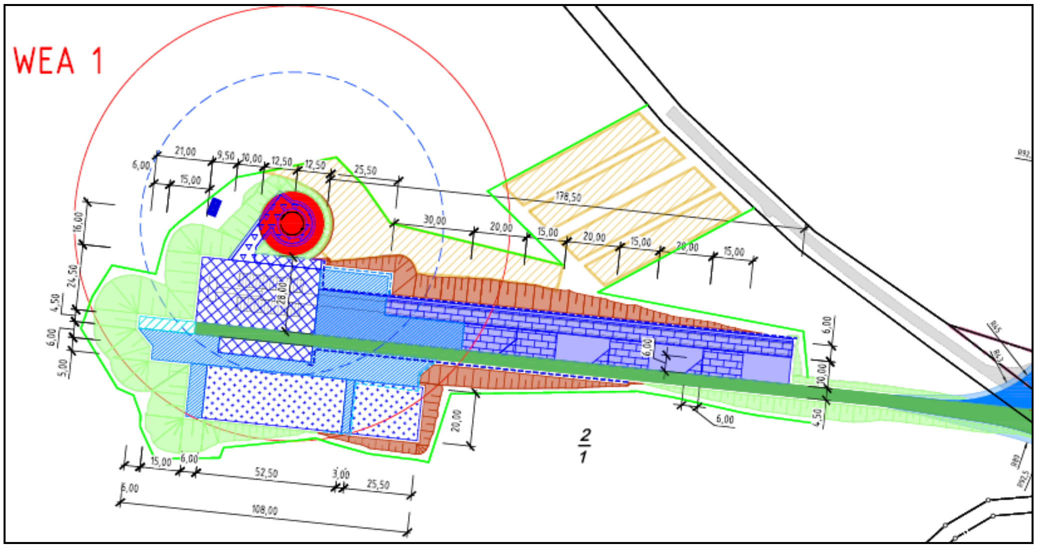


Figure 2.7: Balance of Plant for Wind Turbine Sites

2.5.3.2 WTG site preparation and Turbine Assembly

Site preparation will occur at each WTG location. A list of potential equipment required for both the preparation of WTG foundations and the installation of the WTGs is provided in Table 2.6.

Table 2.6: List of Potential Equipment used for the Installation of Wind Turbine Generators

Equipment	Foundation	WTG Assembly	Use
Excavator	X	-	Digging foundations
Dump Truck	X	-	Delivery/removal of material
Bulldozer	X	-	Removal of overburden
Roller/Compactor	X	-	Grading of cleared land/gravel base
Grader	X	X	Grading of cleared land/gravel base
Crusher	X	X	Crushing stone for gravel
Concrete Truck/Batch plant	X	-	Delivering concrete for tower foundations
Generator	X	X	Power for equipment
Light Tower	X	X	Lighting
Manlift/bucket trucks	-	X	Accessing and working on high structures
Main Crane Unit	-	X	Lifting WTG sections
Assembly Cranes	-	X	Assembling WTG sections

Foundation installation involves the transport and fixing of the foundation in position. Site preparation works, such as geotechnical calculations, boreholes, and laboratory sample testing will be completed prior to the removal of soils and foundation building. WTG foundations will include an envelope of engineered gravel to provide positive drainage away from the foundation. Surface grading will provide positive runoff and avoid ponding of rainfall. Construction activities will seek to reduce the excavation of materials and focus on minimizing the potential environmental impacts such as effects on water resources and vegetation.

The WTG assembly includes tower sections, the nacelle, the hub, and three-blade rotors. The WTG sections will be delivered to the assembly location on flatbed trucks and will require cranes to offload the equipment at each WTG laydown area. The tower sections will be erected (in sequence) on the WTG foundation, followed by the nacelle, hub, and rotors. Rotors are usually attached to the hub on the ground prior to lifting. This assembly will occur with the use of dedicated cranes. Erection will depend on the weather, specifically wind and lighting conditions.

Each WTG will have a buried grounding grid around the perimeter of the foundation, which will be interconnected to the collector neutral wire. The ground wire will be at the base and perimeter of the foundation within the foundation excavation limits and will be connected to the ground conductor in the buried collector system cables. Additionally, it will be connected to the ground wire of the generator tie line.

2.5.4 Electrical Infrastructure Construction

A list of potential equipment required for the Electrical Infrastructure Construction is presented in Table 2.7:

Table 2.7: List of Potential Equipment used for the Installation of Electrical Infrastructure

Equipment	Use
Bulldozer	Removal of overburden
Excavator	Digging trenches and foundations
Hydrovac	Removing excavated material
Dump trucks	Delivery/removal of material
Drill rig/ Auger	Drilling
Concrete batch plant/truck	Delivering concrete for tower foundations
Telescopic crane	Lifting poles and tower sections
Lifts, winches, work platforms	Accessing and working on high structures
Cable reels	Storing and unwinding conductors and cables
Tensioners	Maintaining proper tension
Pullers and take-up reels	Pulling conductors into place
Hydraulic drum lifts	Lifting and handling cable drums
Cable ramps	Unwinding and rolling cables, wires, and other materials

2.5.4.1 Medium Voltage Collector Lines

As the routing of the lines will follow access roads and trails, the additional tree clearing will be minimum. Concrete pads will be used as foundations for wood, aluminum or steel utility poles with a height of 9 m to12 m, depending on topography. Poles will be spaced between 50 m and 70 m apart. Construction of the concrete pad foundations will involve site preparation, excavation of the foundation, setting the pole, and the pouring of concrete. Concrete batch plants will be used to minimize the transport of concrete during construction. Copper or aluminum insulated wires will be pulled from pole to pole at the appropriate tension. Insulators will be attached to the poles, and spacers and vibration dampeners will be installed where necessary. Once transmission line construction is complete, the area between and under the transmission lines will be reclaimed with the original overburden.

2.5.4.2 Wind Farm Substations

In general, once the location for the Wind Farm Substations have been identified and construction starts, site preparation and clearing will occur on the selected locations. Construction of the foundation, administration building, industrial building, battery storage, and parking area will require laying of concrete and general construction. Concrete batch plants will be used to minimize the transport of concrete during construction. The HV switchyard will require installation of electrical equipment, transformers, circuit breakers, insulators, bus bars, and control and protection equipment.

2.5.4.3 High Voltage Transmission Lines

The HV transmission lines will be steel lattice towers with foundations. The depth and design of the foundations will be determined with detailed geotechnical investigations. Towers will be 55 m to 80 m in height with an average span of 366 m. Once the location of the towers has been finalized a 60 m ROW will be cleared. Foundation construction will involve excavation, laying of drainage base, pouring of concrete, and installation of the tower base, using equipment as outlined in Table 2.7. The remainder of the tower will be erected using a telescopic crane. The conductor wire will be pulled between towers, and a tensioner will be used to achieve the appropriate tension on the line, which will then be secured to the tower using insulators and clamps.

2.6 Operations and Maintenance Activities

2.6.1 Industrial Facilities

2.6.1.1 Water Supply

Water is essential for multiple processes at the PtX Plant. The primary demand is as feedstock for the electrolysis process, with additional requirements for steam generation, cooling system make-up water, and general use during construction and within administrative facilities (e.g., sanitation and staff amenities).

Raw water will be sourced from nearby freshwater ponds via a dedicated pipeline network. As an alternative, seawater desalination may be pursued if freshwater sources prove insufficient (see Section 2.10). All raw water will be stored in tanks and treated to meet the stringent purity standards required for the electrolyzers and the Haber-Bosch ammonia synthesis process.

Raw water requirements for the PtX Plant will be between 3.14 million m^3/year and 3.92 million m^3/year corresponding to an average water consumption of 8,800 m^3/day to 11,000 m^3/day. The daily average amount of ultrapure demineralized water generated will be between 4,100 m^3/day and 5,200 m^3/day and there will be between 3,000 m^3/day and 3,800 m^3/day of reject water.

2.6.1.2 Electrolyzers

Ultrapure water will be pumped to the electrolyzers where it will be split into hydrogen and oxygen using an electrochemical process and the installed electrical capacity produced at the wind farms. The electrolyzers will be either p-AEL electrolyzers or PEM electrolyzers or a combination to optimize power usage. Both p-AEL and PEM electrolyzers are at Technology Readiness Level (TRL) 9. The pressure of hydrogen depends on the type and brand of the electrolyzer and will be in the range of 8-30 bar.
In essence the electrolyzer takes ultrapure water and splits it into the base constituents, oxygen (O_2) and hydrogen, through application of electricity.

$$2H_2O \underset{elec}{\longrightarrow} O_2 + 2H_2$$

Typically, the electrolyzers are delivered in modules ranging in size/capacity from 5 to 40 MW depending on type and vendor. Each module will be independently operable (expecting constraints on downstream purification equipment) with a turn down of at least 50%, which in the case of needing +100 modules to cater to the full capacity, means the overall turndown is <5%. The electrolysis system is very flexible and able to follow the variable power profile produced by the generating assets.

2.6.1.3 Hydrogen Purification, Compression, and Storage

The hydrogen leaving the electrolyzers contains minor amounts of oxygen and water. These components are removed in the H_2 purification unit. Deoxygenation, to remove oxygen, is done by catalytic combustion at 100°C to 150°C, where the traces of oxygen react with hydrogen forming water. Water from the electrolyzer and the deoxygenation process is removed in a dehydration unit typically using solid adsorbents. The oxygen leaving the electrolyzers is vented to the atmosphere since the stream does not contain any harmful elements. Variability in power supply due to variation in wind speed can affect the production of H_2.

Hydrogen storage may be in segregated pressurized vessels that will hold 2 hrs to 4 hrs of nominal H_2 production to ensure consistent H_2 flow to the ammonia production plant. The hydrogen produced in excess of the ammonia synthesis requirements will be led to a compression system where it will be pressurized to the determined hydrogen storage specifications.

2.6.1.4 Ammonia Production

To generate ammonia, the hydrogen must be combined with nitrogen. A pure nitrogen stream will be generated in the ASU where nitrogen is separated from the oxygen and other gases. There are multiple methods to do this, which mainly differ in product purity and capacity. However, for the quantities and quality required for the ammonia synthesis, only the cryogenic method is suitable.

The main components of a Cryogenic ASU include a 'cold box' heat exchanger, cooling air down to around -200ºC where it starts condensing to a liquid and can be separated into pure nitrogen and "oxygen rich air" in a distillation column. Passing the liquid back through the heat

exchanger, the nitrogen is re-evaporated to a gas and cooling duty is recycled.
The ammonia is synthesized through the Haber-Bosch process where a stoichiometric ratio of nitrogen and hydrogen gas is mixed, compressed to 130-190 bar and conditioned to +200ºC before entering a catalytic reactor. In the reactor the ammonia synthesis reaction takes place:

$$N_2 + 3H_2 \leftrightarrow 2NH_3 + \text{heat}$$

The reaction is an equilibrium balance meaning the outlet is a mixture of unreacted gases and ~20% ammonia and heat. The gas mixture from the reactor is cooled in a series of steps until the ammonia condenses to liquid and can be separated from unreacted gasses. The liquid ammonia is sent to storage while the unreacted gasses are recycled back for another pass through the reactor unit. The ammonia will be stored in double walled containment tanks at a temperature of -33ºC.

During operations, majority of installed energy production will be used to power the electrolyzers (2,000 to 2,500 MW), the rest of the power used at the PtX plant will be used for the ammonia synthesis units, and associated auxiliary systems. The installed ammonia synthesis capacity will be within 4,400 and 5,550 tons of ammonia per day, with an estimated ammonia production of between 920,000 to 1,300,000 tons per year. Produced ammonia will be sent to storage tanks via pipelines. Pipelines will also transport ammonia to vessels.

All monitoring and maintenance schedules will follow guidelines as recommended by the PtX Plant component manufacturers.

2.6.1.5 Ammonia Storage

The ammonia will be stored at atmospheric pressure and -33°C. To manage boil-off, compressors will recirculate evaporated ammonia back into the tanks as liquid. Redundant systems will be applied, but in the rare event that both systems fail, excess vaporized ammonia will be safely directed to a flare system.

2.6.1.6 Effluent Discharge

Process wastewater will be collected from all industrial operations and piped to the effluent treatment system where it will be appropriately treated and released. All discharge will comply with relevant regulatory requirements and water quality guidelines.

The daily average amount of reject water is expected to be between 3,000 m^3/day and 3,800 m^3/day. The final composition of these streams will be confirmed through laboratory analysis and process modeling during detailed engineering and environmental studies.

TQK is currently evaluating multiple treatment options to ensure all effluent can consistently meet the discharge limits set out in the Environmental Control Water and Sewage Regulations under the Water Resources Act. Preferred treatment methods may include reverse osmosis reject management, pH neutralization, sedimentation, biological treatment (if applicable), and polishing filters, depending on effluent characterization results.

In addition, sanitary wastewater from human use will be managed through septic systems designed to treat effluent to the required environmental standards. Regular water quality monitoring will be done to ensure provincial discharge standards are met.

All aspects of effluent management will be addressed in detail during the EA process.

2.6.1.7 Air Emissions

Preliminary designs indicate that no continuous combustion of hydrocarbons is foreseen during normal operation. Hydrocarbon combustion may be required in the event of back-up power generation. The duration and frequency are yet to be determined but will be minimized to the extent possible (initial analysis indicates a usage of below 100 hours/year). The use of green diesel for backup power is also being considered to further reduce emissions.

During normal operation, an oxygen rich stream (more than 98% O_2) will be vented to the atmosphere from the electrolyzers. With proper dispersion into the atmosphere, oxygen is harmless as it already constitutes approximately 21% of the atmosphere. The O_2 vent stream may contain minor amounts of water vapour and H_2. The content of H_2 will be in the range from 0-1.2 vol-%. The content of H_2 in O_2 is well below the lower explosion limit and the content will continuously be monitored and appropriate actions will be taken if it comes outside the specified range. On this basis, the H_2 on the O_2 vent does not raise any immediate health or safety concerns. H_2 is not in itself considered a greenhouse gas, and H_2 venting/losses are not considered in the Renewable Energy Directive (RED) II or RED III criteria. Some sources suggest that H_2 can contribute to global warming. However, based on conservative estimates, the global warming potential of H_2 is projected to be only 1-5% compared to the global warming caused by CO_2 emission from a Steam Methane Reforming (SMR)-based grey hydrogen generation unit.

Further details associated with Project lifecycle energy consumption scenarios, including backup generation, grid-supplied electricity, and renewable-only operations, will be included in the Project's forthcoming GHG Inventory during the EA process.

2.6.2 Product Transshipment

TQK anticipates that vessels used for the export of ammonia will range in size depending on client arrangements. However, maximum vessel size is not expected to exceed 120,000 summer dead weight tonnes (DWT). International vessels will be required to provide 72 hrs. to 96 hrs. notice prior to arrival. Upon arrival, vessels will report to the Canadian Coast Guard's Marine Communications and Traffic Services division and will enter the bay under the direction of a pilot assigned by the Atlantic Pilotage Authority using the shipping lanes designated within the chosen bay. Should a berth not be available upon arrival, or should the weather not be suitable for vessel berthing operations, vessels will be placed at designated anchoring sites within the bay. In instances where the weather results in the closure of all traffic in the bay, vessels will maintain position outside of the bay until it is reopened.

To ensure compliance with best management practices for biosecurity, and in compliance with Transport Canada regulations, all vessel arriving at the designated facility will follow the Ballast Water Regulations (SOR/2021-120) under the *Canada Shipping Act, SC 2001, c26.*

It is expected that vessels will be loaded from a jetty with 2 berths and 2 loading arms each, so that two ships can be loaded simultaneously. Vessel loading operations are expected to take up to two days with an estimated vessel size of 93,000 m^3 and a loading rate of 2000 tonnes per hour. Loading operations would occur 24/7 immediately following the arrivals and customs clearance of the vessel at the facility, with vessels departing immediately following completion of loading, subject to weather and pilot availability. Based on the anticipated production capacities of the PtX Plant and the predicted size of the ammonia storage facilities, TQK anticipates that it would load approximately 30 vessels per year. During periods with high ammonia production (e.g. high availability of wind resources) an average of three vessels per month will be loaded during that period. With Europe as a primary target export market, many of these vessels would follow the Great Northern Circle Route following their departure from the loading terminal in NL.

As previously stated, the transshipment terminal is intended to be owned and operated by a third party. As such, all operations and maintenance activities associated with the transshipment terminals, including the handling and loading of products to vessels, will be the responsibility of the terminal owners/operators and are not further discussed in this document.

Following each ship loading operation, the ammonia pipeline will be purged of liquid ammonia, ensuring that no liquid remains in the pipeline connecting the storage tank to the vessel.

2.6.3 Wind Farms and Electrical Infrastructure

2.6.3.1 Annual Operations and Maintenance

WTGs will operate at wind speeds between 3 m/s and 25 m/s in temperatures ranging from - 20°C to 45°C. Given the variation in windspeeds across the Study Area, not all WTGs will be in operation at the same time. Ongoing maintenance will be required and is outlined in Table 2.8.

Table 2.8: Maintenance Schedule

Component	Maintenance		
	Type	Frequency	Activities
WTG	Ongoing	Daily-weekly	• Monitor real-time data from sensors to identify potential issues
	Routine	4-6 months	• Inspect key components (blades, nacelle, tower, electrical systems) • Lubricate moving parts (bearings, gears, etc.) • Address any minor damages
	Annual	8-12 months	• Mechanical and electrical checks of systems including gear boxes,

Component	Maintenance		
	Type	**Frequency**	**Activities**
			generators, and control systems • Replace worn or damaged components (bearings, seals, wiring, etc.) • Ensure all bolts are tightened to correct torque specification • Vegetation management
	Cleaning	1-2 years	• Clean nacelles, blades, and other exposed surfaces of debris and pollutants • Inspect for damage caused by debris or environment
Roads	Routine	During use	• Identify potholes and ruts • Identify compaction and erosion • Identify gravel displacement area • Check for blocked ditches or culverts • Check bridge structures
	Annual	6-12 months	• Fill potholes and ruts with fresh gravel • Compact new gravel • Grade if needed • Maintain slope to ensure proper drainage • Clear ditches and culverts • Repair erosion by stabilizing slopes and revegetating disturbed areas • Repair bridge structures as needed • Dust suppression as needed • Snow removal as needed • Vegetation management
Low voltage collector lines	Ongoing	Daily-weekly	• Monitor sensor data and electrical transmission from central substation • Identify irregularities
	Routine	4-6 months	• Inspect lines for sign of damage to wires, connectors, insulators, and other hardware • Ensure all connections are secure • Inspect for dust, corrosion, or signs of excessive sag or tension in lines, and signs of damage from weather

Component	Maintenance		
	Type	Frequency	Activities
	Annual	1-2 years	• Clean connectors and terminals • Lubricate moving parts • Conduct insulation and contact resistance testing • Conduct system performance testing • Vegetation management
Wind farm substations	Ongoing	Daily-weekly	• Monitor real-time sensor data for temperature, humidity, vibration, and electrical current
	Routine	4-6 months	• Inspect visually for wear, corrosion, damage, and debris build up on equipment and connections • Clean and remove contaminants • Check fluid levels • Lubricate moving parts
	Annual	1-2 years	• Check oil and insulation liquid levels, perform turn ratio tests, and ensure proper torque settings for transformers • Inspect circuit breakers for proper operation, damage, and test for performance • Check batteries for electrolyte levels, temperature, and charging • Check switchgear for dirt, debris, and cracks and ensure linkages and operating handles are in good working order • Vegetation management
High voltage transmission lines	Ongoing	Daily-weekly	• Monitor sensor data and electrical transmission from central substation • Identify irregularities
	Routine	4-6 months	• Conduct visual inspections of poles, insulators, conductors and transformers • Use thermal imaging to detect overheating • Analyze transformer oil • Inspect and clean insulator material
	Annual	1-2 years	• Clean insulators • Tighten connectors

Component	Maintenance		
	Type	Frequency	Activities
			• Replace damaged or worn-out insulators, conductors, and hardware • Repaint components as needed • Vegetation management

2.6.3.2 Waste Management

Primary waste streams are anticipated to include turbine blades, lubricants, and mechanical components. The average life expectancy of wind turbine blades is approximately 20 to 25 years, and the replacement of most blades is anticipated to align with the long-term refurbishment or decommissioning timelines associated with the windfarms. While some blades may require replacement or refurbishment prior to these periods, TQK anticipates that these incidental occurrences will be managed directly with the turbine suppliers as part of the global supply chain.

Waste streams associated with general maintenance operations such as lubricant and mechanical or electrical components will be managed within the provinces existing waste management operations, using recognized suppliers. Final handling, management, and destination of these potential waste streams will be managed at the service provider level and align with existing best management practices and regulations within the province.

2.7 Decommissioning and Rehabilitation

The decommissioning and rehabilitation phases of the Project are not expected to begin until after 2058. Drawing from experiences in markets where turbines have already reached the end of their operational lifetimes, a new recycling industry is emerging to manage the dismantling and recycling of turbine components. Currently, state-of-the-art WTGs achieve recycling rates of up to 95% of their total mass and 55% of their rotor. Decommissioning of the PtX facility will include the dismantling and removal of process equipment, tanks, piping, and electrical systems, as well as site remediation to address any residual environmental impacts.

Detailed decommissioning plans, including labor forecasts, will be developed and implemented prior to decommissioning, taking into account the extent of required dismantling, such as foundations, roads, and other infrastructure. Further details regarding the Project's decommissioning and rehabilitation plans will be outlined during the EA process.

2.8 Project Schedule

Table 2.9 outlines the proposed Project Schedule.

Table 2.9: Project Schedule

Project Activity	Timeline
EA Registration	Q3 2025
Environmental Surveys	Q3 2025-Q3 2027
EPR/EIS Submission (if required)	2026-2027
Engineering Design	2024-2028
Land Lease Obtained	2028
Final Notice to Proceed	2029
Construction Period	2029-2034
Commissioning	2032-2034
Operation & Maintenance	2034-2059
Decommissioning	2058-2063

2.9 Permitting

Various approvals are required from the federal, provincial, and/or municipal regulators to construct and operate the Project. Additionally, TQK will evaluate the requirements for any municipal permitting in instances where infrastructure is located within municipal boundaries. Summaries of the potential federal, provincial, and municipal regulatory permits, and approvals that may be required for the Project are provided in Table 2.10, along with the associated regulatory body and a preliminary evaluation of applicability and approach. Table 2.10 does not include all permitting requirements for construction related activities. Additional permitting will be further detailed during the EA process.

Table 2.10: Non Exhaustive List of Potential Governmental Regulatory Requirements

Requirement	Regulatory Body	Status/Comments
Federal		
Notification of Project	Royal Canadian Mounted Police (RCMP)	Will be completed as part of the electromagnetic interference (EMI) consultation
Aeronautical Assessment Form	Transport Canada	To be submitted following detailed design phase as part of Transport Canada aeronautical assessment, including lighting plan
EMI Consultation and Radio Communication Layout Authorization	Various	Notification will be provided to applicable regulatory agencies with the object of receiving letters of non-objection
Fisheries Act, R.S.C., 1985, c. F-14	Fisheries and Oceans Canada (DFO)	If, during the detailed design phase, the Project is determined to have the potential to impact fish or fish habitat, the Proponent will submit a Request for Project Review to DFO

Requirement	Regulatory Body	Status/Comments
Species at Risk Act, S.C. 2002, c. 29 (SARA)	Environment and Climate Change Canada (ECCC), DFO	Compliance legislation – there is no expectation that a SARA permit will be required
Migratory Birds Convention Act (MBCA)	ECCC	Compliance legislation – permits will be applied for should they be required during monitoring programs
Provincial		
Body of Water Alteration Permit	NLECC	Alteration applications, if required, will be submitted to NLECC following EA approval
Water Use Licence	NLECC	Water use licence application will be submitted to NLECC following EA approval, for supply of freshwater to the plants
Certificate of Approval	NLECC	An application for a Certificate of Approval will be submitted to NLECC following EA approval for all stages of the Project
T'Railway Provincial Park Permit Application	NLECC	A T'Railway Provincial Park Permit application, if required, will be submitted to NLECC throughout the Project.
Endangered Species Act (ESA)	NLFFA	Compliance legislation – there is no expectation that an ESA permit will be required
Use of Crown lands	NLFFA	Application submitted. In progress.
Operating Permit	NLFFA	Permits will be applied for throughout the Project with consideration given to all applicable operations during fire season
Permit to Control Nuisance Wildlife	NLFFA	Application for permits will be made on an as-needed basis
Archaeology Research Permit	Provincial Archaeology Office	Application to be filed, if required, following a desktop review of potential Historic and Cultural recourses
Quarry Permit	NLIET	Quarry permit application will be submitted to NLIET following EA approval, for supply of quarry material for construction
Preliminary Application to Develop Land	Government Modernization and Service Delivery NL	A Preliminary Application to Develop Land will be submitted following EA approval, for construction of all accesses to Protected Roads or development within a Protected Road Zone
Wastewater or Water System Approval	Government Modernization and Service Delivery NL	Wastewater and water system permit application will be submitted to Government Modernization and Service Delivery NL following EA approval
Urban and Rural Planning Act, SNL2000, c. U-8	Government Modernization and Service Delivery NL	Permit application will be submitted for development under the Protected Road Zoning Regulations, 996/96 within the building control lines of a protected road

Requirement	Regulatory Body	Status/Comments
Municipal		
Town and Local Services District Act, SNL2023, c T-6.2	Municipalities	Permit applications will be submitted following detailed design and will be updated following EA Approval
Urban and Rural Planning Act, SNL2000, c. U-8	Municipalities	Permit applications will be submitted for any municipality with a planning area in effect following detailed design and will be updated following EA Approval

2.10 Alternatives

2.10.1 Alternatives to the Undertaking

2.10.1.1 Initial Project Concept: Focus on Hydrogen for Domestic Use and Ammonia Export to Domestic Markets

TQK, through the development process, has evaluated several alternatives prior to arriving at the current model of ammonia for export to Western European markets. Initially, the commercial basis for the Project was for the development and supply of green hydrogen to Braya's renewable diesel refinery in Come-by-Chance, NL. Exclusive discussions were held with Braya to provide approximately 55 kilotonnes of hydrogen annually for local use in the refinery. Under that model, any additional hydrogen generated but not required by Braya would be used to produce green ammonia to be sold to international markets.

2.10.1.2 New Project Concept: Focus on Export to International Markets and Optional Hydrogen and Ammonia for Domestic Use

In 2024, the Project was re-envisioned to align investment efforts with market demand, shifting the Project to a single-phase approach with focus on ammonia export. With this, the wind farms were scaled from a previous 5.2 GW down to between 2.5 GW to 3.2 GW, to be generated by a potential of up to 515 wind turbines, respectively (assuming current technology, and a 6.2 MW rated power per turbine). Further, the ammonia facility was scaled to produce up to 1,300 kilotonnes of green ammonia per year, a decrease from the previously forecast 1,670 kilotonnes per year. Under this revised model TQK will continue to explore opportunities for the domestic sale of ammonia and hydrogen, however the primary focus will be production for international export.

2.10.1.3 Supply of Energy to Grid

As part of a review of alternatives, TQK is currently reviewing the feasibility of supplying electricity direct-to-grid to the Newfoundland Interconnected System. As part of this review, TQK is evaluating the potential capacities and seasonal requirements for the Industrial Facilities against the energy production of the Project. TQK will continue to evaluate these values against any potential opportunities for the supply of grid-tied energy. A full exploration of this potential alternative will be outlined during the EA process.

2.10.2 Alternative Methods of Carrying Out the Undertaking

2.10.2.1 Industrial Facilities Location

A comprehensive review of alternative locations for the overall TQK Project was performed resulting in the location presented in the Crown Lands application submitted to NLFFA. The criteria used for the evaluation included the available wind resources, available infrastructure, proximity to local offtake and available export and import infrastructure.

The selection of the industrial facilities location began with a techno-economic analysis to assess whether centralized or decentralized hydrogen production would be more suitable for the TQK Project. This analysis concluded that a centralized production model was preferred. Initial site selection focused on proximity to Braya's Come-by-Chance refinery and was further narrowed through the land nomination process administered by the NLIET.

The choice of locating of the Industrial Facilities in the TQK Central area is based on optimizing the distance to the wind energy production areas and the access to multiple industrial port facilities capable of supporting both the construction and operational phases of the Project.

The final siting of the industrial facilities will be confirmed through detailed engineering and is contingent upon the selected location of the transshipment facility. Site-specific constraints have been reviewed and are further detailed in Section 2.3.

2.10.2.2 Preferred Derivative Selection

While local offtake of green hydrogen is always a preferred option for the TQK Project and continues to be pursued, due to the scale of the development, a major part of the produced hydrogen will be converted into a green derivative for export to international markets.

During early stages of the Project, a techno-economic analysis has been performed to evaluate potential ways of transforming the green hydrogen into green derivatives. This screening of derivatives included synthetic natural gas, e-fuels, e-methanol, methanol-to-gasoline, liquid organic hydrogen carriers (LOHC), hydrogen liquefaction (LH2), and ammonia (NH3).
In a first shortlisting exercise, LOHC, LH2 and NH3 were selected over the CO_2 based derivatives due to the lack of sufficient sustainable source of this molecule.

Further analysis concluded that the most suitable derivative for this Project would be NH3. Handling and production of ammonia is a mature technology, with existing procedures and standards, which can be used for the green ammonia production facility. With respect to CO_2 emissions, both hydrogen and ammonia have the advantage of not containing any carbon atoms. As a result, tracing of feedstocks containing biogenic carbon/CO_2 is not relevant, since combusting/utilizing the green H_2 and green NH_3 does not generate CO_2 into the atmosphere.

2.10.2.3 Electrolyzer Technology Selection

The technology required to produce (green) hydrogen from renewable power is electrolysis of water. The selection of the specific type of electrolyzer will depend on a number of parameters like:

- Product maturity
- Bankability
- Operating and Maintenance cost
- Electrolyzer stack efficiency
- Equipment maintenance/replacement cost
- Safety
- Flexibility with respect to load variations
- Cost
- Lead time

On the basis of the preliminary investigations, it is expected that the electrolyzer type will be either p-AEL or PEM. The maturity level (technology readiness level – TRL) and production facilities for equipment for these types of electrolyzers are considered sufficient to ensure a high degree of certainty when the Final Investment Decision (FID) is made. The final selection will be based on detailed investigation of the renewable wind resources and calculations of Levelized Cost of Hydrogen/Ammonia (LCOH/LCOA)

2.10.2.4 Hydrogen Storage

The electrolyzers will typically be able to cope with the variations from the wind resources, whereas the Haber-Bosch Ammonia Synthesis does have some inertia. While the process can handle relative fast load changes, hydrogen storage will be installed to handle these changes, but also to "bridge" periods with no/low wind and keep the ammonia plant in operation.
The final size and type will be optimized in the coming phases.

The following options are being considered for hydrogen storage:

- Pressurized horizontal vessels
- Pressurized vertical vessels
- Vertical underground pipes
- Spherical vessels

The selection will be based on criteria like:

- Safety
- Cost
- Maturity

2.10.2.5 Ammonia Production

The production of ammonia will use the Haber-Bosch process, where nitrogen and hydrogen are converted into ammonia ($N_2 + 3H_2 \leftrightarrow 2NH_3 + \text{heat}$) at elevated pressure (130-190 bar). It is expected that a Tier 1 licensor/technology provider (Thyssen-Krupp, KBR, or Topsoe) will be selected, but also Tier 2 licensors (Casale, Stamicarbon, Envision, Linde, etc.) will be considered. Again, the selection will be done during detailed engineering and will be based on optimization of the LCOA.

It is expected that N2 will be produced most efficiently in an cryogenic Air Separation Unit where atmospheric air (79% N2, 21% O2, traces of other components) is separated into a Nitrogen stream and an oxygen rich stream by cryogenic distillation.

As renewable wind resources are not constant, dynamic operation (understood as continuously varying load) must be foreseen.

As indicated above (Section 2.10.2.4), it may be advantageous to continue the operation of the ammonia plant in periods with low wind resources.

Apart from the feedstocks, power is also needed for the Haber-Bosch Ammonia synthesis. A preliminary estimate shows that 200 MW to 250 MW power is required to keep the ammonia plant in operation at minimum capacity. Options for the supply of emergency backup power supplied from the NL Island Interconnected System are being explored. Alternatively, back-up power systems like combined cycle gas turbines or diesel generators will be included in order to keep the ammonia plant in operation and to supply power for critical users.

It is expected that ammonia exits the ammonia plant in liquid state and in either of the two formats:

1. Pressurized (10-20 bar), ambient temperature.
2. Atmospheric and -33°C.

In the first case an intermediate storage may be applied at the ammonia plant location having a capacity of 1-12 hours of the nominal ammonia production (230 tons to 2800 tons of liquid ammonia). In the latter case no intermediate storage is foreseen. In both cases the ammonia will be pumped from the PtX Plant to the Ammonia Storage facility as liquid.

2.10.2.6 Ammonia Pipeline and Storage

The configuration of the pipeline will be based on a QRA in order to ensure the required safety precautions. The options to be considered and evaluated may include (but not limited to):

- Above ground pipe
- Buried pipe
- Double pipe ("pipe-in-pipe")

The flow rate will be continuous as long as the ammonia plant is producing.

The ammonia storage facility is based on conventional atmospheric refrigerated double-wall tanks. The tanks will be equipped with Boil-off-Compressors which will handle (recondense) ammonia vapor generated from the ammonia from the process plant, heat gain in the tanks, and during ship loading. The storage facility will be located as close as possible to the jetty, in order to minimize the length of the relatively large (say 20-32 inch, preliminary) ship loading pipes.

The Project is currently evaluating five potential options for the ammonia storage locations. The final ammonia storage location is dependent on a variety of technical and commercial factors. Additional details regarding ammonia storage and offtake will be provided in the EA process.

2.10.2.7 Port Facilities

For the export of ammonia, it is anticipated that the following infrastructure components would be required and would fall under the scope of the third parties EA Registration.

The list provided herein is non-exhaustive and serves as a preliminary overview. Depending on the existing infrastructure some of these units might be located at the Ammonia Storage site.

- Refrigeration
- Loading Arm
- Metering Station
- Control Room and PLC Shelter
- Boil-Off Recovery System
- Emergency Drain & Vent System
- Pumping Station (Transfer and Export Pumps)
- Motor Control Center Shelter
- Electrical Substation
- Maintenance Warehouse
- Telemetry Communication to Storage Terminal

As the marine terminal will be subject to a separate EA process, it will not be discussed further in this EA Registration.

2.10.2.7.1 Ammonia Transshipment Terminal

Currently there are four potential transshipment facilities that TQK is reviewing. TQK understands that each of the below options are intended to be owned and operated by third parties. Any required EA process, approvals, and permitting are the sole responsibility of the respective facility owners. As such, the following options are presented by TQK to inform the operational considerations of the Project only. As part of TQK's internal evaluation, the regulatory compliance of any third party will be a key factor in assessing each location. Since the marine terminal will be registered under a separate EA, it will not be discussed further in this EA Registration.

- North Atlantic Refining Ltd (NARL), Come By Chance, NL: This facility currently houses numerous fuel storage tanks and has a fuel loading jetty designed for the loading and discharge of large tanker vessels. The port is a deep water, ice-free port that operates year-round. The port is also a designated pilotage port under the Atlantic Pilotage Authority and has two tugboats that operate on-site to assist with vessel berthing operations. The port is owned and operated by a third party and as such, any EA processes and permitting associated with the development or upgrade of this terminal would be handled by NARL and would be separate to the Project.
- Intel-Matex Tank Terminals Ltd (IMTT), Whiffen Head, NL: A greenfield site is being evaluated for the establishment of a new transshipment terminal between the existing Whiffen Head Terminal and the NARL Refinery. This terminal will be capable of loading vessels greater than 25,000 dwt. The port will be owned and operated by a third party and as such, any EA processes and permitting associated with the development of this terminal would be handled by IMTT and would be separate to the Project.
- BAFS, Mosquito Cove, NL: The BAFS is a fabrication facility with several berths, including a deep-water site and graving dock. Initially built for the construction of Exxon's Hibernia Offshore platform, the facility has been used over the years to service multiple industrial projects. Ownership of the site is currently under a Request for Proposals process managed by the Government of NL. Following the outcome of this process, TQK will evaluate the potential of working with the resulting owners in relation to the installation of storage and vessel loading infrastructure.
- Southern Harbour, NL: TQK is evaluating the potential development of a greenfield site at the community of Southern Harbour, NL. While this site is not intended to be viewed as a primary location, its potential development is being reviewed as part of the alternatives analysis. Should this site be selected as a primary location or remain within the Project as a potential alternative, a complete review of the required development and potential effects will be provided through the EA process.

2.10.2.7.2 Import Port

As alternatives to the BAFS (Section 2.5.1.6), TQK is also exploring the use of the following ports for imports:

- The Tug berth at the North Atlantic Refining Limited Marine Terminal
- Asphalt Port (north of NARL)
- Port of Argentia
- Southern Harbour

The potential port options will be further refined and evaluated within the EA process and will be detailed as part of the alternative analysis.

2.10.2.8 Grid Interconnection for Backup power

TQK is reviewing the potential for an interconnection to the Provincial utility grid as an alternative to the use of generators as a source of backup power. It is being investigated whether some or all of this can be supplied as firm/non-firm grid power. This alternative is being explored through discussion with NL Hydro to determine its feasibility.

2.10.2.9 High Voltage Transmission Line Between TQK North and TQK Central

TQK is reviewing several potential routings for the high voltage transmission line between TQK North and TQK Central. The corridor between TQK North and TQK Central presented in Drawings 2 and 3 is used in this EA registration document as the base case scenario. However, based on information received through the public engagement process, TQK is reviewing several alternative routes to the east and west of the base case. The alternatives are being evaluated together with NL Hydro and the Towns. Further details regarding the placement of this infrastructure will be determined through the detailed engineering and provided during the EA process.

2.10.2.10 Photovoltaics (Solar Farms)

TQK is currently reviewing the possibility of adding solar PV within the Project Area as a secondary source of renewable energy. It is undetermined at this point whether this option will be pursued further. Furthermore, it is undetermined whether the PV panels would be arranged into a larger scale solar farm or be distributed throughout the site adjacent to other infrastructure. Further details regarding the placement, quantity, electrical infrastructure and anticipated generating capacity of this infrastructure will be provided in the EA process.

2.10.2.11 Desalination Plant

If a desalination plant is used to generate fresh water for operations, seawater will be drawn to the plant through intake pipes located offshore. Screening, filtration, and chemical treatment will be used to remove debris, sand, and other impurities from the seawater before the desalination process begins.

Reverse osmosis or thermal desalination will be used to remove the salt from the water.
For reverse osmosis, high pressure will be used to force seawater through a semi-permeable membrane separating the salts and other impurities from the water.

Thermal desalination heats the seawater until evaporation, under reduced pressure, creating steam. The steam is condensed to produce fresh water.

In both cases the remaining concentrated salt water is discharged back to the ocean or associated receiving environment. The final discharge location will be determined following further technical and environmental studies to ensure compliance with regulatory requirements and to minimize potential impacts. The desalinated water will be stored in tanks and fed to the water purification plant for use in hydrogen and ammonia production.

If this option were to be pursued, the required baseline characterization and supporting information will be prepared and presented accordingly.

2.10.2.12 Construction Camp Location

Three potential construction camp locations have been identified: one in TQK North, one in TQK Central, and one in TQK South. The TQK Central option has been discussed in Section 2.4.3. The alternative construction camp site in TQK North would be located near Black River Pond, and the proposed construction camp in TQK South would be located near Southern Harbour. Further construction camp options may be identified and applied for in the future, both within and outside of the Project Area.

The TQK North and TQK South alternatives are currently planned to have a larger footprint due to the additional lands dedicated for laydown areas. These laydown areas are intended to function as intermediate storage and staging sites to support the construction of the wind farm and the substations in the area.

3.0 PROJECT SCOPE AND ASSESSMENT METHODOLOGY

3.1 Assessment Scope & Approach

EA is a planning tool used to predict the environmental effects of a proposed project, identify measures to mitigate adverse environmental effects, and predict the significance of any effects after the application of mitigation measures.

The EA focuses on Valued Components (VC). VCs are specific components of the biophysical and human environments that, if altered by the Project, may be of concern to regulators, stakeholders, and/or the public.

The scope of the EA Registration for this Project includes:

- Identification of VCs with which the Project may interact with (by activity and phase) within established spatial and temporal boundaries.
- Establishment of the existing conditions for VCs.
- Potential interactions between the Project and the VCs.
- Assessment of the potential effects that could occur from the interaction, if available at the time of EA Registration submission.
- Identification, where possible, mitigation measures to reduce or eliminate impacts based on existing industry best practice.

3.1.1.1 Identification of Valued Components

The following VCs were identified based on the experience of the Project team and through engagement with Indigenous groups, local communities, regulators, stakeholders, and the public. A preliminary interactions assessment is present within the EA Registration for the VCs based on existing field studies and current Project data availability, (Table 3.1).

Table 3.1: Valued Components Identified for Review through the EA Process

VCs	EAR
Atmosphere	X
Climate Change	X
Geology and Hydrogeology	X
Waterbodies and Watercourses	X
Fish and Fish Habitat	X
Vegetation and Habitat	X
Wetlands	X
Mammals	X
Bats	X
Avifauna	X
Land and Resource Use	X
Heritage and Cultural Resources	X
Communities	X
Economy, Employment, and Business	X

3.2 Potential Project-Valued Component Interactions

The potential interactions between the Project and the VCs, by phase, are presented in the EA Registration for individual VC chapters (Section 5.0), following a description of existing conditions. The Study Area and Project Area outlined in Section 2.3 were used to delineate and compare potential interaction of the Project with the greater environment. The summary below of mechanisms described below are not intended to be exhaustive, but rather capture a breadth of possible, anticipated effects for which mitigations can and will be developed, where appropriate.

Potential strategies for mitigation, avoidance, or compensation are proposed within this EA Registration in instances where existing best management practices have been identified within the industry. Mitigation measures are incorporated into Project design to eliminate or reduce potential adverse effects. Detailed mitigation measures and monitoring programs will be solidified and presented during the EA process, as well as the determination of the significance of residual impacts per VC.

3.3 Assessment for Wildlife Species

Special consideration is given to species at risk (SAR) and species of conservation concern (SOCC) within VC chapters. SAR are listed under the federal SARA and provincially under the ESA. SOCC are not listed as SAR, but include species that are:

- Assessed as 'Endangered', 'Threatened', or 'Special Concern' by the Committee on the Status of Endangered Wildlife in Canda (COSEWIC) that are not already listed under SARA.
- Have a subnational rank (S-Rank) of 'S2' or 'S1' or any combination thereof (i.e., S2S3) from the Atlantic Canada Conservation Data Centre (ACCDC).

For SAR, said species and their dwellings are provided protection under SARA and ESA.

4.0 INDIGENOUS AND PUBLIC ENGAGEMENT

TQK is committed to open, honest, and ongoing communication with communities, Indigenous groups, government officials, organizations, and residents. Engaging stakeholders early in the planning process fosters trust and provides ample opportunity for meaningful feedback. It also helps to ensure broad understanding of the Project's scope, underlying technology, and both local and global implications. TQK believes early and genuine engagement leads to better outcomes for everyone.

TQK began its consultation and engagement process in late 2021, during the early stages of exploring wind-to-hydrogen opportunities as part of a broader entry into an emerging market. At that time, an initial Consultation and Engagement Plan was developed to better understand the interests and concerns of local communities, stakeholders, regulatory agencies, and other potentially affected or interested parties.

Since late 2022, the TQK team has built strong relationships with Miawpukek First Nations and is actively working to strengthen its relationship with Qalipu First Nation through ongoing dialogue and planned meetings. Engagement with local municipal leaders and community representatives in the Isthmus and Clarenville regions has also been a priority, with regular in-person meetings and planning sessions held throughout the areas. Acknowledging the importance of giving back to communities in which the Project operates, TQK has contributed funding towards local initiatives including the Chance Cove Coastal trail, the Sunnyside Recreation & Wellness Centre, Clarenville Wheels & Heels Festival, Bellevue Recreation, and more. TQK is committed to continuing sponsorships, donations and Chamber of Commerce memberships within this area of the region to help maximize economic benefits and contribute towards more vibrant and prosperous communities. As the Project progresses, a community benefit fund is planned, with structure and priorities to be shaped through local input.

Engagement with Indigenous groups, stakeholders, and the public will continue throughout the entire lifecycle of the Project and is supported by a centralized tracking platform. This system enables TQK to monitor and manage interactions with regulatory agencies, Indigenous groups, stakeholders, nonprofit organizations, the public, and local community groups in a transparent and accountable manner. Additionally, this platform allows TQK to:

- Prioritize interested parties based on proximity to the Project and the nature of expressed concerns
- Monitor follow-up actions, ensuring timely responses and resolution tracking
- Align and harmonize communications with groups that have raised similar questions or issues

By systematically tracking consultation activities and commitments, TQK is able to support the development of a Regulatory Record of Consultation that holds the Project accountable for communications and commitments, and ensures that engagement outcomes are meaningfully integrated into environmental reporting, mitigation planning, and project decision-making.

4.1 Engagement with Government Departments, Agencies, and Regulators

Prior to the issuance of the WARL, TQK had already initiated ongoing consultation with a variety of regulatory agencies. This engagement will continue throughout all phases of the Project as TQK is responsible for and committed to identifying, applying for, and complying with all applicable legislation, regulations, policies, and authorization requirements relevant to the development, construction, and operation of the Project. Identification of these requirements will be conducted through reference to regulatory application and development guidelines, internal review and input, third party contractor review, and through ongoing discussions with regulatory agencies.

TQK's regulatory consultation approach is rooted in the principle of "engage early, engage often." This enables clear interpretation of legislative requirements, fosters strong working relationships with regulators, and ensures timely alignment with evolving regulatory expectations. TQK believes that for a successfully comprehensive and quality-level EA Registration the following items are required and are actively being conducted:

- Legislative Framework Review: Confirm all applicable laws, regulations, and guidelines related to wind energy, hydrogen production (including desalination), ammonia processing and storage, and associated infrastructure.
- Project-Specific Permitting Matrix: Maintain an actively tracked permit list and application matrix that covers all stages from EA Registration submission through to operations.
- VC Identification and Interaction Analysis: Define valued components (VCs) and assess the Project's potential direct and indirect effects.
- Baseline Data Collection: Supplement existing data with targeted desktop and field studies, identifying any data gaps and strategies for addressing them.
- Regulatory Verification: Consult with agencies to confirm the adequacy of the EA strategy and alignment with legislative requirements.

- Mitigation Planning and EPP Development: Identify potential residual effects and develop practical mitigation measures, including a comprehensive Environmental Protection Plan (EPP).
- Best Practicable Means Assessment: Document how the Project will employ the best available technologies and methods to avoid or minimize impacts.
- EAR Authoring and Submission: Prepare, review, and compile the full EAR, including appendices, for submission to the relevant authorities.
- Future Planning: Identify and initiate any additional studies or mitigation strategies that may be required to support downstream permitting and development phases.

As such TQK has been in contact with government departments, agencies, and regulators (Table 4.1) to initiate and maintain open lines of communication confirm regulatory expectations and gather input to inform the Project's environmental programs and strategy. These early conversations help ensure the Project aligns with applicable legislation and incorporates regulator insights into the planning process.

Table 4.1. Summary of Meetings and Correspondence with Federal and Provincial Government Departments, Agencies and Regulators

Government Departments, Agencies, & Regulators	Dates, Activities, & Comments
Federal Government	
Impact Assessment Agency of Canada (IAAC)	March 2024 TQK provided an introduction to the Project June 2024 TQK followed up with IAAC with presentation and meeting summary.
DFO-MPO	April 2024 TQK provided an introduction to the Project April 2025 TQK provided a Project update
Crown-Indigenous Relations and Northern Affairs Canada	March 2023 TQK reached out to discuss Indigenous engagement in relation to the Project.
ECCC	March 2023 TQK provided formal status update on consultation and engagement and presented current plan to ECCC. September 2024 Meeting with ECCC Canadian Wildlife Service (CWS), NLFFA Wildlife Division, NLECC EA Division to discuss fall avifauna surveys. March 2025 Preliminary assessment and clearance by Meteorological Service of Canada of the proposed Project.

Government Departments, Agencies, & Regulators	Dates, Activities, & Comments
Government of Canada	June 2023 Met with Government of Canada representative, who provided feedback on what Minister O'Regan hopes to see from investors in the renewable energy sector in NL. Reached out to Stephen DeBoer, Federal Govt. Minister for Climate Change
Transport Canada	April 2024 TQK provided an introduction to the Project. August 2024 Project update meeting November 2024 Engaged regarding navigation notifications on lighting
Canadian Coast Guard (CGC)	March 2025 TQK provided an introduction to the Project. Confirmation of no anticipated interference issues between the Project and CGC infrastructure.
RCMP	May 2025 Preliminary assessment and clearance of RCMP retained radio towers or point-to-point microwave links in the Project area.
Provincial Government	
Member of the House of Assembly (MHA) Placentia West	July 2024 Sent update on the 'What We Heard' document and upcoming mobile offices, receipt was acknowledged. February 2025 Informed MHA Jeff Dwyer about unauthorized sharing of confidential Project maps. Responded requesting copy of presentation for review. Informed MHA and Jocelyn Hickey about submission of Crown Land application. April 2025 TQK reached out to request assistance promoting upcoming open house.

Government Departments, Agencies, & Regulators	Dates, Activities, & Comments
MHA Terra Nova	July 2024 Sent update on the 'What We Heard' document and upcoming mobile offices. February 2025 TQK informed MHA Lloyd Parrott about unauthorized sharing of confidential Project maps. Responded requesting copy of presentation for review. Informed MHA about the submission of Crown Land application. April 2025 TQK reached out to request assistance promoting upcoming open house.
NLECC	June 2022 TQK provided introduction to the Project September 2022 Meeting to discuss the NL EA process November 2022 Meeting with NLECC EA Division, Water management Division, and NLFFA Centre for Forest Science and Innovation to review EA table of contents template. June 2023 Met with officials to update about environmental work that has been completed to date and Project plans/phasing. Requested meeting for leases. July 2023 Email sent out regarding answers to land bid process. August 2023 Meeting with Pollution Prevention Division to discuss emissions September 2023 Metting to discuss EA contents and progress. Response to request to provide more information on ABO's wind and other wind projects across Canada. Meeting with Pollution Prevention Division to discuss EA requirements January 2024 Project update meeting with NLECC, NLFFA, and NLIET. April 2024 Sent information via email from open house and discussed info around fiscal framework.

Government Departments, Agencies, & Regulators	Dates, Activities, & Comments
	June 2024 Meeting to discuss Project and cumulative effects. July 2024 Sent June meeting presentation and meeting minutes via email. Email to NLWRMD to pertinent Project updates. September 2024 Project update meeting with NLECC, NLFFA, and NLIET. Sent meeting minutes and presentation via email. Meeting with NLFFA Wildlife Division, NLECC EA Division, and ECCC-CWS to discuss fall avifauna surveys. February 2025 Discussion with Water Resource Division on Project update, water studies, water use license. March 2025 Discussion with Pollution Prevention Division, Project introduction, regulatory guidance. April 2025 Discussion with Climate Change Division on Management of Greenhouse Gas Act. May 2025 Discussion with EA Branch about information to include in EA Registration document.
NLFFA	November 2022 Meeting with NLECC EA Division, Water Management Division, and NLFFA Centre for Forest Science and Innovation to review EA table of contents template. June 2023 Met with officials to update on environmental work that has been completed to date and Project plans/phasing. Email sent regarding titles for licenses related to wind measurement meteorological towers in the Chance Cove area. September 2023 Discussion of awarded reserve lands. July – September 2023 Correspondence regarding NF Crown land application process. January 2024 Project update meeting with NLECC, NLFFA, and NLIET.

Government Departments, Agencies, & Regulators	Dates, Activities, & Comments
	April 2024 Correspondence regarding the crown land application submission. Meeting with NLFFA Wildlife Division. Introduction to Project, and proposed methodology for the 2024 field season. May 2024 Meeting with NLFFA Crown Lands Division to discuss Crown Land applications. July 2024 Meeting with Crown Lands Division to discuss application. Sent meeting minutes and action items via email. Introductory presentations from prior meeting were shared. Information about wildlife surveys and cumulative effects assessment was provided by FFA in response to request. August 2024 Meeting with Crown Lands to provide updates and discuss the NLFFA application. September 2024 Meeting with NLFFA Wildlife Division, NLECC EA Division, and ECCC-CWS to discuss fall avifauna surveys. Project update meeting with NLECC, NLFFA, and NLIET. October - November 2024 Meetings and emails to discuss details regarding the NLFFA application including setbacks, structure, etc. December 2024 ABO reached out about transmission and utility line application. Emails to NLFFA about movement of applications, application for Crown Land Easement. February 2025 Meeting to discuss FFA application. March 2025 Meeting with NLFFA Wildlife Division to provide Project update. Meeting with Forestry Management District 1 to provide introduction to Project and discuss overlap of Project with district 1.

Government Departments, Agencies, & Regulators	Dates, Activities, & Comments
	March 2025 Virtual meeting to discuss Project updates, permitting, and regulatory requirements with Forestry Management District 1, including overlap of Project with forest management district 1. Meeting minutes and preliminary project layout were shared for review with request made for feedback. Meeting to provide Project update, discuss domestic wood-cutting areas and wildfire response (NLFFA), engagement of mineral license holders (NLIET), inspection resources and Owner Used Inspection Organization (OUIO) framework (Digital Government and Service NL). May 2025 Meeting with Forestry Management District 2 to provide introduction to Project and discuss overlap of Project with District 2. Meeting with Wildlife Division to discuss survey protocols and species-specific considerations.
NLIET	May 2022 Introduction of Project concept June 2023 Met with officials to update about environmental work that has been completed to date and Project plans/phasing. Requested meeting for land leases. Met with Minster Parsons to discuss NL's development plans July 2023 Meeting follow up letter of recommendation, requesting Minister Parsons. Email sent out regarding answers to land bid process. Request of clarification for Project timeline, questions on Local jobs, contractors, stakeholders, communities, and land users. August 2023 Meeting to discuss Project status. Met with Government of NL Economic and Benefits Division, sent sample of Industrial Benefits Agreement to be used for the Project. September 2023 Discussion of awarded reserve lands with NLIET and NLFFA. Further discussion of awarded reserve lands and Crown Land application process. November 2023 Meeting with NLIET Industrial Benefits to discuss requirements of Industrial Benefits Agreement

Government Departments, Agencies, & Regulators	Dates, Activities, & Comments
	January 2024 Project update meeting with NLECC, NLFFA, and NLIET. March 2024 Meeting to discuss the Project. April 2024 Reached out to Stephen Hinchey regarding status of application. Responded that review was complete and advised contacting Crown Lands Division for update. May 2024 Material change, Project updates. July 2024 Sent NLIET the 'What We Heard' document. August 2024 Requested guidance on decommissioning wind and hydrogen projects in NL. September 2024 Project update meeting with NLECC, NLFFA, and NLIET. Meeting to discuss change in local offtake, land reserve shrink. Presented to Belgian Energy Delegation. Presentation and follow-up email sent to NLIET afterwards. October 2024 Meeting to discuss Project. Follow up email with questions sent afterwards. November 2024 Meeting to discuss joint venture with CIP. Presented to delegation of ambassadors. Sent NLIET notes from the session. December 2024 Meeting to discuss Crown land update, met towers, open house engagement. February 2025 Meeting to discuss FFA application. Meeting with Industrial Benefits Division to provide Project update and discuss industrial benefits agreement.

Government Departments, Agencies, & Regulators	Dates, Activities, & Comments
	March 2025 Meetings to discuss domestic wood-cutting areas and wildfire response (NLFFA), engagement of mineral license holders on staked land claims that overlap with the Project (NLIET), inspection resources and OUIO framework (Digital Government and Service NL). February 2025 Meeting held with NLECC with NLIET representatives. Discussion included Project progress and 2025 focus, gender equity, diversity, and inclusion plan.
Newfoundland & Labrador Department of Municipal Affairs	August 2023 Meeting regarding engagement of several communities and groups, royalties related to community and municipality level. September 2023 Meeting to go over ABO's involvement with wind development, indicated interest in discussing role of Municipal affairs in wind projects. November 2024 Requested via email an updated list for Local Service Districts. March-April 2025 Requested via emails insight about Local Service Districts. Dates for a virtual meeting were proposed.
Newfoundland & Labrador Department of Health and Community Services	July 2024 Email communication regarding noise and shadow flicker assessment requirements. March 2025 Project update, public considerations of Project, guidance going forward. May 2025 Discussion on survey protocols and information to include in EA Registration document.
Newfoundland & Labrador Office of Indigenous Affairs and Reconciliation	April 2025 Project update, discussion on Indigenous engagement.
Newfoundland & Labrador Water Resource Management Division (NLWRMD)	August 2023 Meeting to discuss watercourse alteration permits, EA infringement, well water and guidelines for Industrial Water Users. February-March 2025 Meeting with NLECC and NLWRMD to provide updates about Project and focus for 2025. Meeting minutes shared for review.

Government Departments, Agencies, & Regulators	Dates, Activities, & Comments
	March 2025 TQK requested confirmation about aspects of Water Use License application.
Newfoundland & Labrador Department of Digital Government and Service NL	March 2025 Meeting to provide Project update, discuss domestic wood-cutting areas and wildfire response (NLFFA), engagement of mineral license holders (NLIET), inspection resources and OUIO framework (Digital Government and Service NL – Engineering and Inspections Division).
Newfoundland & Labrador Rural and Regional Development and Community Economic Development	February 2025 Reached out via email to schedule a virtual meeting with Robert Greenwood. Meeting was held to provide Project update, and discussion points included community response to Project plans and aligning efforts in rural development. TQK followed up to request a report discussed during virtual meeting.
Newfoundland & Labrador Tourism, Culture, Arts, Recreation (TCAR)	March 2023 Discussion on options for engagement. February 2025 Provided Project update and request for virtual meeting.
Parks Division	March 2025 TQK reached out via email to discuss Project with Parks NL and Newfoundland T'Railway via virtual meeting.

4.2 Municipal Engagement

4.2.1.1 Regional Elected Officials

In-person meetings with Regional Community Leaders (Mayors and staff of Chance Cove, Southern Harbour, Come By Chance, Arnold's Cove, Sunnyside and Clarenville) have been ongoing since 2022 to provide regular Project updates. Meetings and ongoing updates have also occurred with Members of the House of Assembly from the region (email and in-person meetings). Project updates with offers to meet have also been sent to the Member of Parliament for the area.

4.2.1.2 Local Service District Chairs and Other Communities

In May 2024, TQK met with several Local Service District (LSD) and unincorporated community representatives to provide an update on the Project. In December 2024 TQK reached out to the LSDs in the general region of the Project by email to provide a Project briefing.

Additional engagement with LSDs were done in March 2025 when TQK reached out directly to each LSD to discuss the Project, how residents typically receive updates and news affecting their community, and to determine opportunities for an Open House. Although engagement efforts are ongoing with all LSDs, TQK had discussion with the following LSDs during this most recent round of engagement:

- Bellevue
- Little Harbour
- Fairhaven
- Swift Current
- Deep Bight
- North Harbour
- Random Sound West

Recognizing there are many small communities (including LSDs) throughout the Project region, TQK has been working to ensure there is engagement with all parties. As such, TQK recognizes an opportunity to consult with additional communities in the region during 2025 and onwards, especially those located near proposed Project components (i.e., the turbines, industrial facilities, etc.).

4.2.1.3 Summary of Municipal Engagement

A summary of municipal engagement is provided in Table 4.2. Engagement with municipalities will continue to be ongoing throughout the Project lifespan.

Table 4.2. Summary of Municipal Engagement

Municipal Group	Dates, Activities, & Comments
Arnold's Cove Chamber of Commerce (ACCC)	November 2022 In-person meeting with Deputy Mayor and Chief Administrative Officer January 2023 Meeting to discuss developing areas for tourism, meeting at the Chamber of Commerce and inviting communities (Arnold's Cove, Sunnyside, Come by Chance, Chance Cove and Southern Harbour). Discussion on making a 'community vibrancy fund' or 'community liaison committee' to allocate shared resource funding opportunities so it's fair and equitable across communities. February 2023 ABO shared job postings with all community contacts. Arnold's Cove Chamber of Commerce reached out to ABO Wind to request a sponsorship (agreed to sponsor for one year). Email correspondence regarding back country guide information. Provided project update and Phase 1 Geotech RFP to distribute. Outreach to Isthmus Communities with office space ready for occupancy (RFO). Request to Isthmus Communities with regards to Mobile Office. April 2024 In-person meeting with Town Mayor. Discussed

Municipal Group	Dates, Activities, & Comments
	community funding. May 2024 Meeting with ACCC. ACCC reportedly appreciated time with TQK. November 2024 Follow-up email sent about ACCC AGM to update about incoming Board of Directors. December 2024 ABO sent email to inform ACCC about new Project investor. February 2025 Contributed funds to the ACCC to support 'building vibrant communities vision'. Chamber seeking to update strategic plan, consultation and engagement being lead Pat Curran Consulting. An update was sent about Crown Land Application and what Chamber can expect for next steps. TQK expressed openness to discussion and feedback.
Clarenville Chamber of Commerce	February 2023 Meeting with Municipal representatives. December 2024 ABO sent email to inform about new Project investor. February-March 2025 TQK reached out for updated membership contact information and for suggestions about open house venues. February 2025 An update was sent about Crown Land Application and what Chamber can expect for next steps. TQK expressed openness to discussion and feedback. April 2025 Virtual meeting held to discuss Project updates, potential luncheon for members, ways to support community.
Community of Swift Current	April 2025 TQK called to confirm receipt of open house promotion. Swift Current shared open house material.

4.3 Community Engagement

TQK's approach to community engagement is grounded in early, transparent, and respectful dialogue that treats engagement as a two-way process. From the outset, efforts have focused on building trust, incorporating local and Indigenous knowledge, and ensuring that community perspectives inform Project planning. This has been supported through a strong local presence, regular in-person meetings, and accessible communication.

TQK views community engagement as an ongoing responsibility that will continue through the lifetime of the Project. A key focus of this effort is supporting local economic development through business engagement, workforce advancement, and training opportunities. These elements are further detailed in the sections that follow.

4.3.1.1 Local Business Engagement

A Business Information Session/Luncheon was held on March 21, 2024, at the Clarenville Inn, in collaboration with the Clarenville Area Chamber of Commerce (CACC) and the Arnold's Cove Area Chamber of Commerce (ACAC). The Business Information Session/Luncheon was promoted via distribution to the membership of both Chambers and had an attendance of approximately 80 people.

TQK has made it a priority to attend and participate in industry events, including speaking at the Energy NL conference in 2023, 2024, and 2025. At the Energy NL Supplier event in fall 2023, TQK shared insights on workforce needs and Project timelines in a presentation to all attendees. These events provided valuable opportunities to connect with potential local suppliers and vendors.

TQK has participated in the following regional conferences and events to share Project updates and opportunities:

- Placentia Bay Industrial Showcase 2024
- WISE (Women in Science and Engineering) Youth Conference 2024
- Econext Conference 2024
- International Delegation Groups 2024
- Arnold's Cove Chamber of Commerce 2024
- Memorial University of NL Engineering Conference 2024

TQK has continued to promote its supplier portal at industry events, via e-newsletter, at open houses, business information sessions and on the website. TQK is guided by their Local Economic Development Policy to provide full and fair opportunity to the local labour force, and vendors and suppliers. It is TQK's intent to maximize economic benefits for communities and their residents and promote long-term commercial growth through access to goods and service contracts, capacity training, and employment.

Vendors interested in providing goods and/or services to TQK are asked to submit company information via our 'Supplier Registration Form' located on Supplier Registration (netbenefitsoftware.com). Hosted by Netbenefit Software, TQK's supplier portal allows interested local companies and vendors to express interest in working on the Project by registering and providing an overview of services offered, expertise and location. To date, 121 companies have registered on the supplier portal to express interest in working with the Project.

4.3.1.2 Advancing Workforce and Training

TQK has had numerous meetings with the College of the North Atlantic (Clarenville and St. John's staff) to discuss potential local training opportunities to meet the Project's needs. TQK has discussed the idea of helping with curriculum development for potential Wind Turbine Technician and Hydrogen Technicians, with the aim of introducing these programs at the Clarenville and/or St. John's campuses (currently offered in Western NL).

TQK has had numerous meetings and continued to share updates on Project advancement with Trades NL and the Construction Labour Relations Association of Newfoundland and Labrador (CLRA NL) during 2023 and 2024. The intent of the meetings was to provide an overview of the Project timeline and anticipated workforce requirements and to understand from these groups the labor and union support they can provide as the Project advances.

4.3.1.3 Summary of Community and Stakeholder Engagement

A summary of community and stakeholder engagement is provided in Table 4.3. Engagement with stakeholders will continue to be ongoing throughout the Project lifespan.

Table 4.3. Summary of Community and Stakeholder Engagement

Stakeholder	Dates, Activities, & Comments
Arnold's Cove Station Development Committee	June 2024 Held information meeting and requested updates as the Project proceeds.
Atlantic Canada Opportunities Agency (ACOA)	May 2024 Project introduction meeting. January 2025 Virtual meeting was held to discuss upcoming conference. An introductory email was sent to connect ACOA with Hydrogen International to provide general insight about hydrogen projects.
Canadian German Chamber of Industry & Commerce	February 2023 Request for meeting to discuss offtake engagement.
Canadian Hydrogen and Fuel Cell Association (CHFCA)	May 2022 Requested to meet for potential collaboration
Canadian Renewable Energy Association (canREA)	August 2024 Asked to be on a panel for Electricity Transformation Canada (ETC) 2024.
Clarenville Area Snowmobile Association	March 2025 Virtual meeting with Snowmobile Association to share Project updates and discuss potential trail impacts. Associated asked about Project layout and TQK confirmed EA and land approvals are required and on-going.

Stakeholder	Dates, Activities, & Comments
Clarenville Heritage Society	March 2025 Virtual meeting scheduled and held to share updates and gather feedback. Heritage Society suggested connecting with Clarenville Nordic Ski Club.
Clarenville Inn	January 2025 Clarenville Inn reached out to ensure they are on contact list for accommodations. ABO responded they will follow-up when expression of interest (EOI) is released.
Clarenville Ski Club	March 2025 Reached out to schedule a virtual call. Ski Club responded it was not necessary. Information shared about open house.
College of the North Atlantic (CNA)	February 2023 ABO reached out to have discussion on training/workforce opportunities. CNA is prepared to implement a program in the Clarenville Campus to train wind turbine techs but asks for more clarification on job types/hours/training estimates. Econext/Hatch Skills gap analysis request April 2024 Proposed to meet in-person. May 2024 Booked space as mobile offices. CNA requested to be added to TQK Project mailing list. June 2024 Booked more spaces as mobile offices. July 2024 Follow up action items from TQK after meeting earlier in the year. August 2024 Reached out to NL Team to ensure items were addressed over summer months. Met with CNA Campus Director to discuss programs. November 2024 Virtual meeting planned for November. December 2024 ABO Community Engagement and Technical teams correspond about wind and hydrogen programs offered at CNA. ABO met with CNA to discuss Human Resources development and Project needs. Plan set to meet again early 2025. January-February 2025 ABO connected about Project updates and to set a time for follow-up meeting.

Stakeholder	Dates, Activities, & Comments
CLRA NL	January 2025 TQK reached out to introduce new staff. Meeting to provide Project update and introduce team, CLRA shared concerns and goals of their organization.
Deep Country Lodge	March 2023 Ongoing discussion with Justin Crocker, Outfitter, in the Project area with regards to the Outfitter Environmental Effects Monitoring Plan (OEEMP) and Memorandum of Understanding (MOU) and Marathon Gold. Discussed Hospitality NL and outfitters and accommodation owners in the Project region. Requested outfitter to confirm any intersection of hunting/outfitting areas, along with a general timeline of construction activity. Emails regarding Project Area and impacts to big game hunting. February 2025 Virtual meeting scheduled with Dean and Justin Crocked and Safari Club International, Canada to discuss Project interactions with wildlife and hunting. Project information sent ahead of meeting, as requested. Status of road discussed and a follow-up meeting was scheduled. TQK sent update about Crown Land Application and what to expect for next steps. Deep Country Lodge informed TQK about the presence of another outfitter in the area and contact information was requested. March 2025 TQK followed up with Deep Country Lodge after virtual meeting summarizing action items. Virtual meeting held to confirm submission of FFA application. Explored idea of meet and greet with Newfounland and Labrador Outfitters Association (NLOA) and requested dates for follow-up meeting to discuss. Details of upcoming LiDAR survey and potential contracting opportunities for outfitters were discussed. TQK expressed commitment to maintaining consistent communication through the EA process. Emails exchanged regarding circulation of preliminary maps outlining Project Layout. ABO confirmed official maps would be shared publicly at upcoming meeting (May 2025). It was requested that topographic maps be presented and ABO confirmed maps would be very detailed. April 2025 TQK contacted Deep Country Lodge to promote open house. Deep Country Lodge expressed concern about proposed turbine locations. Follow-up virtual meeting was held where Project updates were shared and commitment was made to improve engagement.

Stakeholder	Dates, Activities, & Comments
Discovery Trail Snowmobile Association	March 2025 Project introduction April 2025 Email to Peter Troke about potential Project interactions with snowmobile activities, frequently asked questions (FAQ) document and open house details shared.
Econext	March 2023 Met with Chief Executive Officer (CEO) for introductions and involvement in Econext's Clean Energy Initiative programs in NL, became member of the program. Reached out to confirm letter of support for Crown Lands Bid from NL industry organization. Correspondence regarding Green Shipping Corridors and requested meeting to discuss best practices and collaboration on the EA. April 2023 Response to Econext Workforce Capacity Scope for the Clean Energy Sector in NL May 2024 Requested feedback on study on domestic use opportunities for clean fuels. July 2024 Report received from Econext. Reminder to provide feedback. September 2024 Invited to participate in industry challenge with Foresight Canada. Econext provided more information after TQK request. October 2024 Agreed to participate in the challenge. Econext shared Workforce Report via email. Invited TQK to speak at Econext panel. January 2025 In-person meeting held with presentation to Econext team to update about company, Project. February 2025 TQK met with Econext for follow-up discussion.

Stakeholder	Dates, Activities, & Comments
Efford's Hunting Adventures	March 2025 Lucas Efford expressed concerns about potential Project impacts on business and wildlife. TQK responded with a request for virtual meeting and for coordinates of lodges and hunting areas. Virtual meeting was held with Efford's Hunting to introduce Project and hear concerns. They expressed interest in ongoing dialogue, and commitment made for follow-up meetings and collaboration. TQK sent invitation to outfitters inviting them to May 2025 meeting to discuss Project changes. Follow-up email sent to Effords and Dean Crocker (Deep Country Lodge) to confirm NLOA would be able to attend in-person engagement session. March – April 2025 TQK inquired about how best to reach and engage with cabin owners. April 2025 TQK invited outfitters to open house.
Energy NL	April 2023 Meeting to discuss plans for the province with Energy NL CEO and TQK staff. Meetings regarding Energy Campaign and media forms. May 2023 Letter of support for the Project "Energy NL Collective" submitted by Energy NL to the Green Transition Fund to EnergyNL. January 2025 Shared EOI for Environmental Services via e-newsletter. TQK reached out to set up in-person meeting about Project updates. EnergyNL provided information about upcoming exhibit and conference. Reached out to see if there was interest in participating in an Ambassador program for young adults in the energy industry. Responded with request for more information when the program was up and running. February 2025 In-person meeting with Energy NL to provide Project update and discuss upcoming conferences. Email request for feedback about 'Wind at our Backs' campaign. Technical feedback was provided.

Stakeholder	Dates, Activities, & Comments
Fish, Food and Allied Workers Union (FFAW-Unifor)	September 2024 Contacted TQK with concerns from their members. Set up a virtual meeting for September. November 2024 Invitation to introduce newly appointed staff at Southern Harbour meeting. Members requested an in-person meeting. ABO suggested meeting in the New Year when more information would be available. March 2025 Responded to questions and concerns raised by FFAW. April 2025 Information shared about upcoming open house. FFAW indicated they would share the information with their members.
Heritage NL	March 2025 TQK reached out to connect, schedule virtual call.
Hospitality NL	February-March 2025 TQK reached out to connect, schedule virtual call. Virtual meeting held to share Project update and gather feedback. Information shared about open house.
Memorial University of Newfoundland (MUN)	April 2024 Put in contact with Indigenous Consultant at MUN. January 2025 MUN reached out about upcoming Student Energy event. Invited TQK to participate in workshop. Responded to inquire about event structure and participation details.
Mining Industry NL	March-April 2025 TQK reached out to connect about Project and schedule a virtual call. Virtual meeting held to engage with mineral rights holders regarding overlapping land use. Shared information about open house and requested they share with their contacts.
Neighbourhood of Friends	May 2025 TQK reached out about upcoming open house and suggested meeting to connect.
Newfoundland and Labrador Federation of Anglers and Hunters	March 2025 TQK reached out via email with project overview and request to meet.
Newfoundland and Labrador Outfitters Association (NLOA)	February 2025 Reached out to NLOA and Cory Foster via email to introduce Project and propose virtual call. March 2025 Virtual meeting held to provide Project update, understand membership and concerns about wind projects.

Stakeholder	Dates, Activities, & Comments
	TQK followed up via email after virtual meeting, NLOA shared example of OEEMP and maps of outfitter locations. Reached out via email to set up an in-person meeting with local outfitters.
Newfoundland and Labrador Prospectors Association	March-April 2025 Reached out to Norm Mercer to set up call. Met with NL Prospectors Association to introduce Project and discuss land use concerns.
Newfoundland and Labrador Snowmobile Federation	February-March 2025 TQK reached out via email to connect with Peter Troke, set up virtual meeting. Followed up to confirm contacts in the Isthmus region.
Newfoundland T'Railway	February 2025 TQK reached out to schedule virtual meeting. March 2025 TQK reached out seeking contact for Snowmobile Association. Virtual meeting held to discuss Project updates, user concerns. Meeting follow-up via email, shared newsletter invitation.
Pat Curran Consulting	February 2025 Pat Curran reached out to schedule interview with TQK. Arnold's Cove Chamber of Commerce is seeking to update strategic plan, with consultation and engagement being lead Pat Curran Consulting.
Random Trails Inc.	April 2025 Reached out to TQK via email to discuss Project. Responded they would connect soon and informed about upcoming open houses.
Rotary Clarenville Club	December 2024 Request for TQK to speak to the Club. Responded it would have to be in New Year.
Skills Canada NL	July 2024 Coordinated a time to meet. Skills Canada NL expressed interest in student tours of the area. September 2024 Requested Project updates and met with TQK. January 2025 TQK attended free luncheon to learn about Youth Apprenticeship Program. Followed up via email about highlighting luncheon in upcoming newsletter, Skills Canada NL agreed and provided review of content. April 2025 Skills Canada NL reached out to connect about partnership opportunities. TQK responded saying they would be in touch after May 2025.

Stakeholder	Dates, Activities, & Comments
Trades NL	January 2025 TQK reached out to schedule virtual meeting. Met to introduce new staff and share Project update. Discussion focused on labour planning, workforce shortages, and diversity, equity, and inclusion (DEI) partnerships. Trades NL to send and MOU for review. February 2025 Trades NL sent MOU for review.

4.4 Public Communications

4.4.1 Digital Communications

ABO Energy has maintained a Project website, www.toqlukutikproject.com, since the summer of 2023, and continues to update it regularly. The website includes information about the Project and Proponent including:

- Introduction to the Project
- About the Proponent
- News (Project Updates, Press Releases – including the recent investor announcement, Community Office Schedule, meteorological tower (MET) Installation Details, Environmental Studies Updates)
- Project engagement documents (open house presentation and posterboards, 'What We Heard' document)
- Project email newsletter (links to all editions)
- Frequently asked questions
- Glossary of terms
- Question submission section
- Supplier and vendor information
- Project contact information (including phone and e-mail contact)

Through the Project email, info_toqlukutik@aboenergy.com, the Project team provides ongoing and timely responses to stakeholder inquiries. This email address has been widely shared with the public, including in the e-newsletter, through mass mailouts and brochures, and during open houses.

4.4.2 Project Update Advertisements

4.4.2.1 E-Newsletter

Since May 2024, TQK has sent eight e-newsletters to subscribers, now at over 300 recipients in total. All newsletters are available on the Project website and have covered key updates including the recent CIP investor announcement, community office schedules, environmental field study planning, MET installation details, and more.

4.4.2.2 Mailouts

Mass mailouts were sent to all identified communities and rural areas in the Project vicinity (~6500 households) in March 2024 and April 2025. The March 2024 mailout provided a Project overview, schedule of the 2024 open houses, contact information and website, details on location, Project planning and timeline, and potential opportunities. The April 2025 mailout provided a Project overview, schedule of the 2025 open houses, contact information and website, and details on location, Project planning and timeline, and potential opportunities. Mailouts were sent to municipalities, Local Service Districts and other communities in the region, including:

- Chapel Arm
- Normans Cove – Long Cove
- Thornlea
- Bellevue
- Bellevue Beach
- Fair Haven
- Chance Cove
- Little Harbour East
- Rantem
- Southern Harbour
- Southern Harbour Station
- Arnolds Cove
- Arnolds Cove Station
- Come By Chance
- Sunnyside
- Goose Cove
- North Harbour
- Garden Cove
- Black River
- Swift Current
- Goobies
- Goobies Station
- Goobies Siding
- Churchills
- Queens Cove
- North West Brook
- Northern Bight
- Ivany's Cove
- Hillview
- Adeytown
- Deep Bight
- Clarenville
- Shoal Harbour
- Milton
- Port Blandford (2025 only)

Additional mailouts will be distributed in advance of future open houses or significant Project updates. A copy of the mailouts is provided in Appendix B.

4.4.3 Community Consultation Sessions

4.4.3.1 2024 Open Houses

TQK hosted seven Project Information Sessions (Open Houses) in communities in the Isthmus Region and in Clarenville from March 18 to March 21, 2024.

Promotion of the sessions included a householder distribution to 6500 residences and business in the Isthmus of Avalon and Clarenville areas (Project information, contact and open house schedule) along with sending an invitation graphic to all municipal government contacts in the region to post on all regional municipal websites, municipal social media pages and the Chambers of Commerce websites.

Further, the invitation was sent to a large group of existing and identified contacts, including registered suppliers, elected and non-elected government representatives, and other identified stakeholder and community groups. The information session schedule and details were also posted on the Project website.

TQK presented Project information on posterboards, engaged with attendees by answering questions, and gathered valuable feedback on their questions and interests. A Geographical Information Systems (GIS) expert was also on hand with a computer and GIS software, allowing community members to pinpoint important locations, such as hunting areas, cabins, local parks, and salmon rivers, directly on a live map. This real-time mapping allowed TQK to consider and avoid these areas during the planning process.

All materials presented were made available on the Project website, including a "What We Heard" document which summarized feedback from community members during these sessions.

4.4.3.2 2024 Mobile Offices

Being present and accessible to communities throughout the Project region remains a core priority for the TQK team. Between April and October 2024, TQK hosted over 48 mobile office sessions, with two to three team members stationed monthly at accessible, central locations across the region. These three-hour, drop-in style sessions created regular opportunities for community members to ask questions, share input, and speak directly with Project representatives. Sessions were promoted locally to ensure awareness and encourage participation in a relaxed, informal setting.

The mobile community offices included Chance Cove, Southern Harbour, Come By Chance, Arnold's Cove, Bull Arm, Sunnyside, and Clarenville. The mobile office program has been instrumental in fostering open dialogue and building strong connections, allowing TQK to engage meaningfully with local residents on a consistent basis and provide firsthand insights.

4.4.3.3 2025 Open Houses

Staying true to the promise of keeping communities informed and involved, TQK returned to host six more Open House sessions from May 5-7, 2025. Following the initial round of sessions in 2024, these meetings provided an opportunity to share Project updates, respond to questions, and gather additional feedback from local residents, land users, and other stakeholders.

Approximately 200 individuals attended the Open Houses, with around 12 feedback forms submitted across all sessions. In addition to in-person engagement, nearly 40 new community members subscribed to the Project e-newsletter during this period, further expanding the digital outreach of TQK.

Key themes and questions raised during the sessions included interest in community benefits, use of existing infrastructure, water sources, turbine size and layout, impact on local lifestyles, decommissioning plans, fire safety, environmental impacts, Project evolution and phasing, wildlife impacts, and employment opportunities. These conversations and insights are helping shape ongoing engagement efforts and will be used to inform both Project planning and future communications.

4.5 Indigenous Engagement

Since 2022, TQK has been actively engaging with Miawpukek First Nation (MFN) to build a strong and respectful relationship. Initial meetings were held in 2022, followed by more structured consultation beginning in fall 2023. Since that time, TQK has held numerous meetings with MFN's Consultation team to discuss the Consultation Protocol, traditional land use considerations, and the environmental assessment process.

In summer 2024, the Project team traveled to MFN in Conne River to meet in person with Chief Brad Benoit, Council, and staff. That same year, representatives of MFN also visited an ABO Energy wind site in Germany and met with ABO colleagues at the company's global headquarters in Wiesbaden. In September 2024, during an Atlantic Indigenous conference, ABO Energy and MFN's Economic Development Lead co-presented to highlight their collaboration to date, share a Project update, and discuss ABO's Indigenous engagement approach.

As of June 2025, TQK has participated in over 20 meetings with MFN (both virtual and in person) and maintains regular communication with MFN's Economic Development Lead and Chief Benoit as appropriate. A jointly developed Consultation and Engagement Plan is currently in progress and will serve as the guiding framework for future collaboration, including informing baseline studies, VC selection, and mitigation planning. MFN has indicated it will follow its own internal process, supported by TQK to assess how the Project may affect the community. This process will be reflected in the final version of the jointly signed Consultation Plan.

TQK began engagement with Qalipu First Nation (QFN) in 2023 through an initial introductory outreach, followed by ongoing correspondence throughout 2024. In April 2025, a virtual meeting was held to provide a detailed update on the Project and to explore potential collaboration. TQK shared updates on rebranding, the partnership with CIP, Project footprint reduction, and our phase approach to environmental assessments. Qalipu stated that the Project falls within their traditional territory and provided feedback on draft materials and identification of potential regulatory concerns. TQK and QFN committed to quarterly meetings, regular information sharing, and including Qalipu in relevant engagement opportunities and RFPs, laying the foundation for a respectful and collaborative relationship moving forward.

A summary of Indigenous engagement activities is provided in Table 4.4.

Table 4.4 Summary of Indigenous Engagement Activities

First Nation Group	Dates, Activities, & Comments
MFN	February 2023 Meeting on introduction to Colliers Project Leaders June 2023 Reached out regarding the invitation to participate in Hamburg Delegation event in NL, October 2023 October 2023 Met chief at Econext conference, discussion of partnership possibilities. Meeting in person with chief and council and senior band officials, discussion on relationships and next steps. Draft Terms of Reference document for proposed MFN-ABO Wind Taskforce. Check issues for First Nation Youth initiative. November 2023 Community meeting, donation of $5,000 to powwow and $5,000 for Cultural Activity support. Landed on name for special purpose vehicle (SPV), Toqwe'kik Wind and Hydrogen Ltd. Multiple updated drafts of Terms of Reference (TOR) f sent, inquiry on the Indigenous Inclusion Policy. Emails sent regarding preparations for EA Registration submission, environmental field studies and traditional land use studies. Discussion on Project Brochure/FAQ's and Task Force Budget. December 2023 Meeting to discuss partnership and next steps. Resending ToR with comments, questions surrounding environmental studies and traditional land use. Invitation to Chief Joe. Request to have bimonthly meetings between ABO and MFN. April 2024 Planned meeting with MFN with primary focus on

First Nation Group	Dates, Activities, & Comments
	finalizing TOR and equity discussions. MFN TOR was reviewed, responded to, and discussed with MFN lawyer. May 2024 Request for meeting with MFN in June. Karsten wanted TQK to set up a joint lunch in May. Received internal information that could help model the dollar spend for funding plans. June 2024 Scheduled meeting after the canceled meeting in April. Email exchanges finally landed on June 24. July 2024 Thanked MFN for their meeting in June and requested a virtual meeting in July. MFN requested edits before signing the MOU. August 2024 Set up an August 14 meeting to discuss critical components, including scope for rare lichen study. Colliers requested information to establish a financial model for MFN. MFN sent a proposal for the lichen study to be reviewed by TQK. September 2024 Looked to expand the upcoming consultation meeting to include a Project update. October 2024 Received minutes from September meeting. November 2024 Inquired for 2025 budget meeting. Colliers invited to next meeting. ABO inquired about MFN response to MOU. January-February 2025 ABO reached out to set meeting time to discuss Consultation Plan and Project updates. Meeting minutes were shared and reviewed. March 2025 Held monthly meeting to share Project update and priorities for 2025. Minutes and presentations shared in follow-up. Dave Berrade (ABO) initiated discussion with Phoebe Keeping (MFN) regarding the Project MOU and provided document for review. Proposed meeting to discuss.

First Nation Group	Dates, Activities, & Comments
	April 2025 Shared meeting minutes, invited feedback, and discussed promotional materials for open house. TQK and MFN held monthly virtual meeting. Discussion points included meeting format, update on Consultation Plan, open house, and field studies. TQK reached out about an upcoming RFP for field studies. Invitation sent about the upcoming open house, requested MFN share information with contacts. April-May 2025 Correspondence via email to discuss rescheduling upcoming meeting and changing meeting format.
Qalipu First Nation (QFN)	July 2024 Attempted to connect with Band Manager to schedule a meeting. August 2024 Suggestion made for TQK to present when the new Chief and Council are sworn in. Early spring 2025 was recommended. Non-disclosure agreement (NDA) sent to QFN. September 2024 Final NDA emailed to QFN. March 2025 TQK initiated contact with Qalipu to share a Project update. Meeting was scheduled. April 2025 Virtual meeting to introduce Project and share updates. Discussion points included ABO and CIP partnership, Braya update, priorities for 2025, status of FFA application and EA, and consultation. Minutes and key follow-ups were shared after the meeting.

4.6 Review of Questions

4.6.1 What We Heard Report

TQK published a comprehensive 'What We Heard Report' in July 2024 to summarize Project information and provide answers to questions that arose during the seven community engagement session in March 2024. The report was made available on the Project website, shared via the e-newsletter, and a physical copy was available at in-person community office sessions and at the Project office.

In addition, a follow-up 'What We Heard Report' is currently in development to capture and respond to the feedback received during the May 2025 open house sessions. This forthcoming report will further inform ongoing engagement efforts and ensure transparency as the Project progresses.

4.6.2 Specific Topics

TQK places a strong emphasis on public engagement and has held more than 20 community sessions and over 15 council meetings across six communities in the Project region since 2022. During the March 2024 and May 2025 open house sessions, a GIS expert was on-site with an interactive mapping tool. This allowed attendees to identify important areas, such as hunting grounds, cabins, local parks, and salmon rivers, directly on a live map. This real-time input has helped inform Project planning by identifying areas to avoid or investigate further.

Cabin Owners

Through engagement, multiple cabin owners reached out to TQK via the dedicated information email to share details about cabin locations, access routes, and recreational land use. To further support open dialogue, TQK also issued a public call inviting cabin owners to participate in community information sessions and speak directly with Project representatives. TQK remains committed to ongoing engagement with cabin owners through continued conversations, targeted outreach, and future engagement opportunities. This ongoing dialogue is aimed at ensuring cabin owner perspectives are reflected in Project planning and mitigation measures.

Water

TQK has engaged with the Town of Clarenville to better understand the location and significance of the Town's watershed area. TQK recognizes its critical importance and is committed to taking all necessary precautions to avoid any negative impacts to the watershed or adjacent lands. As a result, a buffer zone was added to this area and incorporated into planning efforts (Section 2.3).

TQK is considering land near the Come By Chance refinery for temporary use, including laydown and logistics. This area is near Big Pond and partially overlaps with the Butchers Brook Protected Public Water Supply Area for the Town of Come By Chance.

TQK initiated discussions with the Water Resources Management Division of NLECC in mid-2024 and are also exploring the potential use of portions of the refinery's unused industrial water license. Several alternative water source options have been submitted for evaluation, with water sampling and analysis planned for 2025.

TQK is also planning to meet with the Town to better understand current and future water needs. This engagement will help ensure that Project activities do not interfere with the Town's water supply. All activities in or near the Protected Public Water Supply Area will follow provincial regulations and best practices for watershed protection.

Tourism

TQK has engaged with Hospitality Newfoundland and Labrador, the T'Railway Association, the Clarenville Chapter of the Snowmobile Association, and local communities to better understand the significance of the tourism and recreation industry in the region. Through these conversations, TQK heard that:

- Safety is a primary concern when it comes to the trails.
- Sustainability and the protection of natural beauty are highly valued, visual impacts may be viewed negatively, but can be addressed through thoughtful planning, including the use of buffers.
- Key hiking trails, such as the Chance Cove Coastal Trail, the Cleary Trail, and others, are important to community members. TQK has addressed these concerns through route planning and setbacks to avoid overlap with the Project Area.
- There is a strong interest in collaborating on shared priorities, and stakeholders are open to continued engagement.

TQK is committed to ongoing collaboration with these groups as the Project evolves.

Hunting and Trapping

TQK is committed to ongoing engagement with the NLOA and has held several meetings with key outfitters in the region to better understand their concerns, land use, and business operations. TQK will continue to collaborate closely with these stakeholders to help identify and mitigate any potential impacts.

Fisheries

TQK is also working closely with communities in the region to gain a clearer understanding of important fishing areas. Through engagement, residents shared information about over 49 km of salmon rivers and other valued waterbodies that hold significance. While the specific locations are not publicly named, TQK has incorporated this input which has played a key role in shaping how and where Project components are planned, including incorporating buffer zones into Project planning to help ensure these areas are respected and protected.

TQK has proactively engaged with FFAW-Unifor to better understand any concerns from their members with respect to Project components that are coastally adjacent or within marine waters. As Project design evolves, TQK will continue this engagement to ensure that the Project will have the smallest impact possible on marine waters, and users thereof.

Industrial Activities

TQK has engaged with key industry groups, including Mining Industry NL and the Newfoundland and Labrador Prospectors Association, to better understand mineral rights activity within or near the Project Area. These discussions focused on identifying the extent of existing mineral claims, awareness of any ongoing or planned exploration work, and discussing how proposed development may intersect with existing land uses.

In parallel, TQK has maintained ongoing communication with the Mineral Lands Division of NLIET to ensure accurate alignment with existing tenure information and to understand potential implications for mineral exploration and development in the region. As part of this process, individualized letters have been sent to all mineral license holders whose claims overlap with the Project Area to invite direct dialogue and facilitate early consultation.

TQK is also aware that portions of the Project Area may overlap with aggregate deposits or dormant quarries that could be of future strategic importance. Accordingly, TQK is working to understand how infrastructure siting may impact such areas and is committed to incorporating mitigation measures where appropriate.

While formal engagement with all affected tenure holders is still underway, TQK recognizes their potential interest and is committed to proactive consultation to identify and minimize potential land-use conflicts. The Project remains focused on working respectfully with others who use the land, and ensuring those interests are understood and considered in planning, siting, and mitigation decisions.

4.6.3 Summary of Questions

Table 4.5 summarizes the general questions received from the public through monthly mobile office engagements, open house sessions, information emails, and one-on-one meetings with various stakeholders.

Table 4.5: Summary of Questions related to the Project

Topic	Question	Proponent Response	Section of EAR
Project Design and Location	Will a turbine be located near my cabin?	Current protocols suggest that setbacks from residential areas and cottages will be set at 1000 m (1 km).	2.3.2
	Will I be able to see turbines from my house?	Visualizations will be modelled from specific locations once a final layout and turbine model has been selected. .	2.3.2
	What will it look like with so many turbines near my community?	Visualizations will be modelled from specific locations once a final layout and turbine model has been selected. to model predicted viewscapes.	2.3.2
	What kind of noise can we expect from the turbines?	Noise modelling will be completed once a final layout and turbine model has been selected. to model predicted noise levels at nearby receptors.	3.1.1.1
	What kind of wind turbines will be used?	At this stage no final decision has been made regarding turbine model. The final selection will be depending on climatic and geotechnical conditions, turbine options and market availability.	2.4.3.1
Socio-Economic Impacts	How will the Project interact with First Nations historic areas or other areas of heritage?	An archaeological assessment will be undertaken during future studies, in accordance with the requirements of the *Historic Resources Act* and any direction provided by the Provincial Archaeology Office. This assessment will identify and evaluate potential historic or heritage sites within the Project Area. Should any areas of cultural or archaeological importance be identified, appropriate avoidance, mitigation, or monitoring measures will be implemented in coordination with Indigenous groups and relevant regulatory authorities.	5.13
	Need to support local – ensure you hire within the province.	As per TQK's local economic development policy, local workers and suppliers will be utilized wherever possible. Criteria requiring contractors and workers to come from other parts of Canada, and the world will be dependent on critical factors including	4.3

Topic	Question	Proponent Response	Section of EAR
		specialized skillsets, experience, type of contractor required, and availability of qualified workers.	
	What is the impact to recreational users – will I be able to continue to hunt, fish, hike, all-terrain vehicle (ATV), snowmobile?	TQK will work with the community to ensure that access to hiking trails is not impacted by the Project.	4.6.2
	How is the Project going to impact tourism?	A socio-economic impact analysis will be completed for the EIS to investigate the effect of the Project across a number of industrial sectors and these results will be available to the public.	5.12.4
	How will this impact property values?	Studies in Canada, the United States (U.S.), and internationally consistently show that proximity to wind projects does not negatively impact property values. In Ontario, the Municipal Property Assessment Corporation found no significant effect on home sale prices within 1 to 5 km of turbines, a conclusion echoed by large-scale U.S. research. In some cases, wind projects can have positive effects on property values by improving local infrastructure, increasing municipal revenues, and supporting regional economic growth—all of which can enhance the overall appeal and stability of surrounding communities.	---

Topic	Question	Proponent Response	Section of EAR
Water Usage	Will the Project impact water quality? How much water will be required and what watersheds will it impact?	The Project is not expected to negatively impact water quality. Water withdrawal and usage will be carefully managed in accordance with provincial regulations, including applicable requirements under the *Water Resources Act*. The Project is currently assessing potential water sources, with priority given to sustainable withdrawals from watersheds with sufficient capacity and minimal ecological sensitivity. Detailed hydrological studies will be conducted to determine suitable withdrawal points and ensure that aquatic habitat, downstream users, and watershed health are protected.	5.4.5
Health and Safety	What is the risk to people from turbine ice throw?	TQK recognizes the unique climate in Newfoundland and Labrador and ice and weather conditions will be taken into consideration when selecting a wind turbine model. Also, a deicing plan will be developed and implemented to ensure the safe and continued operations of the turbines during the winter season.	6.6
	Is Ammonia safe? What are the risks to the community?	Ammonia and hydrogen have already been produced on a large-scale industrial application for more than a century; therefore, handling and transport is well known. In fact, Ammonia is a controlled substance that is managed under regulation by Transport Canada. Full analysis of all safety risks and emergency response plans and mitigations will be in place prior to any production.	6.0

Topic	Question	Proponent Response	Section of EAR
	What is the emergency response plan?	A full analysis of all safety risks and emergency response plans and mitigations will be in place prior to any production. TQK and any other companies or contractors involved in the Project must have safety at top of mind and follow all safety and emergency response protocols, from site visits to construction, operations, and decommissioning.	6.0
Wildlife	Will the Project have any impacts on wildlife and birds or other aspects of the local environment?	Robust environmental studies will be completed during the EA process to develop an understanding of habitat conditions as well as the birds and wildlife utilizing the site. The findings of these studies will inform the development of appropriate mitigation measures.	5.0
	How is the Project going to impact caribou and moose populations in the area?	Caribou and moose populations, habitat and migration patterns will be studied as part of the environmental studies required for the EIS. Study results and mitigation measures will be included within the EIS.	5.9
Telecommunications	Will the Project impact wireless and cell service?	The Project is not expected to negatively impact wireless or cell service. In fact, it is likely to improve coverage in the area, as the WTGs and associated infrastructure will require reliable wireless and cellular connectivity for monitoring, communication, and control systems. This may result in enhanced service availability for nearby communities as a co-benefit of the Project's development.	---

4.7 Future Engagement

TQK recognizes the importance of inclusive collaboration and is committed to thorough communication with a broad range of stakeholders. In addition to groups already contacted, the following additional groups have been identified as priorities for future engagement based on feedback received during earlier public consultation, local input, and a growing understanding of regional interests:

- Women in Resource Development Canada
- Inclusion NL
- Provincial Advisory Council on Status of Women
- Association for New Canadians
- Memorial University of Newfoundland – Office of Public Engagement
- Newfoundland and Labrador Construction Association
- Cabin Owners (around the Isthmus of Avalon)
- NL Association of Hunters and Anglers
- Canadian Military
- Carpenter Millwright College
- Harbour Authorities for relative DFO Small Craft Harbours

TQK has made a commitment to host open houses for MFN within the community and to council in fall 2025. Further public open houses are planned for 2026.

Note that these plans are non-exhaustive, and TQK welcomes continued dialogue and remains open to engagement with additional individuals, organizations, and communities who have an interest in the Project.

4.7.1 Community Giving

Since the WARL, TQK has continued to build on local contributions to-date by providing over $56,000 in donations toward initiatives across the local region and MFN. TQK remains committed to giving back to the local community. TQK has a Positive Energy Policy that provides guidance for our sponsorship and donation approach.

5.0 PRELIMINARY INTERACTIONS ASSESSMENT

5.1 Atmosphere

5.1.1 Overview

The objective of the atmosphere assessment was to collect the information necessary to assess potential interactions between the Project and atmosphere. This was accomplished using the following approach:

- Identify existing atmospheric conditions within the Study Area using desktop resources
- Use the information collected to identify potential Project interactions and inform possible mitigation measures

5.1.2 Regulatory Context

Air Quality

The Canadian Council of Ministers of the Environment (CCME) has established Canadian Ambient Air Quality Standards (CAAQS) for fine particulate matter (PM) [<2.5 micrometres (µm) ($PM_{2.5}$)], ozone (O_3), sulphur dioxide (SO_2), and nitrogen dioxide (NO_2) over select averaging periods (CCME, n.d.). The Government of Newfoundland and Labrador has legislated Air Pollution Control Regulations (NL APCR), N.L. Reg. 11/2022 under the NL *EPA*. The province has adopted the CAAQS for SO_2 and NO_2 under the NL APCR (2022). The province has not adopted the CAAQS for $PM_{2.5}$ and O_3 as they are not as stringent as the current provincial legislation. The NL APCR is presented below in Table 5.1 with the new standards in effect as of January 1, 2025 (NLECC, 2024c).

Table 5.1: Summary of Regulations Pertaining to Ambient Air Quality in Newfoundland and Labrador

Contaminant	Averaging Period	unit	Regulatory Threshold
Carbon Monoxide	1-hour	ppb	30582
	8-hour	ppb	13107
Nitrogen Dioxide	1-hour	ppb	213
	24-hour	ppb	106
	Annual	ppb	53
Ozone	1-hour	ppb	82
	8-hour	ppb	44
$PM_{2.5}$	24-hour	μg/m³	25
	Annual	μg/m³	8.8
PM_{10}	24-hour	μg/m³	50
Sulphur Dioxide	1-hour	ppb	344
	24-hour	ppb	115
	Annual	ppb	23
Total Suspended Particulate	24-hour	ppb	120
	Annual	ppb	60

Ppb = parts per billion
μg/m3 = microgram per cubic metre

Shadow Flicker

There is no municipal, provincial, or federal legislation related to shadow flicker, but many jurisdictions, including NL, have adopted the industry guideline of no more than 30 hours of shadow flicker per year, or no more than 30 minutes of shadow flicker on the worst day of the year at residential receptors (Port au Port-Stephenville Wind Power and Hydrogen Generation Project Release Order, NLR18/24).

Sound

Changes to the acoustic environment during construction and operational activities could result in displacement, annoyance, and interference of communication, sleep, and/or working efficiency. As such, sound levels are regulated at the various government levels (Table 5.2).

Table 5.2: Summary of Sound Level Regulations and Guidelines

Regulated By	Regulation/Guidance	Sound Level (dBA)	Hours / Duration
For Residential Receptors			
Health Canada Guidance	Guidance for Evaluating Human Health Impacts in Environmental Assessment: Operational and Construction Noise	45 (Outside Receptor)	NA
For Occupational Safety			
Workplace NL, Government Modernization and Service Delivery	Occupational Health and Safety Regulations, 2012	85	8-hour maximum
Workplace Health and Safety Regulations & Canadian Centre for Occupational Health and Safety (CCOHS)	Noise – Occupational Exposure Limits in Canada (Workplace Health and Safety Regulations & CCOHS)	85	8-hour maximum

There are no municipal, provincial, or federal regulations related to operational sound, Health Canada recommends sound levels produced by wind turbines to be below a weighted sound level of 45 dBA (Health Canada, 2023).

5.1.3 Desktop Assessment Methodology

An assessment of weather and climate, air quality, shadow flicker, and noise was completed for the Study Area. Information was obtained from the following sources:

- ECCC Weather and Climate (ECCC, 2025b)
- NLECC Air Quality Reports (NLECC, 2024a)
- NLECC Air Quality Data (NLECC, 2024b)
- NLECC Climate Data (NLECC, 2024c)
- Braya Air quality monitoring stations: Arnold's Cove, Come By Chance and Sunnyside (NLECC, 2024a).
- Vale MET Data (NLECC, 2024d)

5.1.4 Desktop Assessment Results

Weather and Climate

The weather and climate in Eastern Newfoundland vary, however maritime conditions produce cool summers and short, cold winters within much of the general Project Area. (ECCC, 2025b; NLECC, 2024c).

Local temperature and precipitation data are separated by Study Area section (TQK North, TQK Central and TQK South) obtained by the closest provincial meteorological stations near the Project with the most accurate weather data. Operation of the weather stations vary by year, with most stations having incomplete data for the last 20 to 30 years.

TQK North

Local temperature and precipitation data were obtained from the Swift Current (Climate Identification (ID): 8403825; (NLECC, 2024c)) meteorological station (Drawing 5) just outside the northern portion of TQK North (approximately 2 km to the southwest).

From 2009 to 2019, the mean annual temperature at the Swift Current weather station was 5.7°C, with a mean monthly maximum of 10.4°C and a mean minimum of 0.9°C. January and February were the coldest months, while July and August were the warmest. Most precipitation occurred in October and December, with an accumulation of 163.6 mm and 161.3 mm, respectively (Table 5.3; NLECC, 2024).

Table 5.3: Climate Data from the Swift Current Meteorological Station (2009-2019). Data Reproduced from NLECC (2024c)

Temperature/ Precipitation	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov*	Dec	Year
Avg Temp (°C)	-4.8	-4.6	-1.8	3.2	7.4	11.4	16.0	17.2	13.4	8.2	3.1	-0.9	5.7
Max Temp (°C)	-0.6	-0.0	2.6	7.5	12.8	17.3	21.5	22.6	18.6	12.5	6.7	2.6	10.4
Min Temp (°C)	-9.0	-9.2	-6.1	-1.2	1.9	5.5	10.6	11.7	8.1	4.0	-0.6	-4.5	0.9
Precipitation (mm)	152.5	106.2	108.7	112.9	97.7	85.0	110.8	117.8	144.1	163.6	149.5	161.3	1510.1

* = Data from November 2003 from this weather station is missing. Value taken using average/totals for 10 years rather than 11

TQK Central

Local temperature and precipitation data were obtained from the Come By Chance (Climate Identification (ID): 8401257; (NLECC, 2024c) meteorological station (Drawing 5) just outside TQK Central (approximately 1 km west).

From 1984 to 1994, the mean annual temperature at the Come By Chance weather station was 4.5°C, with a mean monthly maximum of 8.2°C and a mean minimum of 0.7°C. January and February were the coldest months, while July and August were the warmest. Most precipitation occurred in June and October, with an accumulation of 134.6 mm and 132.2 mm, respectively (Table 5.4; NLECC, 2024c).

Table 5.4: Climate Data from the Come By Chance Meteorological Station (1984-1994). Data Reproduced from NLECC (2024c)

Temperature/ Precipitation	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec*	Year
Avg Temp (°C)	-5.6	-5.8	-2.9	2.0	6.1	9.9	14.0	15.7	12.4	7.7	2.6	-2.4	4.5
Max Temp (°C)	-1.1	-1.4	0.9	5.5	9.8	13.7	17.6	19.3	15.9	11.1	5.8	1.1	8.2
Min Temp (°C)	-10.0	-10.2	-6.7	-1.5	2.2	6.1	10.4	12.1	8.8	4.3	-0.7	-6.0	0.7
Precipitation+ (mm)	116.6	130.9	123.0	100.1	99.6	134.6	86.1	84.8	109.8	132.2	119.4	108.7	1345.8

* = Data from December 1993 from this weather station is missing. Value taken using average/totals for 10 years rather than 11

+ = Precipitation data from May 1985, September 1987 and December 1994 are missing from this weather station.

TQK South

Local temperature and precipitation data were obtained from the Long Harbour (Climate Identification (ID): 8402569; NLECC, 2024c) meteorological station (Drawing 5) just outside TQK South (approximately 4 km south).

From 1989 to1999, the mean annual temperature at the Long Harbour weather station was 5.7°C, with a mean monthly maximum of 9.3°C and a mean minimum of 2.0°C. January and February were the coldest months, while July and August were the warmest. Most precipitation occurred in October and January, with an accumulation of 139.8 mm and 123.2 mm, respectively (Table 5.5; NLECC, 2024c).

Table 5.5: Climate Data from the Long Harbour Meteorological Station (1989-1999). Data Reproduced from NLECC (NLECC, 2024c)

Temperature/ Precipitation	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec*	Year
Avg Temp (°C)	-3.6	-4.2	-1.4	2.9	6.9	11.0	14.9	16.5	13.4	8.4	4.2	-0.37	5.7
Max Temp (°C)	-0.2	0.0	2.5	6.4	10.7	15.1	18.6	19.9	17.0	11.6	7.3	2.8	9.3
Min Temp (°C)	-7.8	-8.5	-5.2	-0.6	3.0	6.9	11.2	13.0	9.8	5.3	1.0	-3.6	2.0
Precipitation+ (mm)	123.2	119.0	116.4	91.8	98.4	99.5	101.7	98.1	121.8	139.8	121.7	122.1	1353.6

* = Data from December 1999 from this weather station is missing. Value taken using average/totals for 10 years rather than 11

There is limited wind data from the provincial weather stations near the Project Area (Drawing 5). As such, wind data has been gathered from the two MET stations at Long Harbour operated by VALE. VALE LH1 MET was in operation from 2020 to 2022 and VALE LH2 MET was installed in 2022.

Table 5.6 provides a summary of mean monthly wind speeds (km/h), maximum hourly wind speeds and wind direction (degrees) from both towers (LH1 December 2020 to January 2022, and LH2 February 17, 2023 to December 31, 2024) (NLECC, 2024d).

Table 5.6: Wind Data from Longview VALE MET stations (2020-2024)*. Data Reproduced from NLECC (2024d)

Wind Speed/Direction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Wind Speed (km/h)	19.7	19.9	19.7	19.5	18.2	15.9	15.2	16.0	14.8	16.5	17.0	20.9
Maximum Hourly Wind Speed (km/h)	123.2	77.0	89.3	77.6	53.6	65.4	45	49.0	59.0	55.5	60.0	96.1
Wind Direction (Degrees)	217.1	202.2	189.9	157.1	170.8	178	199.8	196.4	181.6	173.2	189.2	210.4

* - 2020 only has data for the month of December and 2022 only has data for the month of January

Air Quality

Newfoundland and Labrador monitors air quality at seven ambient air quality monitoring stations throughout the province (NLECC, 2024b). Given that none of these provincial air quality stations are within the Study Area, data was gathered from three air quality monitoring stations operated by an industrial facility (Braya) for the communities of Arnold's Cove, Come By Chance and Sunnyside (NLECC, 2024a). Measured air quality parameters at these locations include:

- $PM_{2.5}$
- SO_2

Existing air quality conditions indicate that SO_2 values are below their respective Newfoundland Ambient Air Quality Standards for all three communities. $PM_{2.5}$ exceeded the 24-hour NL APCR in Arnold's Cove and Sunnyside at various times throughout the data period, namely in 2022/2023. The majority of these exceedances can be attributed to wildfire smoke/adverse meteorological conditions (NLECC, 2024a). Data from each station for 2019-2023 are summarized below.

Table 5.7: Current (baseline) Maximum and Annual Ambient Air Quality Conditions at the Air Quality Monitoring Stations near the Project Area (January 1, 2019, to December 31, 2023). Data reproduced from NLECC (2024a)

Parameter	Averaging Period	SO_2 (ppb)	$PM_{2.5}$ (µg/m³)	Fraction of CAAQS (SO_2)	Fraction of CAAQS ($PM_{2.5}$)
Arnold's Cove Ambient Monitoring	1 hour	21.8	-	33.5%	-
	24 hours	5.1	**29.0**	-	116%
	Annual	0.6	5.4	15%	61.4%
Come By Chance Ambient Monitoring	1 hour	12.4	-	19.1%	-
	24 hours	4.22	17.78	-	71.1%
	Annual	1.0	4.4	25%	50%
Sunnyside Ambient Monitoring	1 hour	17.16	-	26.4%	-
	24 hours	4.7	**37.1**	-	148.4%
	Annual	1.0	4.4	25%	50%
NL APCR	1 hour	65	-	-	-
	24 hours[1]	-	25	-	-
	Annual[2]	4.0	8.8	-	-

Source: Air Quality Monitoring Reports 2020-2024 (NLECC (2024d)
Bold and underlined data indicates exceedances

Shadow Flicker
Shadow flicker can occur when rotating blades cast flickering shadows during times of direct sunlight. The magnitude of shadow flicker is determined by the position and height of the sun, wind speed and direction, geographical location, time of year, cloud cover, turbine hub height and rotor diameter, and proximity to the WTG.

For shadow flicker to occur, the following criteria must be met:

- The sun must be shining and not be obscured by clouds/fog.
- The source wind turbine must be operating.
- The WTG must be situated between the sun and the shadow receptor.
- The WTG must be facing directly towards, or away from, the sun such that the rotational plane of the blades (i.e., rotor plane) is perpendicular to the azimuth of incident sun rays. For this to occur, the wind direction would have to be parallel to the azimuth of the incident sun rays throughout the day.
- The line of sight between the WTG and the shadow receptor must be clear. Light-impermeable obstacles, such as vegetation, tall structures, etc., will prevent shadow flicker from occurring at the receptor.
- The shadow receptor must be close enough to the WTG to be in the shadow.

Sound

Ambient Sound
When evaluating sound levels produced by the Project, it is important to understand ambient sound existing in and around the Study Area pre-development. Several developments also contribute to ambient sound levels within/near the Study Area, primarily:

- Active forestry (throughout and surrounding the Study Area)
- Aggregates quarry

Sounds associated with these activities include operation of heavy machinery, tree felling, logging trucks, etc. Recreational and local traffic also exists within the Study Area, increasing ambient sound levels from cars, ATV, dirt bikes, etc. Lastly, in addition to anthropogenic sources, there are also natural sources of sounds originating from wildlife, wind, water, and vegetation.

Construction Sound

During construction activities, sound will predominantly be generated by the operation of construction equipment and heavy machinery such as cranes, backhoes, excavators, dump trucks, graders, and transportation vehicles. A summary of sources and anticipated volumes of sound produced during the Project's construction have been provided in Table 5.8.

Table 5.8: Decibel Limits of Construction Equipment Required for the Project

Equipment	Average Noise Level Ranges (in dBA)
Road, Transmission Line, Grid Connection, and Turbine Pad Development	
Backhoe	85-104[1]
Concrete Truck/Pump	103-108[2]
Dozer	89-103[1]
Dump Truck	84-88[1]
Excavator	97-106[2]
Harvesting Equipment (log truck, manual faller, etc.)	85-103[3]
Roller	95-108[2]
ATV	97[4]
Loaders	88[3]
Pickup Trucks	95[4]
Tracked Drilling Units	91-107[5]
Tracked Dump Truck/Decks	91[6]
Tracked Man Lift/Bucket Machines	85[6]
Tracked Radial Boom Derricks/Cranes	93-98[2/6]
Turbine Assembly	
Crane	78-103[1]
Handheld Air Tools	115[2]
Compressor (drilling, pneumatic tools, etc.)	85-104[7]

Note that measurements shown are relevant to the decibel level ranges within close proximity (i.e., less than 15 m of distance) between a receptor and the relevant piece of equipment.
Sources: [1] (WorkSafe BC, n.d.)
[2] (Transport Scotland, n.d.)
[3] (WorkSafe BC, 2016)
[4] (Government of Oregon, n.d.)
[5] (The Driller, 2005)
[6] (SCE, 2016)
[7] (Government of Ontario, 2021)

Assuming that sound attenuates at the standard rate of 6 dBA per doubling in distance from a given point source, approximate sound levels experienced at incremental distances during construction activities for the Project are provided in Table 5.9. The attenuation rate of sound presented below does not consider local landscape/topography or buildings, and therefore, is considered a "worst-case" scenario for sound levels produced by a single piece of equipment. The range of decibels anticipated for the Project's construction activities will be between 78 to 115 dBA (Handheld Air Tools).

Table 5.9: Attenuation of Construction Related Sounds

Case	Example Equipment Type	Sound Level @ 15 m (dBA)*	Point Source Sound Levels (dBA) at Incremental Distances					
			50 m	100 m	200 m	500 m	1,000 m	2,000 m
Minimum	Crane	78	67.5	61.5	55.5	47.5	41.5	35.5
Median	Pickup/ATV	96	85.5	79.5	73.5	65.5	59.5	53.5
Maximum	Handheld Air Tools	115	104.5	98.5	92.5	84.5	78.5	72.5

*Approximate point source sound levels, based on data collected in Table 10.7 above. Combined sound levels produced by multiple pieces of equipment operating simultaneously have not been included in the assessment.

Operational Sound

Operation sound generated by the Project is dependent on the make and model of turbines and equipment used in the Industrial Facilities. During maintenance programs, equipment similar to that used during the construction phase would present with similar sound profiles and attenuations. However, maintenance stage activities are anticipated to be shorter in duration and less frequent than construction related activities.

5.1.5 Potential Interactions

The expected potential interactions between the Project and atmosphere and air quality by Project phase (construction, operation and maintenance, and decommissioning) are presented in Table 5.10. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.10: Potential Project-Atmosphere and Air Quality Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X

Project Phase	Potential for Interaction
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	X
Turbine Operation	-
Water Withdrawal	-
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

Potential impacts to atmosphere and air quality as a result of Project activities include changes to air quality as a result of the release of fugitive dust and emissions.

Fugitive Dust

Fugitive dust emissions consist of PM and may be generated from open-air activities (e.g., moving earth/disturbing soil, wind erosion, increase in traffic). Fugitive dust emissions are composed mainly of soil minerals, but can also contain salt, pollen, spores, and tire particles. There are two forms of PM which pose the greatest concern for human health: PM with a diameter of 10 μm or less (PM_{10}) and PM with a diameter of 2.5 μm or less ($PM_{2.5}$). PM is measured by total suspended particulate (TSP) and is defined as the mass of airborne particles having a diameter of less than 44 μm.

When fugitive dust enters the atmosphere, it may potentially affect human health through decreased lung function and increased respiratory symptoms such as irritation of the airways, coughing, or difficulty breathing. People with underlying lung and heart disease, children, and the elderly are the most susceptible to particulate pollution exposure (US EPA, 2024).

Fugitive dust may also affect the environment through visibility impairment and environmental damage. Fugitive dust particles can be carried over long distances (via wind), deposited in other locations, and within surface water features. Particulate deposition may lead to damage to sensitive vegetation, if present in proximity to the dusting events (US EPA, 2024):

Anticipated sources of fugitive dust emissions from the Project will be primarily associated with the construction of the Project and may include the following activities:

- Soil disturbance during site preparation (i.e., clearing/grubbing, grading, blasting)
- Wind erosion from soil or rock stockpiles during grading
- Increase in traffic on roadways from travel by Project personnel (to/from the site)
- Management of on-site materials transfers (i.e., loading/unloading)

Emissions

Construction, operations, and maintenance of the Project may result in an increase in combustion residuals and/or exhaust tailpipe emissions, primarily PM, NO_x, SO_2, and CO from vehicles (i.e., travel by Project personnel, transport/delivery activities) and heavy equipment. Exhaust emissions are primarily anticipated to be associated with local roadways and roads developed for the Project within the Project Area. Limited emissions may occur during Project operations in instances where emergency backup power generation is required. All other flare stack emissions are predominantly oxygen and hydrogen (Section 2.6.1.7)

Shadow Flicker

The Project is anticipated to generate shadow flicker during periods when the above noted criteria is met. The setbacks from receptors, as outlined in Section 2.3, are designed to limit the potential for interactions between receptors and shadow flicker.

Sound

During short -term (less than 1 year) stages of the Project construction and decommissioning, decibel limits may exceed 45 dBA at residential receptors (Health Canada, 2023). Construction and decommissioning are considered a temporary source of noise generated by the Project. The setbacks from receptors, as outlined in Section 2.3, are designed to limit the potential for interactions between receptors and sound. Health Canada suggests mitigation when noise levels exceed 45 dba outdoors and 60 dba indoors (Health Canada, 2023).

5.1.6 Mitigation

Potential mitigation measures for fugitive (dust) emissions include:

- Conduct grading and site preparation in phases to minimize disturbed soil areas prior to construction in each area.
- Stabilize exposed soil surfaces by decreasing slope or using vegetation, stone, soil, or geotextiles to prevent dust and airborne particles.
- Enclose or cover soil storage and/or stockpile areas.
- Enclose or cover loads in trucks when hauling material that could generate dust or debris.
- Wet (with water) uncovered aggregate and soil stockpiles to control dust.
- Design storage areas and material stockpiles giving consideration to prevailing wind directions.
    - E.g., stockpiles with compact alignment along the dominant wind direction.
- Wet roadways and heavy traffic areas with water or dust suppressant technologies to minimize airborne emissions.
- Tie down, cover, and/or store loose site materials and/or products prior to inclement weather and wind events to prevent materials from becoming airborne.
- Minimize transfer of dirt to paved surfaces through mitigative measure such as trackout control mats, or washing down vehicles and equipment in designated areas using hoses and water to remove accumulated mud/dirt on undercarriages, tracks, or wheel wells.

Potential mitigation measures for exhaust emissions include:

- Ensure equipment meets all applicable provincial and air quality regulations and emissions standards.
- Ensure equipment is fueled using low-sulphur diesel (to reduce SO_x air emissions).
- Maintain engines and exhaust systems according to the manufacturer's specifications and the recommended maintenance schedule.
- Remove from service malfunctioning equipment and/or equipment generating excess amounts of smoke, odour, or noise until an assessment and necessary repairs can be completed.
- Restrict the idling of equipment where feasible.

Potential mitigation measures for shadow flicker include:

- Development of a complaint response protocol, which will consider complaints related to shadow flicker and outline a process to investigate these complaints. Mitigation to resolve complaints, if determined to be necessary, will be completed on a case-by-case basis in consultation with the affected landowner.

Potential mitigation measures for sound include:

- Use noise suppressants (e.g., mufflers) on vehicles/equipment.
- Ensure that industrial facilities and wind farm equipment is maintained in good working order.
- Limit vehicle idling.
- Conduct construction activities within the recommended daytime hours of 7:00 am to 10:00 pm.
- If geotechnical investigations determine blasting is required, additional mitigation and monitoring will be developed.
- Regular maintenance of turbines and industrial facilities equipment to ensure they are in good working order and continue to comply with sound level standards.

5.2 Climate Change

5.2.1 Overview

The objective of the climate change assessment was to collect the information necessary to assess potential interactions between the Project and greenhouse gases. This was accomplished using the following approach:

- Conduct a desktop review of greenhouse gases (GHGs) and potential sources.
- Evaluate the potential for Carbon Dioxide Equivalent (CO_2e) offsetting by the proposed Industrial Facilities.
- Use the information collected to identify potential Project interactions and inform possible mitigation measures.

5.2.2 Regulatory Context

The climate change assessment considered the following Acts and Regulations:

- *Canadian Environmental Protection Act*, S.C. 1999, c. 33
    - Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations, S.O.R./2010-201
    - Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations, S.O.R./2013-24
    - Ozone-depleting Substances and Halocarbon Alternatives Regulations, S.O.R./2016-137
- *Management of Greenhouse Gas Act, SNL 2016, c M-1.001*
    - Management of Greenhouse Gas Regulations, NLR 116/18
    - Management of Greenhouse Gas Reporting Regulations, NLR 14/17

Regulatory guidance was used to determine the appropriate assessment methodologies, mitigation controls, best management practices, and emissions targets.

5.2.3 Desktop Assessment Methodology

A desktop review for greenhouse gases and potential emission sources was completed using scientific literature and government documents. Additionally, a preliminary estimate of CO2e offsetting was generated using production estimates and emission factors.

5.2.4 Desktop Assessment Results

Greenhouse Gasses and Potential Emissions Sources

Climate change is a long-term alteration of weather patterns and conditions strongly impacted by changes in temperature and precipitation. While climate change typically involves changes in average climate conditions, it may also affect the variability of regional climates (ex. increased major storm activity). The main contributors to climate change are GHGs. GHGs may be natural or anthropogenic in origin, except halocarbons, which are solely anthropogenic (ECCC, 2019). Since GHGs disrupt the natural heat transfer processes within the Earth's atmosphere, a build-up of these gases has been shown to enhance the natural greenhouse effect. These human-induced enhancements are especially of concern since ongoing GHG emissions have the potential to warm the planet to levels that have yet to be experienced (ECCC, 2019).

The main GHGs of concern include:

- CO_2
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Halocarbons
- Water vapour

Carbon Dioxide

The primary sources of atmospheric CO_2 result from the burning of fossil fuels and deforestation/land clearing activities that release stored carbon. Changes to the concentration of atmospheric CO_2 can affect climate change through the greenhouse radiative effect and through impacts to plant physiology, with increased concentrations leading to decrease in plant transpiration (Cao et. al, 2009). This change in plant physiology at a broadscale can result in changes to temperature and water cycles caused by alterations to atmospheric water vapor and clouds.

Nitrous Oxides

The primary sources of Nitrous Oxides (NO_x) are related to the use of nitrogen-based synthetic fertilizers and manure. These sources have added significant amounts of reactive nitrogen to the Earth's ecosystems. Other contributors include the release of NO_x into the atmosphere during the combustion of fossil fuels and biomass (e.g., trees or wood-based fuels) and from some industrial sources (ECCC, 2019).

Methane

Methane is produced when fossil fuels and trees are burned with insufficient oxygen to complete combustion or through the anaerobic decay of organic solid wastes (ECCC, 2019). Approximately 40% of global methane is accounted for through natural processes, with wetlands being the largest natural contributor (Zhang et al., 2017).

Halocarbons

Halocarbons are a group of synthetic chemicals containing an element from the halogen group (e.g., fluorine, chlorine, and bromine) and carbon (ECCC, 2019). They are typically used in refrigerants, fire-extinguishing agents, solvents, foam-blowing agents, and fumigants (ECCC, 2013). There are various industrial sources, but the main contributor relates to the production of aluminum (US EPA, 2024).

Water Vapour

Water vapour is the most important naturally occurring GHG. Human activities do not directly influence the amount of water vapour in the atmosphere to any significant degree. Instead, the amount of water vapour in the atmosphere is a function of the atmosphere's temperature. The atmosphere can hold approximately 7% more water vapour for every additional degree Celsius in air temperature (NASA, 2022). As climate warming gases (i.e., CO_2, CH_4, NO_x) increase in the atmosphere, the temperature rise increases water evaporation from the Earth's surface and increases the atmospheric water vapour concentrations. This increased water vapour, in turn, amplifies the warming effect caused by the GHGs, resulting in the cycle repeating and temperatures continuing to rise (ECCC, 2019).

GHGs may be natural or anthropogenic in origin, except halocarbons, which are human-made (ECCC, 2019). The following subsections describe the GHGs and their contributors (sources) as anticipated during each phase of the Project.

Carbon Dioxide Equivalent

CO_2e is a measurement used to compare the emissions from various GHGs and their global-warming potential. According to the Canada Energy Regulator (2024), Newfoundland and Labrador's 2022 GHG emissions were approximately 8.6 $MTCO_2e$.

In normal circumstances, CO_2e emissions would result from the power generated to supply the hydrogen electrolysis (traditional methods of hydrogen production, such as Steam Methane Reforming, emit approximately 97 gCO_2e/MJ); however, as renewable energy resources from this Project will be supplying the hydrogen electrolysis, no direct CO_2 emissions will be generated (Timmerberg et al., 2020). Likewise, no direct CO_2 emissions are generated through the Haber-Bosch process, also utilizing renewable energy (Smith et al., 2020). Although the Project has the flexibility to supply green hydrogen directly to local or regional consumers, for this assessment, it is assumed that the full hydrogen production capacity will be utilized for green ammonia production for export to global markets.

Based on a life-cycle GHG perspective, a standard emission factor of 0.221 tCO_2/tNH_3 can be applied as a benchmark for green ammonia produced as described above (Liu et al., 2020). It should be noted that this emission factor cannot be used to determine direct GHG emissions produced from the Project, but rather as a comparison to conventional ammonia production pathways, which are substantially more carbon-intensive. This comparison can help demonstrate the Project's potential to contribute to global GHG reductions by displacing traditional, fossil fuel-based ammonia production with low-carbon green ammonia.

The ammonia will be shipped to Europe, where it will replace carbon-intensive, fossil-based conventional ammonia production processes. The benchmark ammonia production emission factor in the EU is 1.57 tCO_2e/tNH_3 (European Commission, 2021). This displacement of CO_2 therefore represents an 85% reduction in the total GHG emissions from the perspective of a life cycle assessment.

The anticipated maximum ammonia production capacity of 5,550 tonnes of ammonia per day would therefore reduce the emission of 2,479,158 tCO_2e annually. It should be noted that this assessment is based on a life cycle GHG emission factor. No direct GHG emissions are anticipated to be generated during the operation of the wind turbines, solar farm, or Industrial Facilities (Haber-Bosch process), except when using backup power systems, during regular inspection and maintenance, and intermittent flaring (if required). Operation and maintenance with respect to cost generally represents less than 3% of the total investment for wind, solar, and hydrogen production facilities (Timmerberg et al., 2020). Additionally, the above numbers do not account for the transport of ammonia between North America and Europe, however CO_2e for tankers is 5.9g/t-km (ICS, n.d.), giving a rough estimate of approximately 1,500 tCO_2e per voyage between the proposed facilities and Europe. Therefore, it is anticipated that emissions related to these activities would be minimal and represent low levels of direct GHG emissions throughout the Project's operational life.

5.2.5 Potential Interactions

The expected potential interactions between the Project and GHGs by Project phase (construction, operation, and decommissioning) are presented in Table 5.11. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.11: Potential Project - Climate Change Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	X
Turbine Operation	-
Water Withdrawal	-
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

The Project may have effects on Climate Change and GHG emissions during the construction, operation, and decommissioning stages.

During the construction and decommissioning phases of the Project, the Project may trigger requirements under the provincial *Management of Greenhouse Gas Act* if emitting more than 15,000 tonnes of GHG emissions. A detailed emissions inventory will be completed as part of an EIS. This emission inventory will include emission sources from the manufacturers of equipment, projected distances and equipment types, fuel consumption and published carbon coefficients. Shipping weights and CO_2factors will be incorporated into the calculation.

Carbon Dioxide

Site preparation will include several activities likely to produce CO_2, such as:

- Use of heavy equipment (excavators, dozers, cranes, etc.).
- Use of light-duty vehicles and equipment (pick-up trucks, light plants, generators, etc.).
- Land clearing, including the decay of cut foliage (which releases carbon dioxide slowly). Note that the removal of vegetated areas also reduces the carbon sequestration capacity of the site.
- Cement production - heating of the limestone releases CO_2 (ECCC, 2019).

During the operations phase, CO_2 emissions will be produced by light- and heavy-duty vehicles, diesel generators, and maintenance activities associated with off-site road maintenance. While the Project is currently not designed to connect to the provincial electrical grid, this option may be considered in the future to support backup power needs. In the absence of grid availability, backup electricity may be supplied by fossil fuel-based systems such as diesel generators, LPG, or combined cycle natural gas turbines. These systems would introduce additional direct GHG emissions, with the magnitude depending on the fuel type, operating hours, and generator efficiency.

Methane

The Project's construction and operation phase will rely on different light- and heavy-duty equipment, which are expected to produce methane emissions. In addition, methane may be generated through the decay of non-salvageable biomass associated with vegetation clearing and management activities.

Nitrous Oxides

The Project's construction phase will rely on different heavy- and light-duty equipment, which can contribute to NO_x emissions. While these sources may contribute to emissions, the primary contributor will likely relate to land restoration activities (i.e., soil amendments and reclamation) following construction and decommissioning. Overall, the production of NO_x in association with this Project is anticipated to be relatively minimal as the need for synthetic fertilizer and manure applications will be considered on a case-by-case basis.

During the operations phase, NO_x emissions will be limited to using light- and heavy-duty vehicles and equipment for material handling and transportation.

Halocarbons

The primary source of halocarbon emissions from the Project will be coolants in air conditioning units found in vehicles, portable construction buildings (i.e., trailers), Industrial facilities (i.e., office buildings), construction camps, and other small-scale equipment. Air conditioning units will be used during the Project's construction and operations phases. Fire-extinguishing agents (containing halocarbons) may also be used for the Project in the event of a fire-fighting emergency response.

5.2.6 Mitigation

Potential mitigation measures for GHG emissions include:

- Use locally sourced materials, where possible, to reduce CO_2, CH_4, and NO_x emissions associated with transport.
- Specify lower embodied carbon materials such as steel and concrete used in the Project components.
- Request environmental product declarations for major components.
- Incorporate the shortest construction/transport routes where possible to minimize the use of fossil fuels during construction.
- Recover and recycle construction and demolition/decommissioning waste, where possible.
- Recycle and compost workforce waste (i.e., food waste). Diverting this waste will reduce methane generated in landfills as it decomposes.
- Minimize deforestation during land clearing by only clearing the area that will be needed. This will reduce CH_4 and NO_x emissions associated with soil disturbance and limit the use of equipment (lowering emissions produced during equipment operations). This also has the added benefit of reducing loss of carbon sequestration potential.
- Plan construction activities to reduce the double handling of materials, reducing GHG emissions associated with heavy equipment operations.
- Use recycled or repurposed materials, where possible, to reduce GHG emissions associated with embodied energy (i.e., the energy associated with manufacturing a product or service).
- Ensure Project equipment meets all applicable provincial and air quality regulations and emissions standards.
- Maintain engine and exhaust systems according to the manufacturer's specifications and applicable maintenance schedule.
- Remove from service malfunctioning equipment or equipment generating excess amounts of smoke, odour, or noise until an assessment and necessary repairs can be completed.
- Ensure construction equipment with an improperly functioning emission control system is not operated.
- Ensure regular equipment maintenance is undertaken to maintain good operations and fuel efficiency.
- Ensure equipment containing coolant (i.e., air conditioning units) undergoes preventative maintenance and inspections (i.e., leak testing).
- Train Project personnel (as appropriate) in the proper disposal of halocarbon-containing substances.
- Hire from a local labour force to reduce emissions associated with workforce transportation.
- Dispose of halocarbon-containing substances at an approved hazardous waste facility per applicable regulations and in compliance with local requirements.

- Ensure trucks removing waste from or bringing materials to the Project are filled to the maximum allowable capacity where practical (dependent on the truck size and load weight) to reduce transportation requirements and limit the number of trips.
- Implement an anti-idling policy to limit GHG emissions from vehicles and equipment and limit the use of fossil fuels.
- Incorporate energy-efficient infrastructure (i.e., solar panels) where feasible to limit GHG emissions and the use of fossil fuels resulting from standard equipment (e.g., diesel-powered generators or light stands).

5.3 Geology and Hydrogeology

5.3.1 Overview

The objective of the geology and hydrogeology assessment was to collect the information necessary to assess potential interactions between the Project and geology and hydrogeology. This was accomplished using the following approach:

- Identify potential geological and hydrogeological features within the Study Area using desktop resources.
- Use the information collected to identify potential Project interactions and inform possible mitigation measures.

5.3.2 Regulatory Context

Management and protection of geological and hydrogeological features are provincially regulated in Newfoundland and Labrador. Legislation relevant to geology and hydrogeology includes:

- *Mineral Act*, RSNL 1990 c. M-12
  - Mineral Regulations, NLR 1143/96
- *Occupational Health and Safety Act*, RSNL 19990, C. O-3
  - Occupational Health and Safety Regulations, 2012, NLR 5/12
- Water Resources Act, S.N.L. 2002, c. W-4.01

5.3.3 Desktop Assessment Methodology

The assessment was completed through a review of the following resources:

- Aerial imagery and topography
- Newfoundland and Labrador Geoscience Atlas (Newfoundland and Labrador, n.d.-b)
- Newfoundland and Labrador Land-Use Atlas (Newfoundland and Labrador, n.d.-c)
- Well Logs Database (NLECC, 2008b)
- Water Resources Online Portal (NLECC, 2022)

5.3.4 Desktop Assessment Results – Geology

Surficial Geology

Surficial geology in the Study Area primarily consists of glacial till with areas of bedrock which is either exposed at surface or concealed by vegetation, as presented in Drawings 6, 7 and 8. Glacial till in the Project Area consists of unsorted to poorly sorted sediments ranging from clay to boulders. Glacial till, deposited by, or from, glacier ice with no significant sorting by water, exists as gullies, channels, knobs, mounds, and ridges at various thicknesses throughout the Study Area.

In TQK North, bedrock at or close to surface is primarily concealed with vegetation; however, in the central and southern portions of the Study Area there is a more balanced mix of exposed bedrock and bedrock concealed by vegetation. Small bog areas (i.e., poorly drained accumulations of peat, peat moss, and other organic matter) are present throughout the Study Area, though their occurrence is less frequent in the southern regions. Glaciofluvial deposits of fine-grained sand to coarse-grained cobbly gravel are present in small areas within the area of TQK North and to a lesser extent in the area of TQK South. Fluvial (i.e., silt and clay to bouldery gravel deposited by fluvial action), colluvial (i.e., coarse-grained bedrock derived materials at the base of steep rock faces transported by gravity) and/or marine (i.e., clay, silt, sand, gravel and diamicton deposited in marine environments) sediments have a minor presence throughout the Study Area.

Bedrock Geology

Bedrock geology within the Study Area consists of various volcanic and sedimentary rock units of Late Proterozoic age with volcanic intrusive rocks of Late Proterozoic to Cambrian age from the Avalon Tectonic Zone (Drawing 9 to 11). The Avalon Zone contains Late Proterozoic submarine and non-marine volcanic rocks and turbiditic, deltaic and fluviatile sedimentary rocks. These are overlain unconformably by a Late Proterozoic and Early Paleozoic shallow marine succession (Coleman-Sadd, et al., 1990).

TQK North

Bedrock geology within TQK North generally consists of fluviatile and shallow marine siliciclastic sedimentary rocks from the Musgravetown Group, submarine to subaerial volcaniclastic rocks with minor siliciclastic sedimentary rocks from the Love Cove Group, and granitoid (i.e., plutonic felsic igneous rock) intrusive rocks from the Swift Current Intrusive Suite, as shown on Drawing 9. Bedrock in this area also consists of subaerial volcanic rocks including siliciclastic sedimentary rocks from the Musgravetown Group, as well as mafic intrusive rocks and siliciclastic shelf sedimentary rocks towards the southern portion of the TQK North area (Coleman-Sadd, et al., 1990; Blackwood, et al., 1984).

TQK Central

Bedrock geology within TQK Central primarily consists of sandstone and shale turbidites from the Connecting Point Group and subaerial volcanic rocks including siliciclastic sedimentary rocks from the Musgravetown Group, as shown on Drawing 10. Bedrock in this area also consists of siliciclastic sedimentary rocks from the Musgravetown Group, plutonic mafic igneous intrusive rocks of the Powder Horn Diorite Complex and Early to Middle Cambrian aged shallow marine, mainly fine grained, siliciclastic sedimentary rocks of the Adeyton Group (Coleman-Sadd, et al., 1990; King, 1988).

TQK South

Bedrock geology within TQK South generally consists of sandstone and shale turbidites from the Connecting Point Group, as well as subaerial volcanic rocks including siliciclastic sedimentary rocks and fluviatile and shallow marine siliciclastic sedimentary rocks from the Musgravetown Group, as shown on Drawing 11. (Coleman-Sadd, et al., 1990; King, 1988).

5.3.5 Desktop Assessment Results - Hydrogeology

Groundwater Flow Conditions

Hydrostratigraphy

The hydrogeology of the Study Area is detailed in the report "The Hydrogeology of Eastern Newfoundland" by AMEC Earth and Environment (2013). This desktop study summarized the physical characteristics of major geological units in relation to groundwater occurrence, availability, and quality, utilizing provincial water well records for 11,665 drilled wells to categorize areas into hydrostratigraphic units. Analysis of the water well records allowed for the subdivision of surficial deposits into two hydrostratigraphic units and the identification of six bedrock hydrostratigraphic units. Groundwater yields varied significantly, from low (<1 litres per minute [L/min]) to high (>550 L/min), a variance that correlates with the encountered surficial deposits and bedrock types. Table 5.12 provides a summary of the hydrostratigraphic units defined in AMEC (2013) for the eastern Newfoundland region.

Table 5.12: Surficial Deposits and Bedrock Hydrostratigraphic Units in the Study Area

Hydrostratigraphic Unit	Lithology	Number of Wells	Well Yield Characteristics (L/min)		Well Depth Characteristics (m)	
			Average	Median	Average	Median
Surficial Deposits						
Unit A Moderate to High Yield	till	153	59	45	17	15
Unit B Moderate to High Yield	sand and gravel	148	54	36	19	17
Bedrock						
Unit 1 Low to Moderate Yield Siltstone and Shale Strata	siltstone, shale, with minor volcanic flows and tuffs	5,100	20	9	64	61
Unit 2 Low to Moderate Yield Sandstone and Conglomerate	sandstone, conglomerate, breccia, greywacke,	2,789	22	9	64	56

Hydrostratigraphic Unit	Lithology	Number of Wells	Well Yield Characteristics (L/min)		Well Depth Characteristics (m)	
			Average	Median	Average	Median
	with minor volcanic flows and tuff.					
Unit 3 Moderate Yield Cambro-Ordovician Sedimentary Strata	shale, siltstone, sandstone, with minor slate and limestone beds	1,694	29	14	54	44
Unit 4 Low to Moderate Yield Volcanic Strata	basic pillow lava, flows, breccia and tuff, with minor sedimentary rocks	1,819	25	9	67	61
Unit 5 Moderate Yield Plutonic Strata	granite, granodiorite, diorite and gabbro	95	31	14	69	64
Unit 6 Low to Moderate Yield Meta Volcanic Strata	Sericite & chlorite schist derived from felsic and mafic volcanic and sedimentary rocks; minor gneiss and migmatite	168	18	4	61	52

From AMEC (2013)

Several of these hydrostratigraphic units are present within the Study Area and are discussed further below. As the primary units occur in all three Study Area sections in varying proportions, the hydrostratigraphy is described for the full Study Area rather than by section.

In the Study Area surficial till deposits, which form a thin veneer less than 1.5 m thick over much of the area, are not considered a significant hydrostratigraphic unit due to their shallow thickness. Furthermore, sand and gravel deposits, localized and limited to stream and river channels, also do not represent an important hydrostratigraphic unit owing to their limited spatial extent.

Five primary bedrock hydrostratigraphic units are present in the Study Area, including:

- Unit 1 - comprising predominantly sedimentary siltstone and shale strata
- Unit 2 - comprising sedimentary sandstone and conglomerate
- Unit 3 - comprising mainly Cambro-Ordovician sedimentary shale, siltstone and sandstone
- Unit 4 - comprising volcanic rocks
- Unit 5 - comprising plutonic rocks (granite, granodiorite, diabase, and diorite intrusions)

Of these hydrostratigraphic units, Unit 5 is assessed as having the highest well yields in the Study Area and is described as having moderate well yield potential, with yields from 95 well records averaging 31 L/min (range: 0.5 L/min to 182 L/min) and well depths averaging 69 m (range: 9 m to 207 m). This unit makes up the majority of the southern portion of TQK North and the northern portion of TQK Central.

Unit 2 and Unit 3 are also reported as having moderate well yield potential. For Unit 2, 2,789 well records, show yields averaging 22 L/min (range: 0.3 L/min to 454 L/min), with well depths averaging 64 m (range: 12 m to 287 m). For Unit 3, 1,694 well records show yields averaging 29 L/min (range: 0.5 L/min to 591 L/min), with well depths averaging 54 m (range 7 m to 235 m. Unit 2 occurs in much of the northern portion of TQK North, and the southwestern extent of TQK South, and occurs locally in TQK Central. Unit 3 is limited to a small portion of TQK Central.

Both Unit 1 and Unit 4 are reported as having lower well yields than the other hydrostratigraphic units in the Study Area and are described as having low to moderate potential. For Unit 1, 5,100 well records indicate well yields averaging 20 L/min (range: 0.1 L/min to 546 L/min), with well depths averaging 64 m (range: 7 m to 220 m). For Unit 4, 1,819 well records indicate well yields averaging 25 L/min (range: 0.3 L/min to 455 L/min), with well depths averaging 67 m (range: 8 m to 228 m). Unit 1 is mainly present in TQK South and is locally present in the other two Study Area sections; while Unit 4 is a dominant hydrostratigraphic unit in all three sections.

Of the 5,100 well records for Unit 1, eight records representing local conditions within the Study Area are from Arnold's Cove and Southern Harbour (TQK South), drilled 1968-1997. These local well records indicate conditions in these specific areas with yields lower than the regional average for Unit 1, averaging 11.2 L/min and 53 m depth for these eight wells.

Of the 2,789 well records for Unit 2, 20 records representing local conditions within the Study Area are from Come By Chance (TQK Central), drilled 1969-1991. These local well records indicate conditions in this area with yields higher than the regional typical for Unit 2, averaging 48 L/min and 39 m depth for these 20 wells.

Of the 1,819 well records for Unit 4, 37 records representing local conditions within the Study Area are from Bellevue Beach, Chance Cove, and Fair Haven (TQK South), drilled 1969-2007. These local well records indicate conditions in these specific areas with yields lower than the regional typical for Unit 4, averaging 13 L/min and 58 m depth for these 37 wells.

Of the 95 well records for Unit 5, 51 records representing local conditions within the Study Area are from Swift Current and Goobies (TQK North), drilled 1970-2005. These local well records indicate conditions in these specific areas with yields lower than the regional typical for Unit 5, averaging 24 L/min and 64 m depth for these 51 wells.

None of the water wells defining the other regional hydrostratigraphic units are located in the Study Area.

No known hydraulic conductivity testing has been completed in the hydrostratigraphic units of the Study Area. However, these regional hydrostratigraphic units are defined by a wide variety of rock types, each with its own unique hydraulic properties. Consequently, the rocks in the Study Area are expected to display a broad range of hydraulic conductivity values, potentially differing by multiple orders of magnitude.

Groundwater Levels and Flow Directions

TQK North

Based on information from existing water wells, which indicates an absence of significant low-permeability layers (aquitards) directly overlying the water-bearing zones, the TQK North area is inferred to be underlain by a shallow, generally unconfined aquifer system contained within the mixed siliciclastic sedimentary, volcanic, and plutonic bedrock. The movement of groundwater within the bedrock is expected to mainly occur within secondary openings, such as fractures and joints, and will be variable depending on the frequency and interconnection of these structural features. Semi-confining to confining conditions may be present at depth due to an increase in lithostatic pressure resulting in fracture closure and reduced permeability of some rock types with depth.

Groundwater flow within TQK North is assumed to be primarily controlled by water table conditions and variations in topography. Based on a review of topographic maps, this means groundwater generally flows from higher-elevation recharge areas in the southcentral and southeast (where hydraulic head is higher) toward lower-elevation discharge areas (where hydraulic head is lower), following the regional topography. Major regional discharge features include the Pipers Hole River to the west and the Southwest River to the north. The shallow groundwater system is expected to be largely controlled by local recharge from precipitation and the presence of wetlands, ponds, rivers, and lakes within the sub-region serve as discharge points within this shallow system. Information from water well records for Swift Current and Goobies, suggests groundwater levels are generally within 7 m of the ground surface and are a subdued reflection of the topography in the area.

TQK Central

Based on information from existing water wells, which indicates an absence of significant low-permeability layers (aquitards) directly overlying the water-bearing zones, the TQK Central area is inferred to be underlain by a shallow, generally unconfined aquifer system contained within the siliciclastic sedimentary and plutonic bedrock. The movement of groundwater within the bedrock is expected to mainly occur within secondary openings, such as fractures and joints, and will be variable depending on the frequency and interconnection of these structural features. Semi-confining to confining conditions may be present at depth due to an increase in lithostatic pressure resulting in fracture closure and reduced permeability of some rock types with depth.

The direction of regional groundwater flow within this Study Area section is assumed to follow topography, which is generally from topographic highs along the interior portion of the region toward coastal areas to the east and the west from the interior. It is expected that the shallow groundwater system in the area will be largely controlled by surface runoff and local recharge, and wetlands, ponds, rivers, and lakes will serve as local discharge points. Information from water well records for Arnold's Cove, Come By Chance Southern Harbour and Sunnyside suggests groundwater levels are generally within 4 m of the ground surface and are a subdued reflection of the topography.

TQK South

Based on information from existing water wells, which indicates an absence of significant low-permeability layers (aquitards) directly overlying the water-bearing zones, the TQK South area is inferred to be underlain by a shallow, generally unconfined aquifer system contained within the siliciclastic sedimentary bedrock. The movement of groundwater within the bedrock is expected to mainly occur within secondary openings, such as fractures and joints, and will be variable depending on the frequency and interconnection of these structural features. Semi-confining to confining conditions may be present at depth due to an increase in lithostatic pressure resulting in fracture closure and reduced permeability of some rock types with depth.

The direction of regional groundwater flow within the Study Area section is assumed to follow topography, which is generally from topographic highs along the interior portion of the region toward coastal areas to the east and the west from the interior. It is expected that the shallow groundwater system in the area will be largely controlled by surface runoff and local recharge, and wetlands, ponds, rivers, and lakes will serve as local discharge points. Information from water well records for Bellevue Beach, Chance Cove, and Fair Haven suggests groundwater levels are within 12 m of the surface and are a subdued reflection of the topography.

Local Water Users

TQK North

TQK North's water supplies are predominantly derived from surface water sources. However, an assessment of the provincial Drilled Water Well Database (NLDEC, 2008) and a potable well search conducted by NLECC for this Project identified a total of 64 drilled or dug wells within a 2 km buffer of the sub-region. These wells, installed between 1970 and 2019, are situated immediately outside the Project area, specifically within the communities of Goobies and Swift Current. Of these, three wells in Swift Current serve as unprotected public water supplies, with the remainder being mainly private domestic wells.

TQK Central

TQK Central's water supplies are predominantly derived from surface water sources. However, an assessment of the provincial Drilled Water Well Database (NLECC, 2008b) and a potable well search conducted by NLECC for this Project identified a total of 44 drilled or dug wells within a 2 km buffer of the sub-region. These wells, installed between 1970 and 2010, are situated immediately outside the Project area, specifically within the communities of Arnold Cove Station, Come by Change, Southern Harbour and Sunnyside. All 44 of the reported wells in these communities are used as private domestic water supplies.

TQK South

TQK South's water supplies are predominantly derived from surface water sources. However, an assessment of the provincial Drilled Water Well Database (NLECC, 2008b)and a potable well search conducted by NLECC for this Project identified a total of 51 drilled or dug wells within a 2 km buffer of the sub-region. These wells, installed between 1969 and 2017, are situated immediately outside the Project area, specifically within the communities of Bellevue Beach, Chance Cove, and Fair Haven. Of these, five wells in Chance Cove serve as unprotected public water supplies, with the remainder being mainly private domestic wells in these communities.

Groundwater Quality

No known groundwater quality data exists directly for the Project Area. Therefore, the characterization of groundwater quality is based on a broader regional compilation of public drinking water well quality data for the Avalon region prepared by the NLECC (2024). This dataset is informed by public supply water well data from two communities located near the Project Area, Swift Current, and Chance Cove. Given the limited site-specific data available, groundwater quality characterization is presented for the Project Area as a whole, rather than being differentiated by sub-region. Public drinking water wells are sampled every two to three years to provide a representative overview of groundwater quality across the province. The summary of this Avalon Region dataset used for the current assessment includes data collected up to October 30, 2020.

A summary of groundwater quality data for Eastern Newfoundland is provided in Table 5.13 below.

Table 5.13: Summary of Provincial Public Water Well Groundwater Quality Data for Eastern Newfoundland

Parameter	Units	Number of Samples	Minimum	Maximum	Average	Median	GCDWQ[1]
Alkalinity	mg/L CaCO3	1,205	0	220	84.7	88	na
Color	TCU	1,206	0	119	3.34	1	15 (A)
Conductivity	µS/cm	1,205	43	1580	284.71	270	na
Hardness	mg/L CaCO3	1,205	0	282	75.47	75	na
pH	N/A	1,205	5.47	9.71	7.66	7.78	7.0-10.5 (A)
Total Dissolved Solids (TDS)	mg/L	1,206	0	1030	181.21	171	500 (A)
Turbidity	NTU	1,206	0	205	0.74	0.2	1 (C)
Boron	mg/L	1,209	0	0.2	0.02	0.02	5 (C)
Bromide	mg/L	1,206	0	1.03	0.02	0	na
Calcium	mg/L	1,209	0	103	23.61	23	na
Chloride	mg/L	1,206	3	405	31.51	22	250 (A)
Fluoride	mg/L	1,205	0	1.25	0.15	0.12	1.50 (C)
Potassium	mg/L	1,209	0	4	0.68	1	na
Sodium	mg/L	1,209	2	195	28.21	20	200 (A)
Sulphate	mg/L	1,206	0	116	11.87	10	500 (A)
Ammonia	mg/L	1,206	0	0.58	0.02	0	na
Dissolved Organic Carbon	mg/L	1,206	0	11.3	1.18	0.7	na
Nitrate +Nitrite	mg/L	1,206	0	3.37	0.29	0.06	10 (C)
Kjeldahl Nitrogen	mg/L	1,206	0	3.39	0.075	0.025	na
Total Phosphorus	mg/L	1,206	0	1.31	0.026	0.01	na
Aluminium	mg/L	1,209	0	0.86	0.03	0	2.9 (C)
Antimony	mg/L	1,123	0	0.004	0.0002	0	0.0060 (C)
Arsenic	mg/L	1,225	0	0.044	0.003	0.001	0.01 (C)
Barium	mg/L	1,210	0	1.66	0.05	0.02	2.0 (C)
Cadmium	mg/L	1,210	0	0.006	0	0	0.0070 (C)
Chromium	mg/L	1,209	0	0.1	0.001	0	0.05 (C)
Copper	mg/L	1,209	0	0.122	0.004	0.001	2.0 (C)
Iron	mg/L	1,209	0	6.35	0.08	0	≤ 0.1 (A)
Lead	mg/L	1,229	0	0.128	0.001	0	0.0050 (C)
Magnesium	mg/L	1,209	0	19	4.06	3	na
Manganese	mg/L	1,209	0	35.4	0.099	0.005	0.12 (C)
Mercury	mg/L	1,209	0	0.0021	0.00002	0	0.0010 (C)
Nickel	mg/L	1,209	0	0.006	0.0008	0	na
Selenium	mg/L	1,210	0	0.023	0.0004	0	0.05 (C)
Uranium	mg/L	1,122	0	0.02	0.0009	0	0.02 (C)
Zinc	mg/L	1,209	0	5.53	0.009	0	5 (A)

[1] Guidelines for Canadian Drinking Water Quality Summary Table (Health Canada, 2025)
na = No applicable criteria
mg/L = milligram per litre
µS/cm = microsiemens per centimeter
TCU = True colour units
NTU = Nephelometric Turbidity Unit
CaCO3 – Calcium carbonate
(A) – Aesthetic
(C) – Contaminant

Based on this regional public supply water well dataset, the chemical quality of groundwater in the Project Area is generally expected to meet the Guidelines for Canadian Drinking Water Quality (GCDWQ) established by Health Canada (2025). However, maximum reported concentrations indicate that several parameters—specifically colour, total dissolved solids, turbidity, chloride, arsenic, chromium, iron, manganese, and mercury—exceeded guidelines over the monitoring period in some sampled wells. These include wells located in the communities of Swift Current and Chance Cove, located near the Project Area. Notably, arsenic concentrations exceeded guidelines for several annual sampling events from 2006 to 2022 in the monitored Swift Current well, and iron and manganese concentrations exceeded guidelines for several annual sampling events from 2006 to 2024 in the monitored Chance Cove well.

5.3.6 Potential Interactions

The expected potential interactions between the Project and geology and hydrogeology by Project phase (construction, operation, and decommissioning) are presented in Table 5.14. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.14: Potential Project – Geology and Hydrogeology Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	-
Turbine Assembly, Erection, and Commissioning	-
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	-
Turbine Operation	-
Water Withdrawal	X
Inspection and Maintenance	-
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

Potential impacts to the geology and hydrogeology related to Project activities include the loss or change in surficial and bedrock geology, changes in groundwater quality and quantity, and modifications to the quantity and quality of surface water bodies from changes in groundwater baseflow.

Loss or Change in Surficial and Bedrock Geology

Changes in surficial and bedrock geology could occur during construction through blasting and earth works. The removal of overburden and rock, and replacement with other materials such as crushed stone and concrete may change the local geology and could have further reaching effects on habitat and water resources. Earthworks as part of decommissioning and rehabilitation may cause similar effects.

Change in Quality or Quantity of Groundwater

Construction activities, primarily blasting, have the potential to impact the quantity and quality of surrounding groundwater by altering the size, stability, and structure of bedrock aquifers. Changes in substrates from construction and decommissioning and rehabilitation activities can alter local hydrogeological flow regimes by changing infiltration rates and surface water flow patterns. Additionally, groundwater quality can potentially be impacted through the mobilization of different types and volumes of sediment.

Change in Quantity or Quality of Waterbodies

The withdrawal of surface water for PtX operations from groundwater recharge areas could decrease infiltration rates, thereby affecting groundwater levels and modifying hydraulic flow regimes. These alterations may result in changes to baseflow contributions to waterbodies located in discharge areas and affect water quality.

5.3.7 Mitigations

Potential mitigations for loss or change in surficial and bedrock geology include:

- Minimize areas of overburden and bedrock disturbance and removal.
- Carry out controlled blasting techniques carried out in accordance with provincial legislation and subject to terms and conditions of applicable permits.
- Manage excavated materials implanting through proper handling, storage, and disposal or reuse of excavated overburden and rock.

Potential mitigations for changes in groundwater quality and quantity:

- Develop and execute a monitoring program for nearby private and public water wells to protect users from Project-related impacts. The program will establish baseline water quality and quantity through pre-construction surveys and define clear trigger levels for action. A corresponding response plan will outline the specific investigation, notification, and mitigation measures to be followed if monitoring indicates a trigger level has been exceeded.

- Implement sediment and erosion control measures during construction to prevent the mobilization of sediment that could infiltrate into groundwater.
- Conduct groundwater monitoring throughout the construction and operational phases by installing a network of wells in strategic areas. Locations will be determined based on hydrogeological conditions and potential pathways to sensitive receptors. Data will be used to establish a baseline, detect any changes, verify mitigation effectiveness, and ensure regulatory compliance.

Potential mitigations for changes in waterbodies (via groundwater baseflow):

- Manage the rates and timing of water withdrawals to minimize drawdown in recharge areas and subsequent impacts on baseflow considering seasonal variations and ecological flow requirements.
- Monitor surface water temperatures, flows and levels in discharge areas to track changes that could be indicative of altered groundwater baseflow.
- Maintain appropriate buffer zones between construction and operation activities and sensitive groundwater recharge areas and surface water bodies.

5.4 Waterbodies and Watercourses

5.4.1 Overview

The objective of the waterbody and watercourse assessment was to collect the information necessary to assess potential interactions between the Project and waterbodies and watercourses. This was accomplished using the following approach:

- Identify watercourses and waterbodies within the Study Area using desktop resources.
- Use the information collected to identify potential Project interactions and inform possible mitigation measures.

5.4.2 Regulatory Context

Management and protection of waterbodies and watercourses are regulated both federally and provincially in NL. Legislation relevant to waterbodies and watercourses includes:

- *Canadian Navigable Waters Act. R.S.C., 1985, c. N-22*
- *Water Resources Act*, S.N.L. 2002, c. W-4.01
- *Fisheries Act, R.S.C.* 1985, c. F-14

The *Canadian Navigable Waters Act* R.S.C., 1985, c. N-22 protects navigation on all navigable waters in Canada that the public may use for travel or transportation, whether or not the water is on the list of Scheduled waters. The act separates works into two main groups; minor works and major works.

A minor work order allows for the following to be built if it meets the criteria for the applicable class of works, and may proceed without an application for approval, as long as they comply with the legal requirements:

- Erosion-protection works
- Aerial cables
- Submarine cables
- Buried pipelines
- Outfall & water intakes
- Dredging
- Watercourse crossings

A submission through the External Submission Site, publication of a public notice, and the CGC must be notified in writing 48 hours prior to the commencement of the Project for minor works.

An application is required for a major work, which includes:

- Aquaculture sites
- Bridges
- Causeways
- Works - water control structures
- Ferry cables

At the current state of the Project, it is not anticipated that the Project will interact with navigable waters.

The *Water Resources Act* S.N.L. 2002 c. T-6.2 requires an approval from NLECC prior to any alterations to a body of water. Therefore, it is necessary to understand what watercourses and water resources are present within the Study Area prior to development.

The *Water Resources Act* S.N.L 2002 c. T-6.2 defines a body of water as:

> "a surface or subterranean source of fresh or salt water within the jurisdiction of the province, whether that source usually contains liquid or frozen water or not, and includes water above the bed of the sea that is within the jurisdiction of the province, a river, stream, brook, creek, watercourse, lake, pond, spring, lagoon, ravine, gully, canal, wetland, and other flowing or standing water and the land occupied by that body of water".

Using this definition and the parameters listed in the Guidelines for Applying to Alter a Body of Water (Newfoundland and Labrador, 2018b), watercourses will be identified and described throughout the Study Area to support the description of fish habitat, and effects to regulated watercourses which may require provincial approval.

Although the *Water Resources Act* S.N.L 2002 c. T-6.2 also defines a body of water as "surface or subterranean", this section focuses on surface water features in the context of fish habitat provision.

The *Fisheries Act* protects fish and fish habitat within Canada. The *Fisheries Act* prohibits a work undertaking or activity that results in the harmful alteration, disruption, or destruction (HADD) of fish or fish habitat and the deposit of harmful substances into water frequented by fish, unless authorized.

The *Fisheries Act* defines a deleterious substance as:

> "(a) any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, or
> (b) any water that contains a substance in such quantity or concentration, or that has been so treated, processed or changed, by heat or other means, from a natural state that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water"

If an alteration to a watercourse or waterbody is required, a review under the DFO Request for Review process may be required.

The *Fisheries Act* and how it relates to the Project is further described in Section 5.5.

5.4.3 Desktop Assessment Methodology

A desktop review was conducted to identify mapped and potential waterbodies within the Study Area using the following sources:

- Provincial Land Cover (NLFFA, 2025d)
- Federal CanVec watercourse and waterbody shapefiles (NRCan, 2023).
- Local watersheds were identified using the provincial digital elevation model (DEM) (NRCan, 2024).
- Newfoundland and Labrador Land Use Atlas (Newfoundland and Labrador, 2025b).
- Newfoundland and Labrador Angler's Guide (DFO, 2025a).
- Protected water supplies were identified by reviewing the Water Resources Portal (NLECC, 2022).
- Previous baseline studies completed by GEMTEC (GEMTEC, 2024b)

Watersheds were derived using the provincial 5-meter DEM in ArcGIS Pro by first preprocessing the DEM to fill sinks, which removed depressions that could interfere with accurate flow modeling. A flow direction raster and flow accumulation raster were then derived to determine the direction of water flow from each cell and to highlight areas where flow converged. Streams were modelled, and stream order was derived, from the flow accumulation raster and restricted based on a review of streams visible in the province's aerial imagery. Pour points for the watershed were identified based on the intersection of the modelled streams and an outline of the island. These inputs were used to delineate watershed boundaries.

At crossing locations, aerial imagery was used to classify permanent and intermittent watercourses. Streams were assigned an initial classification based on the watershed area upstream of the crossing point and aerial imagery using methodology approved by DFO (T. Wight, personal communication, March 25, 2025). The classifications are presented below in Table 5.15.

Table 5.15: Stream Classification Criteria

	Stream Classification						
	Intermittent	Small			Intermediate		Large
	N	S1	S2	S3	I1	I2	L
Upstream Drainage Area from Water Crossing (km^2)	<2.6	2.6 - 50	50 - 100	200 - 500	500 - 1,000	1,000 - 10,000	>10,000

The results of this desktop review will be used to design the field surveys by identifying what proportion of the watercourses have to be field assessed using the following rationale (T. Wight, personal communication, March 25, 2025):

- N:
    - 100 % surveyed by aerial photography
- S1:
    - 100 % surveyed by aerial photography
    - 10% selected for ground survey with 50 m up and 100 m down study reach
- S2:
    - 100 % surveyed by aerial photography
    - 25% selected for ground survey with 50 m up and 100 m down study reach
- S3:
    - 100% surveyed by aerial photography
    - 50% selected for ground survey with 50 m up and 100 m down study reach
- I1:
    - 100% surveyed by aerial photography
    - 50% selected for ground survey with 50 m up and 100 m down study reach
- I2:
    - 100% surveyed by aerial photography
    - 50% selected for ground survey with 50 m up and 100 m down study reach
- L:
    - 100% surveyed by aerial photography
    - 100% selected for ground survey with 50 m up and 100 m down study reach

Physical attributes of the watercourses were characterized by reviewing aerial and satellite imagery at each crossing location. This included identifying the flow regime based on the stream classification, measuring stream width based on aerial imagery, identifying the dominant riparian vegetation, dominant substrate, and existing infrastructure (e.g. culverts, bridges, causeways). Dominant substrate was determined based on the riparian vegetation identified. According to correspondence with DFO, wetland riparian vegetation is typically associated with fine substrates, shrub riparian vegetation is associated with fine and coarse substrates, and treed riparian vegetation is associated with coarse substrates (T. Wight, personal communication, January 10, 2025).

5.4.4 Desktop Assessment Results

TQK North

Analysis of the CanVec waterbody and watercourse database and the Newfoundland Anglers Guide identified 1,471 watercourses intersecting TQK North. Nine watercourses are named: Southwest River, Red River, Northwest Brook, North Harbour River, Mother's Brook, Darby Creek, Black River, Piper's Hole River, and Black Brook. Southwest River and Piper's Hole River are the most prominent aquatic features. Southwest River flows in and out of the northeast portion of TQK North. Piper's Hole River flows along the southwest of TQK North, eventually flowing into Placentia Bay (Drawing 12).

TQK North intersects 8,741 waterbodies. Nine are named: Westermost Lake, Tug Pond, The Feeder, Sleigh Pond, Rocky Pond, Red Indian Lake, Island Pond, Frost Pond, and Black River Pond. The largest waterbody is Black River Pond, which is approximately 9,303.7 km^2.

There are three scheduled salmon rivers that fall within TQK North: Piper's Hole River, Black River, and North Harbour River. Piper's Hole River originates approximately 2.3 km west of TQK North. Black River and North Harbour River both originate within the southern portion of TQK North. All three scheduled salmon rivers flow south into Placentia Bay (Drawing 13).

The desktop classification of watercourse crossings within TQK North identified 793 watercourses at crossing locations (Table 5.16). No S3, I1, I2, or L crossings were identified.

Table 5.16: Summary of Watercourse Crossings in TQK North

	Location	Total	Intermittent (N)	Small (S1)	Small (S2)
Total # of Watercourse Crossings by Classification	TQK North	793	708	78	7

Based on the results of the desktop watercourse crossing classification and the rationale for field survey design, two S2 watercourses and eight S1 watercourses will be field assessed to meet the targets of 25% of S2 and 10% of S1 watercourse crossings selected for ground survey.

Three protected public water supplies are located on the boundary of TQK North (Drawing 13):

- Deep Bight River: Located in WS-S-0896, servicing Deep Bight, approximately 24.3 km^2
- Shoal Harbour River: Located in WS-S-0168, servicing Clarenville, Shoal Harbour, approximately 114.86 km^2
- Middle Brook: Located in WS-S-0000, servicing Middle Brook, Town of Port Blandford, approximately 54.55 km^2

Additionally, there are two protected public water supplies within 5 km of TQK North:

- Arch Cove Pond: 1.5 km south, located in WS-S0272, servicing Garden Cove, approximately 2.67 km^2
- Reservoir: 4.8 km east, located in WS-S-0602, servicing Queen's Cove, approximately 0.26 km^2

There are no anticipated impacts to protected public water supplies from the Project in TQK North.

TQK North falls within three fundamental drainage areas (ID; 403, 474, and 396). All three drain into the Atlantic Ocean (NLECC, 2022).

There are 19 local watersheds that Intersect TQK North (Table 5.17; Drawing 14a).

Table 5.17: List of Local Watersheds in TQK North

Local Watershed ID	Drainage Area (km^2)	Outfall
1	511,397.6	Piper's Hole River, into Placentia Bay
5	112,624.5	Shoal Harbour
6	88,523.2	North Harbour River into North Harbour and Placentia Bay
7	76,881.9	Come By Chance River into Placentia Bay
8	53,511.8	Ivanys Cove
9	46,840.4	Port Blandford
12	29,468.3	Placentia Bay
16	21,699.6	Northwest Arm
22	15,819.3	Northwest Brook into Ivany Cove
25	9,735.1	Goose Cove into Placentia Bay
38	4,730.5	Mooring Rock Cove into Placentia Bay
41	4,420.8	Swift Current into Placentia Bay
45	3,926.0	Deep Bight into The Bottom
56	2,003.1	Swift Current into Placentia Bay
71	766.7	Swift Current into Placentia Bay
73	681.5	Swift Current into Placentia Bay
76	596.1	Swift Current into Placentia Bay

Local Watershed ID	Drainage Area (km^2)	Outfall
104	212.8	Swift Current into Placentia Bay
153	79.3	Swift Current into Placentia Bay

TQK Central

Analysis of the CanVec waterbody and watercourse database and the Newfoundland Anglers Guide identified 787 watercourses in the Study Area. Eight are named: Neds Brook, Jacks Pond Brook, Halfway Bridge Brook, Eastern Brook, Come By Chance River, Brigades Brook, Blue Beach River, and Arnolds Cove Brook. Eastern Brook and Jacks Pond Brook are the most prominent watercourses in TQK central, both flow west into Placentia Bay (Drawing 15).

TQK Central intersects 530 waterbodies. Of the 530, 28 are named: Uncle Stevens Pond, Twillik Pond, Switch Pond, Stock Cove Gull Pond, Southern Pond, Siding Pond, Rushy Pond, Round Pond, Peddles Cove Pond, Little Mosquito Pond, Little Harbour Pond, Jim Hollis Pond, Jacks Pond, Island Pond, Happy Pond, Gull Pond, Goose Cove Pond, Freshwater Pond, Frenchmans Pond, Eastern Pond, Dam Ponds, Brigades Pond, Bottom Pond, Blue Beach Pond, Black Duck Pond, Big Pond, Big Musquito Pond, and Barasway Pond. The largest waterbody is Jacks Pond Brook, which is 1.57 km^2.

Come By Chance River is a scheduled salmon river that intersects TQK Central. The river flows south into Come by Chance and the greater Placentia Bay (Drawing 15).

The desktop classification of watercourse crossings within TQK Central identified 29 watercourses at proposed crossing locations (Table 5.18). No S3, I1, I2, or L crossings were identified.

Table 5.18: Summary of Watercourse Crossings in TQK Central

	Location	Total	Intermittent (N)	Small (S1)	Small (S2)
Total # of Watercourse Crossings by Classification	TQK Central	29	28	1	0

Based on correspondence with DFO, all watercourses within TQK Central should be field assessed as there are fewer than 50 expected crossings (T. Wight, personal communication, January 10, 2025).

There are three protected public water supplies that intersect TQK Central (Drawing 16):

- Butcher's Brook: Located in WS-S-0184, servicing Come By Chance, approximately 1.18 km^2
- Steve's Pond: Located in WS-S-0006, servicing Arnold's Cove, approximately 3.83 km^2
- Brigades Pond: Located in WS-S-0671, servicing Southern Harbour, approximately 1.71 km^2

Additionally, there is one protected public water supply within 5 km of TQK Central:

- Center Cove River: 2.1 km northeast, located in WS-S-0846, servicing Sunnyside, approximately 10.07 km^2

TQK Central falls within three fundamental drainage areas (ID: 459, 396, and 474). All three drain to the Atlantic Ocean (NLECC, 2022).

There are 51 local watersheds that intersect TQK Central (Table 5.19; Drawing 14b).

Table 5.19: List of Local Watersheds in TQK Central

Local Watershed ID	Drainage Area (km^2)	Outfall
7	76,881.9	Come By Chance River into Placentia Bay
11	32,860.4	Arnold's Cove into Placentia Bay
12	29,468.3i	Placentia Bay
19	16,871.4	Jack's Pond Brook into Arnold's Cove, then Placentia Bay
21	16,009.1	Rantem Pond into Rantem Harbour
28	9,088.9	Northern Brook
29	8,594.7	Come By Chance
32	7,180.2	Arnold's Cove
35	6,817.4	Little Southern Harbour
39	4,558.7	Otter Path
40	4,537.5	Little Southern Harbour
42	4,423.9	Sunnyside
43	4,246.3	Placentia Bay
44	3,955.8	Placentia Bay
46	3,783.0	Placentia Bay
47	3,733.1	Sunnyside
52	2,614.5	Placentia Bay
55	2,234.7	Big Mosquito Cove
57	1,934.0	Sunnyside
61	1,319.1	Brinson Cove
62	1,242.7	Little Mosquito Cove
64	1,101.4	Placentia Bay
65	1,079.1	Otter Path

Local Watershed ID	Drainage Area (km^2)	Outfall
68	1,009.6	Placentia Bay
69	915.2	Placentia Bay
70	820.5	Big Mosquito Cove
72	753.5	Placentia Bay
74	667.6	Placentia Bay
79	521.2	Placentia Bay
84	445.5	Long Beach Sunker
87	380.6	Come By Chance into Placentia Bay
89	369.5	Placentia Bay
93	318.8	Arnold's Cove
95	302.7	Luther's Point
98	292.4	Come By Chance into Placentia Bay
99	284.5	Placentia Bay
105	210.4	Placentia Bay
108	187.4	Come By Chance into Placentia Bay
109	180.4	Placentia Bay
116	159.9	Big Mosquito Cove
122	138.7	Placentia Bay
123	136.3	Placentia Bay
129	122.7	Come By Chance into Placentia Bay
133	114.3	Placentia Bay
134	109.3	Arnold's Cove
137	103.2	Placentia Bay
139	101.4	Arnold's Cove
140	100.3	Little Mosquito Cove
143	97.5	Little Mosquito Cove
149	89.4	Otter Path
158	69.1	Arnold's Cove

Initial baseline studies completed by GEMTEC in August 2024 included the assessment of 46 watercourses, which were selected based on anticipated interactions with infrastructure (GEMTEC, 2025b). Watercourses were identified using the CanVec 1:50,000 topographic data, aerial imagery, and published literature. Aquatic surveys were conducted in accordance with DFO standards for fish surveys outlined in Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers & Streams (Sooley et al., 1998). The following measurements were collected to support quantification of watercourse descriptions and for fish habitat assessments:

- Channel and wetted width (m)
- Bank height (m)
- Bank stability
- Water depth (cm)
- Velocity (m/s)

- Substrate composition
- Bank vegetation
- Habitat type
- Water quality (pH, dissolved oxygen (mg/L), temperature (°C), and specific conductivity (µS/cm)
- Notable features (dams, culvert, etc.)

Within TQK Central, seven of the 46 watercourses assessed remain within the Project Area (GEMTEC, 2025b). Preliminary results are summarized with the intention to describe general watercourse characteristics within the Project Area. Of the watercourses remaining within the Project Area, six watercourses were first order streams, and one was a second order stream. Channel widths ranged from 1.05 m to 9.75 m and depths ranged from 0.03 m to 0.30 m. The dominant substrates across the seven watercourses were bedrock, cobble, and gravel and the dominant habitat types were riffles and runs. The dominant riparian vegetation was shrub and coniferous forest (GEMTEC, 2024b).

TQK South

Analysis of the CanVec waterbody and watercourse database and the Newfoundland Anglers Guide identified 1,430 watercourses in the Study Area. Nine are named: Trinny Cove Brook, The Brook, Rattling Brook, Pumbly Cove Brook, Island Cove Brook, Hollis Cove Brook, Haddocks Brook, Duffy Brook, and Bungays Brook. Trinny Cove Brook is the longest watercourse and flows southwest into Placentia Bay (Drawing 17).

TQK South intersects 839 waterbodies. Of the 839 waterbodies, 87 are named (Drawing 17). The largest waterbody is Big Gull Pond, which is 40.90 km^2.

There are no scheduled salmon rivers that intersect TQK South.
The desktop classification of watercourse crossings within TQK South identified 117 watercourses at crossing locations (Table 5.20). No S3, I1, I2, or L crossings were identified.

Table 5.20: Summary of Watercourse Crossings in TQK South

	Location	Total	Intermittent (N)	Small (S1)	Small (S2)
Total # of Watercourse Crossings by Classification	TQK South	117	101	16	0

Based on the results of the desktop watercourse crossing classification and the rationale for field survey design, two S1 watercourses must be field assessed to meet the target of 10% of S1 watercourse crossings selected for ground survey. All watercourses will be characterized via aerial and satellite imagery. This includes flow regime, estimated width, dominant substrate, riparian vegetation, and any other relevant features.

There are two protected public water supplies that intersect TQK South (Drawing 18):

- Trout Pond: Chance Cove – potential surface water natural drainage area
- Unnamed Brook: located in WS-S-0047, servicing Bellevue Beach, approximately 0.27 km^2

Additionally, there are four protected public water supplies within 5 km of TQK South:

- Big Pond: 2.7 km east, located in WS-S-0045, servicing Bellevue, approximately 2.37 km^2
- Big Bakeapple Pond: 4.6 km east, located in WS-S-0731, servicing Thornlea, approximately 0.72 km^2
- John Newhooks Pond: 4.7 km east, located in WS-S-0863, servicing Norman's Cove-Long Cove, approximately 0.84 km^2
- Shingle Pond and/or Trout Pond: 0.7 km south, located in WS-S-0427, servicing Long Harbour-Mount Arlington Heights, approximately 3.42 km^2

TQK South falls within two fundamental drainage areas (ID: 459 and 396). Both drain to the Atlantic Ocean (NLECC, 2022).

There are 94 local watersheds that intersect TQK South (Table 5.21; Drawing 14c).

Table 5.21: List of Local Watersheds in TQK South

Local Watershed ID	Drainage Area (km^2)	Outfall
10	41,151.1	Broad Lake into Chance Cove
13	26,872.4	Trinny Cove into Placentia Bay
15	24,074.6	Placentia Bay
17	21,140.5	Placentia Bay
18	20,865.8	Placentia Bay
20	16,910.4	Placentia Bay
21	16,009.0	Rantem Pond into Rantem Harbour
23	14,292.1	Little Chance Cove
24	12,223.8	Davies Cove Head into Placentia Bay
26	9,706.6	Placentia Bay
27	9,663.6	Placentia Bay
30	8,155.1	Little Harbour East into Placentia Bay
31	7,253.5	Broad Lake into Chance Cove
33	7,150.8	Chance Cove
36	6,824.2	Broad Lake into Chance Cove
37	5,752.2	Placentia Bay
40	4,537.5	Rantem Harbour
44	3,955.8	La Manche Bay
46	3,783.0	Placentia Bay

Local Watershed ID	Drainage Area (km^2)	Outfall
48	3,345.5	Sailing Point
49	3,054.5	Placentia Bay
50	2,781.9	Chance Cove
51	2,783.4	Hollis Point, Placentia Bay
53	2,562.6	Placentia Bay
54	2,442.0	Broad Lake into Chance Cove
58	1,843.5	Sailing Point
59	1,589.9	Placentia Bay
60	1,471.6	Chance Cove
63	1,138.2	Placentia Bay
66	1,077.9	Placentia Bay
67	1,064.6	Placentia Bay
68	1,009.6	La Manche Bay into Placentia Bay
75	668.3	Broad Lake into Chance Cove
77	538.2	Placentia Bay
78	539.3	Placentia Bay
80	524.0	Placentia Bay
81	469.1	Broad Lake into Chance Cove
82	456.6	Placentia Bay
83	453.9	Placentia Bay
85	417.1	Placentia Bay
86	407.8	Hollis Point into Placentia Bay
88	374.6	Little Southern Harbour
90	370.6	Placentia Bay
91	335.6	Hollis Point into Placentia Bay
92	322.2	Hollis Point into Placentia Bay
94	306.0	Placentia Bay
96	302.1	Placentia Bay
97	297.7	Placentia Bay
100	267.1	Little Chance Cove
101	240.9	Placentia Bay
102	240.0	Placentia Bay
103	223.9	Little Chance Cove
106	206.3	Placentia Bay
107	200.8	Placentia Bay
110	174.1	Placentia Bay
111	168.6	Rantem Harbour
112	168.3	Broad Lake into Chance Cove
113	167.3	La Manche Bay into Placentia Bay
114	163.6	Placentia Bay
115	162.4	Placentia Bay

Local Watershed ID	Drainage Area (km^2)	Outfall
117	157.7	Placentia Bay
118	149.9	Broad Lake into Chance Cove
119	147.2	Placentia Bay
120	145.1	Hollis Point into Placentia Bay
121	140.8	Placentia Bay
124	136.2	Placentia Bay
125	133.2	Placentia Bay
126	130.0	Little Chance Cove
127	128.5	La Manche Bay into Placentia Bay
128	126.8	Sailing Point
130	122.0	Rantem Harbour
131	118.5	Placentia Bay
132	114.8	Placentia Bay
135	105.4	Placentia Bay
136	105.3	Placentia Bay
138	102.8	Placentia Bay
141	99.7	Placentia Bay
142	99.2	La Manche Bay into Placentia Bay
144	97.8	Placentia Bay
145	96.9	Placentia Bay
146	95.2	Placentia Bay
147	92.3	Placentia Bay
148	92.0	Placentia Bay
150	85.0	Placentia Bay
151	83.6	Placentia Bay
152	79.7	Little Chance Cove
154	79.7	Placentia Bay
155	77.2	La Manche Bay into Placentia Bay
156	76.6	Placentia Bay
157	73.6	Placentia Bay
159	65.9	Placentia Bay
161	65.4	Placentia Bay
162	64.3	Placentia Bay
163	62.4	Placentia Bay

Initial baseline studies completed by GEMTEC in August 2024 included the assessment of fish habitat in 46 watercourses, which were selected based on anticipated interactions with infrastructure. Within TQK South, six of the 46 watercourses assessed remain within the Project Area (GEMTEC, 2025b). Preliminary results are presented with the intention to describe general watercourse characteristics within the Project Area.

Five watercourses are second order streams, and one is a first order stream. Channel widths ranged from 1.05 m to 8.10 m and depths ranged from 0.05 m to 0.60 m. The dominant substrates across the five watercourses were boulder, rubble, and gravel and the dominant habitat types were riffles, pools, and runs across all watercourses. The dominant riparian vegetation was shrub and coniferous forest (GEMTEC, 2024b).

5.4.5 Potential Interactions

The expected potential interactions between the Project and waterbodies and watercourses by Project phase (construction, operation, and decommissioning) are presented in Table 5.22. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.22: Potential Project - Waterbodies and Watercourses Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	-
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	X
Turbine Operation	-
Water Withdrawal	X
Inspection and Maintenance	-
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

Potential impacts to waterbodies and watercourses as a result of Project activities could include altered hydrology, erosion and sedimentation, changes to water quantity, and changes to water quality.

Altered Hydrology

Altered hydrology may occur from alterations to waterbodies and watercourses during construction activities for the Industrial Facilities that alter the landscape, such as infilling, earthmoving, vegetation clearing, road construction, pipeline construction, and Industrial Facilities installation.

Alterations to channel morphology including altered substrate composition and interference with sediment transport can also result in watercourse degradation. Direct loss of watercourses due to the Industrial Facilities is also a possibility, depending on the location of the infrastructure and the associated impact to the catchment areas.

Erosion and Sedimentation

The mobilization of sediment within aquatic environments can cause shifts in ecological integrity, including changes to the plant species composition, the distribution of primary and secondary producers, and the habitat suitability for vulnerable species (Tilman et al., 1997). Erosion and sedimentation can occur throughout the lifecycle of the Project, including during construction efforts, routine road maintenance, daily traffic, and water management. However, the highest potential for these effects is related to the construction and upgrading of access roads, the installation or upgrading of crossing structures, and the construction of the Industrial Facilities. The alteration or removal of riparian vegetation can also result in bank instability and erosion.

Water Quantity

Changes to the amount of flow and size of catchment areas can alter channel morphology, increase flood potential, and disrupt habitat characteristics that support vulnerable species (MTO, 2009). These impacts could result from:

- Alteration of bank or channel grades for road development.
- The compaction of soil from the heavy machinery required for infrastructure construction.
- Alteration of channel beds to facilitate the removal and replacement of preexisting infrastructure (e.g., rusted culverts).
- Water withdrawal from nearby waterbodies.
- Effluent discharge into the surrounding environment.
- Placement of infrastructure that results in a change to the catchment area.

Water Quality

Water quality can be impacted through erosion and sedimentation within the watercourse or waterbody. The mobilization of sediment within aquatic environments can cause shifts in ecological integrity, including changes to the plant species composition, the distribution of primary and secondary producers, and the habitat suitability for vulnerable species (Tilman et al., 1997). Erosion and sedimentation can occur throughout the lifecycle of the Project, including during construction efforts, routine road maintenance, daily traffic, and water management. However, the highest potential for these effects is related to the construction and upgrading of access roads, the installation or upgrading of crossing structures, and the construction of the Industrial Facilities. The alteration or removal of riparian vegetation can also result in bank instability and erosion.

Changes in the quality of surface water can also arise from alterations to the surrounding environment and effluent discharge during construction and operation, which can cause an increase in water temperature from decreased shade, an increase in pollutants, changes in nutrient concentrations, and the mobilization of sediments (MTO, 2009).

5.4.6 Mitigation

Potential mitigation measures for waterbodies and watercourses include:

- Obtain approvals for all watercourse crossings and have crossings installed by a certified professional and designed to avoid any permanent diversion, restriction, or blockage of natural flow, such that the hydrological function of the watercourse is maintained.
- Maintain 30 m vegetated buffers surrounding waterbodies and watercourses, where possible.
- Develop a Surface Water Monitoring Plan to monitor changes in water quantity and quality.
- Complete a contributing drainage area assessment.
- Only conduct work in estuaries and main stems of scheduled salmon rivers on the island of Newfoundland between October 1 and April 30, outside the salmon migration period (May 1 to September 30).
- Only conduct work in tributaries and headwaters of scheduled salmon rivers between June 1 and September 30, outside the spawning, incubation, and hatching period (October 1 to May 31).
- Follow the Interim code of practice: end-of-pipe fish protection screens for small water intakes in freshwater. The code of practice provides guidance on the design, installation and maintenance of intakes for water withdrawals.
- Only conduct work in estuaries and main stems of brown trout rivers between December 1 and September 30, outside the brown trout migration period (October 1 to November 30) (DFO, 2019a).
- Revegetate along the watercourse edge and above the ordinary high-water mark to facilitate the stabilization of the area.
- Redesign existing watercourse crossings to facilitate habitat upgrades, including unblocking culverts and making waterways more conducive to fish passage.
- Plan construction activities to align with low flow periods, where possible.
- Maintain surface water flow via cross drainage culverts on access roads to any new and existing culverts.
- Leave riparian vegetation as intact as Project developments will allow.
- Integrate water management systems including diversion and collection ditches, roadside drainage channels, and stormwater retention ponds.
- Design any necessary alterations in a way that maintains the natural grade of a watercourse, to ensure the hydroperiod remains as it was pre-alteration.
- Fit any watercourse crossings with appropriately sized infrastructure, as prescribed by a certified professional.

- Integrate outlet protection features to dissipate flow velocities and decrease erosion at the outflow.
- Utilize vegetated swales for the phytoremediation of site runoff.
- Utilize rock material that is clean, coarse granular, non-ore-bearing, non-watercourse-derived, and non-toxic to aquatic life.
- Develop site-specific erosion and sedimentation control plans during the detailed design phase. Properly install, inspect, and repair erosion and sediment controls.
- Develop a spill response plan within the EPP to mitigate the impacts of spills, hazardous substances.
- Require that all fuels, lubricants, chemicals, and dangerous goods are stored in designated, adequately sized containers and are sited >30 m from a wetland or watercourse.
- Require that fuel storage areas, refueling and equipment lubrication are located a minimum of 30 m from any surface water.

5.5 Fish and Fish Habitat

5.5.1 Overview

The objective of the fish and fish habitat assessment was to collect the information necessary to assess potential interactions between the Project and the fish and fish habitat. This was accomplished using the following approach:

- Identify existing fish and fish habitat conditions within the Study Area using desktop resources.
- Use the information collected to identify potential Project interactions and inform possible mitigation measures.

5.5.2 Regulatory Context

Management and protection of fish and fish habitat are regulated both federally and provincially in Newfoundland and Labrador. Legislation relevant to fish and fish habitat includes:

- *Fisheries Act, R.S.C. 1985, c. F-14*
- *Species at Risk Act*, S.C. 2002, c. 29
- *Canadian Environmental Protection Act, S.C. 1999, c. 33*
- *Endangered Species Act*, S.N.L. 2001, c. E-10

The *Fisheries Act* defines fish as "(a) parts of fish, (b) shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and (c) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals;", and fish habitat as "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".

Section 34.4(1) of the *Fisheries Act* states that "No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish", and Section 35(1) states that "No person shall carry on a work undertaking or activity that results in the harmful alteration, disruption or destruction of fish or fish habitat".

Under Section 35(2) of the *Fisheries Act*, authorization may be granted for a proposed work, undertaking or activity that may, respectively, result in the death of fish or the harmful alteration, disruption, or destruction of fish habitat.

In NL, retention of Atlantic salmon is only permitted on scheduled rivers. Scheduled salmon rivers are explicitly named and listed in the Newfoundland and Labrador Fishery Regulations (Newfoundland and Labrador, 2018a). Correspondence with the DFO indicated that all scheduled salmon rivers that are anticipated to be directly or indirectly affected by the Project must be characterized.

5.5.3 Desktop Assessment Methodology

A desktop review for fish and fish habitat was completed using the following resources and databases:

- Aquatic Species at Risk Map (DFO, 2025b)
- Atlantic Canada Conservation Data Centre (ACCDC) Data Report (ACCDC, 2022a, 2022c)
- CanVec Database – Hydrographic Features (NRCan, 2023)
- Newfoundland and Labrador Land Use Atlas (Newfoundland and Labrador, 2025b)
- Government of Newfoundland Fisheries, Forestry, and Agriculture (FFA) GeoHub Aquaculture Licenses dataset (NLFFA, 2023)
- Scientific literature and government documents

The Aquatic Species at Risk Map (DFO, 2025b) is a federal database showing the distribution of aquatic SAR and their associated critical habitat within Canadian waters. The ACCDC is part of a network of NatureServe data centres and heritage programs that maintain records of rare flora and fauna species and habitat areas of ecological interest that exist within the majority of North and South America.

There is no publicly available database outlining fish species present in the Study Area. Therefore, government research and previous studies completed within the Study Area were reviewed for records of species present.

5.5.4 Desktop Assessment Results

TQK North

A review of the Aquatic SAR Map identified two potentially occurring SAR in TQK North within Piper's Hole River. Those species are spotted wolffish (*Anarhichas minor;* threatened) and northern wolffish (*Anarhichas denticulatus*; threatened). There are five additional species adjacent to TQK North that are classified as special concern or endangered. The species listed include fin whale (*Balaenoptera physalus;* special concern), blue whale (*Balaenoptera musculus*; endangered), north Atlantic right whale (*Eubalaena glacialis*; endangered), leatherback sea turtle (*Dermochelys coriacea*; endangered), and white shark (*Carcharodon carcharias*; endangered) (DFO, 2025b).

TQK North does not overlap with the habitat for the aforementioned species located adjacent to and within the Study Area, as those species occur offshore. Although the Aquatic SAR Map shows northern and spotted wolffish as potentially occurring in Piper's Hole River, there is no habitat present. Spotted wolffish and northern wolffish are found in water depths of 100 m to 800 m and 300 m to 1200 m, respectively (DFO, 2013).

TQK Central

A review of the Aquatic SAR Map identified seven SAR adjacent to TQK Central that are classified as special concern, threatened and endangered. The species listed include fin whale (special concern), blue whale (endangered), spotted wolffish (threatened), north Atlantic right whale (endangered), leatherback sea turtle (endangered), white shark (endangered), and northern wolffish (threatened) (DFO, 2025b).

TQK Central is not expected to overlap with the habitat for these species, as TQK Central is inland and coastal, whereas the aforementioned species occur in deeper waters offshore. Therefore, potential water withdrawal or discharge is not anticipated to impact aquatic SAR habitat.

TQK South

A review of the Aquatic SAR Map identified seven SAR adjacent to TQK South that are classified as special concern, threatened and endangered. The species listed include fin whale (special concern), blue whale (endangered), spotted wolffish (threatened), north Atlantic right whale (endangered), leatherback sea turtle *(*endangered), white shark (endangered), and northern wolffish (threatened) (DFO, 2025b).

Potential Fish Community

A review of the ESA identified habitat within the Study Area for two inland SAR:

- American eel *(Anguilla rostrata)*
- Banded killifish (*Fundulus diaphanous)*

While habitat was identified for these two SAR species, the ACCDC report did not identify any SAR or SOCC within 5 km of the Study Area (ACCDC, 2022a, 2022c). In total, 10 fish species are expected to occur within TQK North, Central, and South. These species are identified below in Table 5.23.

Table 5.23: Fish Species Potentially Present Within the Study Area

Species	Common Name	Habitat	Source	Species Status		
				SARA	ESA	COSEWIC
*Salmo salar**	Atlantic salmon – northeast Newfoundland population	Anadromous	(NLFFA, 2024b)	---	---	Not at Risk
*Salmo salar**	Atlantic salmon – south Newfoundland population	Anadromous	(NLFFA, 2024b)	---	---	Threatened
Gadus morhua	Atlantic Cod	Marine	(Robichaud & Rose, 2006)	---	---	Endangered
Salmo trutta	Brown trout	Freshwater or Anadromous	(Newfoundland and Labrador, n.d.-e)	---	---	---
Salvelinus fontinalis	Brook trout	Freshwater or Anadromous	Newfoundland and Labrador, n.d.)	---	---	---
Anguilla rostrata	American eel	Catadromous	Newfoundland and Labrador, n.d.)	---	Vulnerable	Threatened
Osmerus mordax	Rainbow smelt	Anadromous	Newfoundland and Labrador, n.d.)	---	---	---
Gasterosteus aculeatus	Threespine stickleback	Anadromous	Newfoundland and Labrador, n.d.)	---	---	---
Pungitius pungitius	Ninespine stickleback	Freshwater or Anadromous	(Newfoundland and Labrador, n.d.-d)	---	---	---
Fundulus diaphamus	Banded killifish	Freshwater	(Newfoundland and Labrador, 2001)	Special Concern	Vulnerable	Special Concern

*Northeast Newfoundland and south Newfoundland populations

Of the species identified in Table 5.203, Atlantic salmon and Atlantic cod are considered socio-economically valuable species that use coastal habitat in Placentia Bay as nursery grounds before migrating offshore (Robichaud & Rose, 2006).

Banded Killifish

Banded killifish are a euryhaline species that inhabit freshwater streams and lakes but can tolerate more saline environments. Their habitat preferences include clear, shallow slow-moving water with mud, sand, or gravel substrate and aquatic vegetation (DFO, 2018). Banded killifish live for 3-4 years, reaching 7-9 cm in length at maturity. Spawning occurs in the summer (late June to mid-August) when water temperatures are between 19-23°C (COSEWIC, 2014c). Currently there are only 10 known populations of banded killifish in Newfoundland, three occur in southeastern Newfoundland near Placentia Bay, however, all are outside the Study Area (DFO, 2018).

Banded killifish are listed as special concern under the SARA and COSEWIC and vulnerable under the ESA.

American Eel

American eel is a catadromous species, meaning individuals spawn in the ocean and mature in saltwater bays, estuaries, or freshwater rivers and lakes (COSEWIC, 2012). Juvenile American eels, referred to as "glass eels", are long, slender, and clear in appearance. As glass eels grow, they become pigmented and mature into elvers for 3-12 months, then develop into yellow eels for up to 30 years, and fully mature (i.e., silver eels) for 9-18 years (COSEWIC, 2012).

Marine habitat preferences include protected shallow waters containing submerged vegetation (e.g., eelgrass) and woody debris (COSEWIC, 2012). Freshwater habitat preferences include rivers and lakes with mud, sand, fine gravel, or cobble substrate for burrowing and woody debris. A recent laboratory experiment determined that American eels have a 26˚C upper thermal tolerance limit, indicated by heightened mortality rates, and the optimal temperatures for rearing ranged between 18–22˚C (Blakeslee et al., 2018).

American eel are listed as vulnerable under the NL ESA and threatened by COSEWIC.

American Eel have been historically captured in Northwest Brook and Piper's Hole River; these rivers are present in TQK North.

Atlantic Salmon

The south Newfoundland population of Atlantic salmon (*Salmo salar*) were identified as SOCC, listed as "Threatened" under COSEWIC but have no status under SARA (DFO, 2022a) or the ESA.

Atlantic salmon are an anadromous species, meaning individuals reside in salt water but spawn in freshwater. Atlantic salmon undergo their homing migration from May to August and spawn in the Fall (October–November) (DFO, 2020b). There are, however, some landlocked populations as well—locally known as ouananiche. Atlantic salmon spawning typically occurs in tributaries or main river headwaters, where there are riffles, and the stream bed is composed of gravel substrate (2-8 cm) with limited silt. Parr (young salmon) reside in freshwater for 2-4 years before migrating offshore.

Salmonids (i.e., Atlantic salmon and trout species) have low thermal tolerance thresholds compared to other fish species. The critical maximum temperature for Atlantic salmon aged 2+ is 24°C (i.e., low survival rates after 10 minutes at 25°C (DFO, 2012). Juveniles have a higher thermal tolerance threshold than mature fish, with a thermal optimum between 16 and 20°C and a critical temperature threshold at 30°C (i.e., low survival rates after 10 minutes exposure) (DFO, 2012). While in freshwater, parr feed on insects and insect larvae (COSEWIC, 2011).

Atlantic salmon have been historically captured in TQK North watercourses such as: Southwest River, Northwest Brook, North Harbour River, and Piper's Hole River. In TQK central, Salmon have also been caught in Come By Chance River. This list is based on local knowledge of the area and is not exhaustive of the other watercourses and waterbodies within TQK North, Central and South.

Atlantic Cod

Atlantic cod stocks in Placentia Bay and Fortune Bay area managed under Northwest Atlantic Fisheries Organization (NAFO) subdivision 3Ps (DFO, 2024d). Atlantic cod have historically been one of the most commercially fished species but entered in a moratorium that ceased commercial fishing in the early 1990s due to overfishing (DFO, 2024d). After 32 years, this moratorium was lifted after Northern cod scientific assessment changed the stock classification from "critical" to "cautious" (Robertson & Eddy, 2024).

Timing of spawning is variable (DFO, 2024d). Juveniles (age 0 to ~3) inhabit structurally complex nursery habitats in the coastal zone, such as eelgrass (*Zostera marina*) meadows, before migrating offshore (Gotceitas et al., 1997). Staging behaviour enables juvenile Atlantic cod to forage for food and develop, while providing refuge from predation risk. Juveniles predominantly feed on zooplankton then benthic and epibenthic species including other smaller fish as they mature (Scott & Scott, 1989). As Atlantic cod mature, they move offshore into more diverse habitats. 3Ps Atlantic cod reach sexual maturity at ages 4–6 (Scott & Scott, 1989).

Brook Trout

Brook trout (*Salvelinus fontinalis)* are targeted by recreational fisheries in Newfoundland. Brook trout are native to eastern North America, though brook trout have been introduced into other regions (Scott & Scott, 1989). Habitat preferences of brook trout include clear streams or lakes with gravel or rocky substrate, often with alder covered banks (Raleigh, 1982). Brook trout typically live up to 6-7 years and feed on insects, other fish, and invertebrates (MDNR, 2012). Although brook trout are an anadromous species, there are several populations that do not go to sea. Brook trout spawn in the fall, between September and November, in shallow streams with gravel substrates and occasionally in lakes (Raleigh, 1982).

Brook trout have been historically captured in TQK North watercourses such as: Southwest River, Northwest Brook, North Harbour River, and Piper's Hole River. In TQK central, Brook trout have also been caught in Come By Chance River. This list is based on local knowledge of the area and is not exhaustive of the other watercourses and waterbodies within TQK North, Central and South.

Brown Trout

Brown trout (*Salmo trutta*) are targeted by recreational fisheries in NL. Brown trout were introduced to Newfoundland in 1884 from a hatchery in Scotland for stocking purposes (Newfoundland and Labrador, n.d.-a). Presence of sea-run brown trout was confirmed in Placentia Bay (Westley et al., 2011). Brown trout occupy medium to fast flowing, silt-free streams with pools; however, brown trout habitat is typically warmer and more turbid than brook trout (Scott & Scott, 1989). Brown trout feed on other fish, insects and invertebrates (Westley et al., 2011).

Brown trout have been historically captured in Southwest River and Northwest Brook, located in TQK North.

Marine Environment

Placentia Bay is located along the western boundary of TQK Central and TQK South, and south of TQK North. The intertidal zones of Placentia Bay are rocky and dominated by rockweeds and knotted wrack (DFO, 2008). In subtidal areas, filamentous brown, green, and red algae, fucoids, and kelps are typically present (DFO, 2008). As water depth increases, kelp and short filamentous brown algae can be found sporadically (DFO, 2008).

In the coastal marine environment, there are several invasive species known to be present. The most prominent invasive species is European green crab (*Carcinus maenas*), but others include violet tunicates (*Botrylloides violaceus*), golden star tunicates (*Botryllus schlosseri*), and coffin box bryozoan (*Membranipora membranacea*).

European green crab were introduced to Newfoundland in 2007, and there are many confirmed occurrences within Placentia Bay, which is adjacent to the Study Area, presumably via vessel ballast water (DFO, 2023). Occurrences of European green crab correlated with a decline in eelgrass meadows and fish abundance in Placentia Bay. European green crab are generalists and can survive long durations in air, brackish water, and freshwater (DFO, 2023). Work, led by DFO and the Fisheries and Marine Institute of Memorial University, is ongoing to control the spread of European green crab in Newfoundland.

There are known eelgrass meadows within and adjacent to the Study Area, including meadows that are undergoing active restoration, monitoring, and stressor mitigation by the Fisheries and Marine Institute of Memorial University and the World Wildlife Fund Canada (DFO, 2024b). The World Wildlife Fund restoration site is located within TQK Central. All other sites appear to fall outside of the Study Area. These locations are located in Placentia Bay (Figure 5.1).

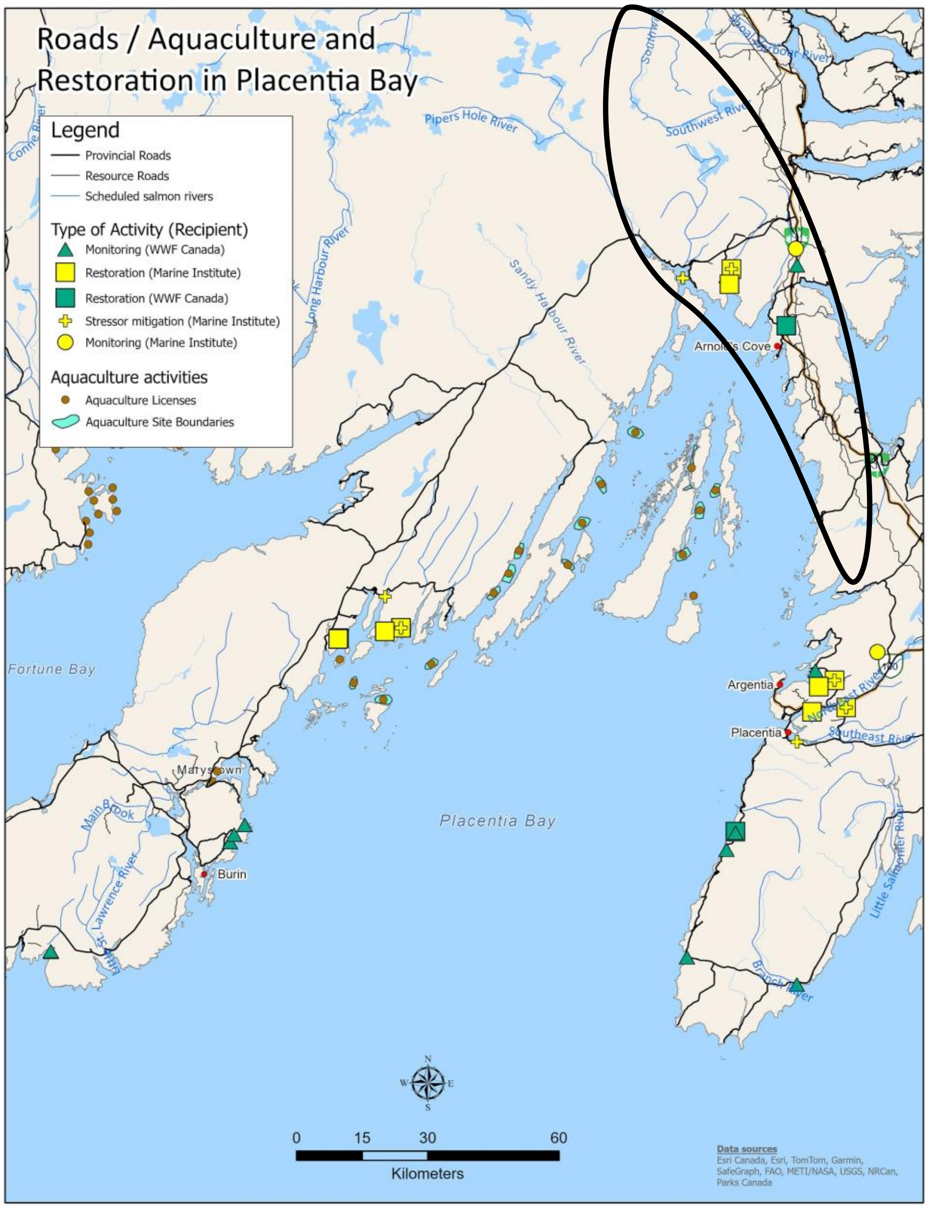


Figure 5.1: Map of Ongoing Eelgrass Restoration Programs in Placentia Bay, Newfoundland Reproduced (DFO, 2024b). The black outline is the approximate Project location.

Eelgrass meadows provide numerous ecosystem functions and services, including but not limited to assisting with sediment and nutrient deposition, serving as a nursery ground for social-economically valuable species (e.g., Atlantic cod, Atlantic salmon), and have high levels of primary production and nutrient storage, including carbon and nitrogen (Murphy et al. 2021; Prystay et al. 2023b). Eelgrass meadows in Placentia Bay have been declining since 2012, presumably due to the introduction of European green crab. Increasing European green crab abundance has corresponded with a 50% decline in eelgrass cover in Placentia Bay since 1998, and a 10 fold decline in fish abundance and biomass (i.e., shift in community structure and composition) (Matheson et al., 2016). In 2009, DFO designated eelgrass as an 'Ecologically Significant Species' in recognition that perturbations to eelgrass meadows would negatively affect other species and ecosystem functions (DFO, 2009).

Additionally, a map of known and potential eelgrass locations shows a location in Southern Harbour, which falls within TQK Central (Rao et al., 2014).

5.5.5 Field Assessment Methods

Fish Collection

GEMTEC completed baseline fish collection surveys at eight locations in August 2024. An open, single pass methodology was used. For each proposed road crossing location, a 100 m section was fished, including 50 m reaches above and below the point of crossing. Fish sampling was completed using backpack electrofisher (Smith Root, Inc. LR-24), under a Scientific Licence issued by DFO (NL-8423-24) (GEMTEC, 2025b).

Field methods followed those described in the Quantitative Electrofishing section (4.2.2) of Sooley et al.,(1998).

Surface Water Quality

Surface water quality was collected as part of pre-construction hydrology baseline studies conducted by GEMTEC in May and August 2024. The water quality locations fall within portions of TQK Central and TQK South (GEMTEC, 2025a). The surface water samples were analyzed for pH, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), general water chemistry (major ions, nutrients, hardness, conductivity, turbidity, and true colour), and metals. Results are compared against CCME water quality guidelines for the protections of freshwater aquatic life (FWAL) (CCME, n.d.).

From May 6 to May 8, 2024, surface water quality was collected at 18 locations. From August 4 to August 7, 2024, surface water quality was collected at 19 locations (GEMTEC, 2025a). Water quality locations fall within and adjacent to TQK Central and TQK North. No samples were collected in TQK South.

5.5.6 Field Assessment Results

Fish Collection

Pre-construction baseline studies were conducted by GEMTEC in 2024. Electrofishing resulted in the capture of American eel, brook trout, and Atlantic salmon (GEMTEC, 2024a). A summary of the electrofishing results is provided below:

- American Eel: A total of four American eel were captured at two sampling locations: 2024-ABO-WC-046 and 2024-ABO-WC-017.
- Brook Trout: A total of 357 brook trout were captured across all eight electrofishing locations within the Study Area.
- Atlantic Salmon: A total of 24 Atlantic salmon were captured at two locations: WC-AB-WC-016 and WC-ABO-WC-046, located within TQK Central and TQK South.

Surface Water Quality

A review of the surface water quality results from May and August 2024 for the hydrology program revealed that pH ranges from 5.87 to 7.41. The CCME FWAL guidelines establish that a range of pH from 6.5 to 9.0 is suitable within freshwater habitat (CCME, 1987). Kalff (2002) indicates that the loss of fish populations is gradual and depends on fish species, but decline is evident when pH is <6.5. Kalff (2002) further states that a 10 to 20% species loss is apparent when pH <5.5. The pH values for water samples collected were outside of the suitable range at two locations in August 2024and all 19 locations in May 2024.

Regarding Brook trout, the species is known to tolerate acidic conditions particularly well, compared with other species. They have been known to survive at pH 4.5, though only in unusual circumstances (MDNR, 2012). American eel are also more tolerant of low pH than are many other species, although densities and growth rates may be adversely affected by direct mortalities or declining abundance of prey as productivity declines at low pH (Reynolds, 2011). Atlantic salmon can tolerate pH values as low as 5.5 (MDEP, 2022).

Total iron concentrations exceeded the CCME FWAL guidelines for long-term exposure (300 µg/L), in four locations. There were no other exceedances.

5.5.7 Potential Interactions

The expected potential interactions between the Project and fish and fish habitat by Project phase (construction, operation, and decommissioning) are presented in Table 5.24. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment, the Project description and DFO Pathways of Effects (DFO, 2024c). This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.24: Potential Project - Fish and Fish Habitat Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	-
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	X
Turbine Operation	-
Water Withdrawal	X
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

The Project may have effects on fish and fish habitat during the construction, operation, and decommissioning stages. These effects may result in habitat loss, changes in water quality, changes in fish habitat availability, altered fish community composition, and changes to fish health and survival.

Habitat Loss

Changes to fish habitat are expected to occur through construction activities requiring work in or near water and infrastructure placement for the Industrial Facilities. Habitat selection varies depending on life history stage and season. For instance, deep pools may serve as overwintering habitat, whereas shallow, low flowing runs with gravel substrate may serve as spawning habitat for salmonids. Such channel characteristics (i.e., pool, riffle, run) are dependent on water velocity and substrate. Alterations to habitat quality and quantity can occur due to construction-related activities that alter substrate composition, aquatic vegetation, water flow, water quantity, and water physio-chemical properties (e.g., temperature, salinity, pH) such as culvert installation and construction of the Industrial Facilities.

Operation-related activities such as water withdrawal and Industrial Facilities operation may also result in changes to fish habitat quality and quantity due to erosion and sedimentation, altered hydrology, and wastewater discharge. These impacts may result in a loss of suitable habitat for fish species within the Study Area.

Changes in Water Quality

Changes to riparian habitat may occur at stream crossings for access roads and the Industrial Facilities, which could result in bank and slope instability and exposed soils, thus altering water velocity and flow direction over time, resulting in increased erosion and sedimentation (DFO, 2024c). The mobilization of sediment within aquatic environments can cause shifts in ecological integrity, including changes to the plant species composition, the distribution of primary and secondary producers, introduction of deleterious substances, and the habitat suitability for vulnerable species (DFO, 2024c; Tilman et al., 1997).

Changes to canopy cover can also lead to changes to water temperatures or turbidity, due to a decrease in stream shade and increase in exposure to wind and mixing. Temperature changes can alter fish physiological stress, pathogen virulence, and dissolved oxygen (Volkoff & Rønnestad, 2020). Changes to water turbidity can alter light penetration and instream vegetation, which are important for primary productivity, may contribute to regulating water velocity, and contribute to nutrient cycling in aquatic systems.

Accidents and malfunctions near fish habitat may result in the introduction of fuel and other deleterious substances, which leads to a decrease in water quality.

Changes in water quality may result in direct or indirect impairment of the habitat's capacity to support one or more life processes of fish, resulting in sublethal or lethal effects (DFO, 2024c).

Change in Fish Habitat Availability

Changes to the amount of surface water through altered groundwater flow and alteration of land drainage patterns can lead to changes to channel morphology, such as a change or loss of wetted area. Other effects of changes in flow include increased flood potential, change or loss of fish passage, and disruption of habitat characteristics such as structure, cover, and food supply (DFO, 2024c; MTO, 2009). These impacts could result from the alteration of catchment area grades for road development, loss of catchment area from Industrial Facilities development, water withdrawal, and wastewater discharge, or the redirection of overland flow via roadway construction.

Altered Fish Community Composition

Changes to fish community composition can occur during construction activities that require in-water work (e.g., culvert installation) and activities that alter the local environment in and around fish habitat, such as construction of the Industrial Facilities. Changes to fish habitat could influence fish species distribution in the landscape due to changes in water quality, predation refuge, and habitat suitability for different life history stages. Changes to access facilitated by new roads could increase fishing effort in the region, and potentially alter community composition, erosion, and local pollution (e.g., garbage dumping). Lastly, moving equipment between aquatic habitats may result in introducing non-native species into the habitat.

Fish Health and Survival

Changes to fish health and survival can occur during operation activities involving water withdrawal and work in water for culvert installations. Water withdrawal and work in water may result in dewatering of downstream areas, obstruction of fish passage, or impingement of fish on pump screens (DFO, 2024c).

At the time of the EAR submission, these interactions are noted as possible, not probable. Analysis will be completed to support the EIS with TQK relating to the potential for changes to fish health and survival as the Project description is more fulsomely defined and as impacts are better understood.

5.5.8 Mitigations

Potential mitigation measures to prevent effects to fish and fish habitat include:

- Maintain 30 m vegetated buffers surrounding wetlands and watercourses, where possible.
- Develop a site-specific erosion and sedimentation plan during the detailed design phase.
- Redesign existing watercourse crossings to facilitate habitat upgrades, including unblocking culverts and making waterways more conducive to fish passage.
- Integrate water management systems including diversion and collection ditches, roadside drainage channels, and stormwater retention ponds.
- Design any necessary alterations in a way that maintains the natural grade of a watercourse, to allow fish passage.
- Integrate outlet protection features to dissipate flow velocities and decrease erosion at the outflow.
- Utilize vegetated swales for the phytoremediation of contaminated runoff.
- Utilize rock material that is clean, coarse granular, non-ore-bearing, non-watercourse-derived, and non-toxic to aquatic life.
- Educate Project personnel on the sensitivity of aquatic habitat.
- Only conduct work in estuaries and main stems of scheduled salmon rivers on the island of Newfoundland between October 1 and April 30, outside the salmon migration period (May 1 to September 30).
- Only conduct work in tributaries and headwaters of scheduled salmon rivers between June 1 and September 30, outside the spawning, incubation, and hatching period (October 1 to May 31).
- Only conduct work in estuaries and main stems of brown trout rivers between December 1 and September 30, outside the brown trout migration period (October 1 to November 30) (DFO, 2019a). Plan any activities within the bed of a watercourse or along the banks of a watercourse to align with low-flow periods, where possible.
- Complete a fish rescue, as required, prior to construction.
- Develop a spill response plan within the EPP to mitigate the impacts of spills, hazardous substances.

- Ensure water pumps are designed to avoid fish entrainment or impingement as described by DFOs Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater (DFO, 2020a).

5.6 Vegetation and Habitat

5.6.1 Overview

The objective of the vegetation and habitat assessment was to collect the information necessary to assess potential interactions between the Project and habitat and terrestrial flora. This was accomplished using the following approach:

- Use publicly available information to identify habitat types within the Project and Study Area through the development of a vegetation community model
- Identify potential SAR/SOCC terrestrial flora within the Study Area and Project Area using desktop resources
- Use the information collected to identify potential Project interactions and inform mitigation measures

5.6.2 Regulatory context

Management and protection of vegetation and habitat are regulated both federally and provincially in Newfoundland and Labrador. Legislation relevant to terrestrial flora and their habitat includes:

- *Species at Risk Act*, S.C. 2002, c. 29
- *Canadian Environmental Protection Act, S.C. 1999, c. 33*
- *Endangered Species Act*, S.N.L. 2001, c. E-10
- *Environmental Protection Act*, S.N.L. 2002, c. E-14.2
- *Forestry Act*, R.S.N.L. 1990, c. F-23
- *Wilderness and Ecological Reserves Act*, R.S.N.L 1990, c. W-9

For species designated as rare or at risk, individual species and/or their dwellings are provided federal protection under SARA. Provincially, species designated as endangered, threatened or vulnerable are provided protection under the NL ESA.

5.6.3 Desktop Assessment Methodology

A desktop review was conducted to identify habitat types present, key areas of interest, and potential SAR/SOCC terrestrial flora species within the Project Area and Study Area. Several datasets and resources were reviewed to inform the vegetation community surveys, including:

- Newfoundland and Labrador land use atlas (Newfoundland and Labrador, 2025b)
- Fisheries, Forestry and Agriculture land cover database (NLFFA, 2025d)
- Newfoundland ecoregions dataset (NLFFA, 2025b)
- ACCDC data reports (ACCDC, 2022c, 2022b, 2022a)
- Provincial Aerial Imagery
- Government and other documents cited herein

A vegetative community model (VCM) was developed from the NLFFA Land Cover database. The VCM is a simplified ecological land classification (ELC) model based on present vegetation and hydrologic conditions. The purpose of defining the vegetation communities within the Study Area was to determine what communities are present, what habitats and species they can support, and if unique or rare habitats are present (i.e., areas to target during future biophysical surveys).

SAR/SOCC terrestrial flora species potentially occurring within the Study Areas were identified using the VCM and ACCDC reports (Appendix C). Their potential occurrence, and that of other potential terrestrial flora SAR/SOCC, within the Project Area will be further assessed during future field studies and will be reported on during the EA process.

5.6.4 Desktop Assessment Results

Ecoregions

The Study Area is located in two of the nine Newfoundland ecoregions: the Maritime Barrens ecoregion and the Central Newfoundland Forest ecoregion (Drawing 19). Within the Maritimes Barren ecoregion it occupies the Southeastern Barren and Central Barrens subregions and within the Central Newfoundland Forest ecoregion, the Project overlaps the Northcentral sub region (Table 5.25).

Table 5.25: Ecoregion within the Study Area

Study Area Section	Ecoregion	Subregion	Characteristics
TQK North	Maritime Barrens	Southeastern Barrens	• Dominated by balsam fir (*Abies balsamea*) interspersed with extensive open heathland. • Forest productivity is highest on long slopes occurring in infrequent valleys. • History of frequent, anthropogenically caused, wildfire. • Soils mainly composed of two types: ferro humic podzols, which occur in humid areas and have a high organic content; and humo ferric podzols, which occur on drier sites and contain mostly inorganic material.
		Central Barrens	• Bogs and fens occur regularly throughout this subregion, though domed bogs become more common than in the rest of the Maritime Barrens. • Scarce forested areas due to widespread fires that occurred following European colonization. • Highly competitive dwarf shrub species dominate the landscape, such as sheep laurel (*Kalmia angustifolia*), lowbush blueberry (*Vaccinium angustifolium*), and rhodora (*Rhododendron canadense*). • Soils are mainly humo ferric podzols.
TQK Central/ TQK South	Central Newfoundland Forest	Northcentral	• Largest of the central Newfoundland forest subregions. Gently rolling terrain with hills ranging from 150-200m above sea level. • Bogs are common, though with a distinct absence of dwarf huckleberry (*Gaylussacia bigeloviana*) and black huckleberry (*Gaylussacia baccata*) as is found in other subregions. • High forest fire frequency and warm summers, with black spruce (*Picea mariana*), white spruce *(Picea glauca)*, and trembling aspen (*Populus tremuloides*) occurring alongside dwarf-shrub heathland – these commonly dominated by sheep laurel. • Majority of soils found in this subregion are humo ferric podzols.

Source: (PAANL, 2008a)

Central Newfoundland Forest

Covering the majority of north-central Newfoundland, the Central Newfoundland Forest is the second largest ecoregion on the Island of Newfoundland (PAANL, 2008a). This ecoregion is the most continental part of the island and experiences cool summers and short, cold winters. It has a mean annual temperature of 4.5°C and a winter to summer range from -3.5°C to 12.5°C (CCEA, n.d.-a). Annual mean precipitation ranges from 1000 mm to 1300 mm. Forests here are dominated by closed, intermediate to low stands of balsam fir and black spruce on steep, moist, upland slopes. In disturbed areas, paper birch, aspen, and black spruce are predominant. The surficial geology in this region is dominated by hummocky to ridged, sandy morainal deposits with slopes that can range from 5 to 30% slope and are associated predominantly with humo-ferric podzols (CCEA, n.d.-a).

Central Newfoundland Forest – Northcentral subregion

The North-central Subregion encompasses approximately 83% of the Central Newfoundland Forest (PAANL, 2008a). Climate in the ecoregion is typified by highest summer and lowest winter temperatures, with the least amount of wind and fog of any of the ecoregions. Terrain of the subregion consists primarily of rolling hills with elevations ranging from 150 m to 200 m above sea level. There are four distinct geological zones in the subregion providing for diverse and varied geology. Forests are densely vegetated and dominated by black spruce (*Picea mariana*) and white birch (*Betula papyrifera*) due to the low rainfall and high fire-cycle (PAANL, 2008a). Domed bogs are commonly found across the landscape, but distinctive from neighbouring ecoregions, plants such as dwarf huckleberry (*Vaccinium cespitosum*) and black huckleberry (*Gaylussacia baccata*) are absent from the North-central subregion (PAANL, 2008a).

Maritime Barrens

Influenced by the Atlantic Ocean, this boreal ecoregion extends from the uplands of southern Newfoundland to the Long Range Mountains. It is dominated by foggy, cool summers with short winters, moderate along the coast and becoming colder moving inland (CCEA, n.d.-b). The mean temperature ranges from -1.1°C in winter to 11.5°C in the summer. It can experience a mean precipitation range of 1200 mm to over 1600 mm. The surficial geology of this region is primarily composed of rolling to hummocky, sandy morainal deposits as well as humo-ferric podzols. It is dominated by balsam fir stands that occasionally become replaced by stands of black

Maritime Barrens - Southeastern Barrens subregion

The Southeastern Barrens subregion's characteristic feature is exposed bedrock and extensive barrens, covering most of the central portions of the Avalon Peninsula (PAANL, 2008c). Small forest stands, dominated by balsam fir (*Abies balsamea*) scattered with yellow birch (*Betula alleghaniensis*) and with an understory of mosses occur in sheltered areas and valleys. Historically, the ecoregion was forested but logging and fires combined with strong winds, lack of protective snow cover and frequent fog resulted in a transition to dwarf shrub species such as mountain alder (*Alnus incana*), sheep laurel (*Kalmia angustifolia*), purple-flowering rhodora (*Rhododendron canadense*), larch (*Larix decidue*), dogberry (*Sorbus decora*), and mountain holly (*Ilex mucronata*) (PAANL, 2008c).

Maritime Barrens - Central Barrens subregion

The Central Barrens subregion is in the south-central portion of the island between the northern forests and the south coast barrens. It is one of the coldest ecoregions in winter but has less fog and wind due to its more interior location and has warmer summer temperatures (PAANL, 2008b). Bogs and fens are common with more domed bogs than are seen in the other subregions of the Maritime Barrens. Most of the subregion is covered by glacial ground moraine scattered with boulders deposited by glacial action. Lakes and ponds are common. Like other subregions, fire and climate have transformed a landscape once dominated by forest to one now dominated by dwarf shrubs including stunted balsam fir, sheep laurel, low bush blueberry (*Vaccinium angustifolium*), rhodora, dogberry, mountain holly, and larch. In forested areas, balsam fir and black spruce are common with an understory of mosses (PAANL, 2008b).

Habitat Classification

Analysis of VCM classes within the Study Area sections of TQK North, TQK Central, and TQK South examined both the proportion and total area of habitat coverage within the Study Area. The VCM demonstrated a mix of habitat classes throughout TQK North, TQK Central, and TQK South (Drawings 20, 21, and 22, Table 5.26).

As expected of the Maritime Barrens ecoregion, TQK North is largely composed of wetlands and coniferous scrub, with those two habitat classes composing almost 70% of that Study Area section. Barrens and softwood forest are present to a lesser extent. Comparatively, TQK Central and TQK South have a larger variety of habitat classes compared to TQK North. TQK Central has proportionately the most coniferous scrub of all three Study Area sections, and also has large coverage of mixedwood forests, softwood forests and wetlands. TQK South has proportionately the highest coverage of barrens of all three Study Area sections, with large areas of coniferous scrub, mixedwood forest, softwood forest and wetlands. Additionally, TQK south has proportionately more waterbodies than the other Study Area sections.

Table 5.26: VCM Habitat Class Coverage in Study Area Sections

Habitat Class	Study Area Habitat Coverage (ha)			Study Area Habitat Coverage (%)		
	TQK North	TQK Central	TQK South	TQK North	TQK Central	TQK South
Anthropogenic	86	646	554	0.1	5.7	2.3
Barrens	6,127	748	3,597	7.5	6.6	15.2
Coniferous Scrub	16,892	3,454	6,022	20.6	30.7	25.4
Deciduous Scrub	1,640	210	552	2.0	1.9	2.3
Hardwoods	283	24	1	0.3	0.2	0.0
Mixedwood	2,647	1,528	2,827	3.2	13.6	11.9
Regenerating	267	58	133	0.3	0.5	0.6
Softwood	7,592	1,608	2,862	9.2	14.3	12.1
Unclassed	166	80	568	0.2	0.7	2.4
Waterbody	7,145	874	2,825	8.7	7.8	11.9
Wetlands	39,251	2,023	3,754	47.8	18.0	15.8
Total	82,096	11,253	23,695	100.0	100.0	100.0

Analysis of VCM classes within the Project Areas of TQK North, TQK Central, and TQK South examined both the proportion of each Project Area by habitat type, and the total of each habitat type found within each Project Area by Project section (Drawings 23, 24, and 25, Table 5.27). Habitat coverage is similar for each habitat class as identified in the broader Study Area, suggesting a relatively even distribution of habitat classes throughout the Study Area. The only habitat class with significantly less coverage in the Project Area is Waterbodies, which is indicative of the buffers utilized during Project siting.

Table 5.27: VCM Habitat Class Coverage in Project Area Sections

Habitat Class	Project Area Habitat Coverage (ha)			Project Area Habitat Coverage (%)		
	TQK North	TQK Central	TQK South	TQK North	TQK Central	TQK South
Anthropogenic	3	84	30	0.0	2.4	0.7
Barrens	2,893	254	1,056	14.9	7.3	24.2
Coniferous Scrub	4,737	1,123	1,143	24.4	32.1	26.2
Deciduous Scrub	560	76	181	2.9	2.2	4.1
Hardwoods	49	7	0	0.3	0.2	0.0
Mixedwood	562	351	630	2.9	10.0	14.4
Regenerating	85	21	9	0.4	0.6	0.2
Softwood	1,947	412	446	10.0	11.8	10.2
Unclassed	20	40	89	0.1	1.1	2.0
Waterbody	309	236	176	1.6	6.8	4.0
Wetlands	8,286	892	607	42.6	25.5	13.9
Total	19,451	3,496	4,367	100.0	100.0	100.0

Project Areas are intentionally larger than the expected Project footprint. This provides room for Project component rearrangement in response to observations of sensitive or at-risk species and their habitat. It is important to note, however, that disturbance would only occur within a portion of the Project Area, and thus the proportions identified in the VCM review do not represent total anticipated habitat loss. Rather, these comparisons are for reference in understanding the habitat types where disturbance may occur relative to total abundance of habitat types within the area.

Information gained through habitat modelling during the development of this EA registration, biophysical studies conducted during the EA process, and further habitat modelling using the results of biophysical studies will guide Project design. This iterative process will help ameliorate impacts to ecologically significant habitat by allowing the Project to microsite infrastructure placement to avoid sensitive habitats and species to the extent possible.

Terrestrial Flora

ACCDC Data Reports (2022c, 2022b, 2022a) were used to identify SAR and SOCC potentially occurring near or within the Project Area. The ACCDC database contains 112 records of six SAR and SOCC flora within a 5 km radius of the Project Area (Table). Of these species, only boreal felt lichen (*Erioderma pedicellatum*) is listed under the NL ESA.

Table 5.28: SAR and SOCC Flora within 5 km of the Project Area (ACCDC 2022a, 2022b, 2022c)

Common Name	Scientific Name	S-Rank	COSEWIC	SARA	ESA
Gritty pixie-cup lichen	*Cladonia merochlorophaea*	S2S4	--	--	--
Boreal felt lichen (boreal population)	*Erioderma pedicellatum*	S3	Special Concern	Special Concern	Vulnerable
Lesser pocket moss	*Fissidens bryoides*	S2S3	--	--	--
Punctured Ramalina lichen	*Ramalina dilacerata*	S1S3	--	--	--
American sea-blite	*Suaeda calceoliformis*	S1S2	--	--	--
Lance-leaf violet	*Viola lanceolata*	S2S3	--	--	--

Gritty pixie-cup lichen

The gritty pixie-cup lichen (*Cladonia merochlorophaea*) grows on non-calciferous, sun-exposed to partly shaded humic soils, rotten wood, and roots (Consortium of Lichen Herbaria, n.d.). It has greenish-brown and relatively large scyphi, and produces varied, granulose propagules (Pino-Bodas et al., 2021). Nationally, it is considered relatively secure (NatureServe, 2025a) and its status in Newfoundland as S2S4 reflects the lack of confidence in understanding of its distribution and abundance.

Boreal felt lichen

Boreal felt lichen (*Erioderma pedicellatum*) is a foliose cyanolichen with a green-coloured thallus covered in tomentum, distinctively turning upward at the margin to reveal a white underside (ECCC, 2020). The boreal population is listed by SARA and COSEWIC as "special concern" in Newfoundland, due to threats to its habitat despite its current wide distribution (COSEWIC, 2014a; Government of Canada, 2022). Elsewhere in Atlantic Canada, the Atlantic population is designated as "endangered" due to lower populations and greater threats to remaining habitat. The species will primarily range from 2 cm to 5 cm but can grow up to 12 cm in diameter. The surface of mature thalli are covered in red/brown apothecia, with the species reproducing only through sexual means (ECCC, 2020). With a population conservatively estimated to consist of 15,000 mature thalli in Newfoundland, the number of boreal felt lichen in the province is considered to be the largest of the Atlantic provinces (ECCC, 2020). The vast majority of boreal felt lichen in Newfoundland has been found on stems of balsam fir, with few individuals having been found on black spruce, red maple, and white birch (ECCC, 2020).

Fissidens bryoides

This moss, sometimes known as lesser pocket moss, is found growing in fresh, non-wet soils and does not tend to grow on rock (British Bryological Society, n.d.). The species is primarily found in lowland areas, favouring neutral to slightly acidic soil including in woodlands, near streams, and arable fields (Atherton et al., 2010, p. 407). Nationally, it is considered relatively secure (NatureServe, 2025b) and its S2S3 status in Newfoundland reflects a lower abundance and potential threats to its habitat.

American sea-blite

American sea-blite (*Suaeda calceoliformis*), also known as pursh seepweed or pahute weed, is an annual herb that grows from its taproot. As a halophyte, the species grows in wet salt marshes, on beaches, salted roadsides, and alkaline lowland habitats (E-Flora BC, n.d.). Nationally, it is considered relatively secure (NatureServe, 2025c) and in In Newfoundland it is listed as S1S2, reflecting an apparent lower population and risks potentially to specimens and their habitat.

Lance-leaf violet

Lance-leaf violet (*Viola lanceolata*), also known as white bog violet, is a white-flowered, stemless violet found on sandy or peaty shorelines, marshes, and disturbed sites (Native Plant Trust, 2025). It is a short-lived perennial flowering throughout the spring and early summer months (MDNR, 2025). The species is most threatened by loss or degradation of wetland habitats, often through land conversion for agricultural use, though urban, suburban, and other developments are more common threats today (MDNR, 2025). Nationally, it is considered relatively abundant (ACCDC, 2022b), and has an S2S3 status in Newfoundland.

5.6.5 Potential Interactions

The expected potential interactions between the Project and vegetation and terrestrial habitat by Project phase (construction, operation, and decommissioning) are presented in Table 5.29 The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.29: Potential Project-Vegetation and Habitat Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	-
Turbine Operation	-
Water Withdrawal	-
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

Project activities, primarily those which may involve moving ground or vegetation removal, have the potential to directly impact existing vegetation communities or to impact their habitat through direct mortality, habitat alteration or loss, habitat creation or the introduction of invasive species.

Direct Mortality

Direct mortality may occur during the construction phase when vegetation clearing is conducted in preparation for roads, laydown areas, and other infrastructure required to develop the Project., The five species listed in Section 5.6.4.3 have the potential to be found in areas planned for clearing and subsequent Project development. The gritty pixie-cup lichen, boreal felt lichen, and *F. bryoides* that typically grow in wooded areas, may be found where forest clearing is required. American sea-blite and Lance-leaf violet both prefer habitats near marshes, beaches, roadsides, and disturbed sites. Although the extent to which clearing in coastal areas is dependent on finalization of the Project description, they may also be impacted through construction activities.

Habitat Alteration or Loss

Habitat loss, fragmentation, or other alteration may occur within unfragmented or undisturbed terrestrial habitat within the Project Area. Most directly, this would occur as the loss of habitat through clearing and grubbing. The gritty pixie-cup lichen prefers sunny to partly-shaded humic soils, and clearing will remove both sources of shade and inputs to the forest floor, reducing habitat suitability. Similarly, boreal felt lichen is only found growing on the trunk or branches of trees, typically balsam fir. As such, the loss of trees through clearing results in lower habitat availability for this species.

Less directly, habitat alterations may occur because of wide-spread changes in environmental conditions, such as alterations to hydrologic conditions. Changing wetland drainage patterns due to road building or water withdrawal for industrial processes will reduce moisture levels in areas that may otherwise be suitable habitat for species such as the lance-leaf violet. Alternatively, diversion of runoff may cause areas with previously fresh soils to become more periodically saturated, reducing suitability for soil-growing moss such as *F. bryoides*.

Vehicles and machinery travelling into the Project Area may bring with them species not native to the area, including both flora and fauna. While the introduction of certain fauna may cause direct mortality of vegetation through feeding that may not have otherwise occurred, introduction of non-native flora may cause competition for similar habitat niches that reduces habitat availability for native vegetation (CFIA, 2008). Species of concern in Newfoundland include black knapweed, Canada thistle, goutweed, Japanese knotweed, St. John's wort, and more (NLECC, 2008a).

Another potential impact of habitat alteration is the introduction of new edges to the landscape. A new road through a forested area will expose many trees to sunlight on sides not previously exposed. The effect, while perhaps less important to the trees themselves, causes habitat alteration for species that do not flourish near edges where they are exposed to increased sunlight, airflow, increased particulate such as dust from dry roads, and more. An investigation of edge effect impacts on heathland vegetation in Britain found that species in the genus *Cladonia*, of which gritty pixie-cup lichen is a member, were particularly sensitive to proximity to a major highway (Angold, 1997). This effect extends to tree-dwelling species, as demonstrated in Sweeden's boreal forests with other epiphytic lichens (Esseen & Renhorn, 1998) and may be a concern for boreal felt lichen. Microclimate alteration may occur in conjunction with new road construction, possibly affecting boreal felt lichen populations. However this interaction may be mitigated by the potential beneficial effect of decreased moose densities through increased hunter access (COSEWIC, 2014a),

Habitat Creation

While alterations to the landscape during the Project's construction and other phases may decrease habitat suitability in many cases, certain habitat types may be augmented through different Project phases. New and widened road rights-of-way may become new habitat for species that prefer such habitat. Roadside ditches and cleared rights-of-way will be revegetated through both mitigative measures and natural processes. This process may lead to the creation of different habitat types than were previously present, including wet areas and early successional forests. Although succession will be induced by anthropogenic mechanisms, natural processes will persist, and this new habitat may be used by a variety of species.

5.6.6 Mitigations

The following potential mitigations may eliminate or reduce the Project's impacts on vegetation and habitat:

- Complete field studies as required for flora species prior to construction and avoid SOCC/SAR and their habitat, where possible, if found.
    - Reclaim small roads to minimize long-lasting effects of habitat loss.
- Conduct proper equipment cleaning and decontamination before transporting to the Project site to avoid transporting invasive species.
- Minimize loss of important habitat required by any identified SOCC (i.e., for reproduction events).
- Develop a Spill Response Plan and an Emergency Response Plan within the Environmental Protection Plan to mitigate the impacts of spills, hazardous substances, and other emergencies.
- Potential mitigation measures based upon recognized practices to transplant or collect seeds can be used as a contingency if flora SOCC are unexpectedly encountered during construction activities. A transplantation plan will be developed along with a monitoring protocol through consultation with NLFFA should this be required during construction.
- Minimize overall area to be cleared, road density, habitat fragmentation, and habitat isolation by utilizing pre-existing roads and previously altered areas (i.e., clearcuts), where possible.
- Restore cleared temporary areas to reduce impacts from habitat loss and promote continued growth of terrestrial flora, primarily through revegetation of road rights of way, and limit effects of fragmentation.
- Revegetate cleared areas using native seed mixes.
- Develop a Fire Response Plan in accordance with provincial standards.
- Develop a site reclamation plan in accordance with engineering standards and in consultation with NLECC and NLFFA.
- Any identified sensitive habitats will be avoided and provided with a buffer zone where feasible.
- Site remediation activities shall be executed to promote natural vegetation by recovering and redistributing overburden and organic material, and decompacting soils where possible.
- Ensure all fuels, lubricants, and chemicals are stored in designated containers and in designated areas.
- Provide secondary containment for all hazardous products placed in storage areas
- Ensure equipment in use is inspected and free of fluid leaks.

- Ensure refuelling of machinery and equipment is conducted on an impervious surface and/or that secondary containment is in place during product transfer.
- Ensure the storage of all dangerous goods comply with the Workplace Hazardous Material Information System (WHMIS).
- Ensure all mobile equipment (including heavy equipment, welders, light panels, etc.) have spill kits stocked with soaker pads, oil-absorbing materials, and containment booms.
- Locate stationary spill kits or spill drums at work areas utilizing mobile equipment, hazardous fluids and/or in proximity to sensitive environmental features (i.e., wetlands).
- Stock spill kits with the appropriate quantity and type of material for the anticipated product types(s) and volumes(s) in use.

5.7 Wetlands

5.7.1 Overview

Wetlands on the island of Newfoundland serve many critical ecosystem functions and services including freshwater purification, run-off and flood storage, nutrient storage (e.g., carbon storage), and habitat for many wildlife and fish species. These ecosystem functions and services, including the value of a wetland to other wildlife, vary depending on the type of wetland (e.g., bog, fen, swamp).

The objective of the wetlands assessment was to collect the information necessary to assess potential interactions between the Project and Wetlands. This was accomplished using the following approach:

- Identify potential wetlands within the Study Area using desktop resources.
- Use the information collected to identify potential Project interactions and inform mitigation measures.

5.7.2 Regulatory Context

A wetland is defined under the *Waters Resource Act* (Newfoundland and Labrador, 2002) as land that has the water table at, near, or above the land surface and includes bogs, fens, marshes, swamps and other shallow open water areas.

Wetlands are protected provincially under the *Waters Resource Act* (SNL 2002 cW-4.011), which is overseen by the Water Resources Management Division of the NLECC (NLECC, 2001; Water Resource Act, 2002). Section 48 of this *Act* provides protection to wetlands through means such as permitting, where any alteration to wetlands or development-related effects (direct or indirect) are prohibited unless approved by the Minister of Environment and Climate Change.

5.7.3 Desktop Assessment Methodology

A desktop analysis was conducted to delineate and classify all wetlands located within the Study Area. Wetlands have been identified and categorized based on total area of cover by wetland class. Wetland classification was done using the guidelines outlined in the NL Water Resources Division classification document (AMEC, 2015; NWWG, 1997).

A review of the Newfoundland Forest Resource Inventory (FRI), the CanVec Saturated soils dataset (NRCan, 2023), and the Canadian Wetland Inventory Map (CWIM) (Government of Canada, 2022) was conducted for the Study Area. The Newfoundland FRI is primarily designed to inform forestry operations in the province, and therefore, provides limited detail for non-merchantable stands such as wetlands (NLFFA, 2023). In particular, the wetland groupings used in the vegetation cover mapping (i.e., bog, wet bog, and treed bog; Section 5.6) are too broad to support detailed wetland classification. Conversely, the CWIM, developed through Memorial University, provides more refined wetland classifications. While further analysis will be conducted during the EA process to review and integrate additional data where appropriate, for the purpose of this document the desktop review of wetlands will be based on the data provided within the CWIM.

Additionally, the VCM (discussed in Section 5.6) was reviewed and compared to the data from the CWIM. The CWIM and the FRI Land Classification map, which guides the VCM, both provide spatial data related to land and ecological features, but they serve different primary purposes and use different classification systems. While the FRI layer focuses on forested landscapes and land use, it often captures wetland features with higher spatial accuracy than the CWIM due to it being trained on high-resolution Newfoundland specific, aerial imagery and its associated vegetation types. However, its primary goal is forest management, so wetland classification is more generalized and is represented as such in the VCM. In contrast, the CWIM is specifically designed to identify and classify wetlands across Canada using the standardized Canadian Wetland Classification System, offering more ecologically nuanced information on wetland types—such as bogs, fens, marshes, and swamps. Therefore, while the VCM might delineate wetlands more precisely, the CWIM provides more consistent and detailed classification aligned with national ecological standards.

5.7.4 Desktop Assessment Results

Wetland Classification

Wetlands under the Canadian Wetland Classification System are divided into two main categories (NWWG, 1997): Peatland and Mineral Wetlands. Within these categories the five following classifications are used to delineate wetlands:

- Bog – Peatland not influenced by groundwater. Water is received exclusively from precipitation. *Sphagnum* spp. dominated vegetation.
- Fen – Peatland receiving water with high concentrations of dissolved minerals. Graminoid species and brown mosses dominate vegetation.

- Swamp – Peatland with water containing high concentration of dissolved minerals, dominated by trees, shrubs, and forbs. Or a mineral wetland with standing or gently moving surface water, nutrient rich groundwater, and vegetation dominated by woody plants.
- Marsh – Mineral wetland with neutral to alkaline, nutrient-rich, periodic or persistent standing water or slow-moving surface water that fluctuates dramatically. Graminoid-, shrub-, forb-, or emergent-dominated vegetation.
- Shallow water – Wetlands with free surface water up to 2 m deep, with less than 25% of the surface area covered by standing emergent or woody plants. Vegetation dominated by submerged or floating plants. Surface water present for most of the year.

The presence and coverage of bogs, fens, swamps and marshes within the Project Area and Study Area for each region have been reviewed below. For the purposes of this desktop review the "shallow water" class has been excluded and thus will not be discussed further. The "water" class within the data includes all waterbodies and watercourses present in the Study Area. These have been previously discussed in Section 5.4.

TQK North

Within TQK North, bogs have the greatest coverage within the Study Area of all wetland classes (Table 5.30) followed by fens, which is expected based on its ecoregion (Central Barrens subregion). The CWIM identifies wetland coverage of 23,691 ha (29%), which is significantly less than identified by the VCM which identified 39,254 ha (48%) of wetlands. Of the three Study Area sections, TQK North has the greatest area of wetland as well as the greatest coverage.

Table 5.30: Wetland Coverage by Class and Relative Percent Interaction for TQK North

Wetland Class	Project Area		TQK North	
	Wetland Coverage (ha)	Wetland Coverage (%)	Wetland Coverage (ha)	Wetland Coverage (%)
Bog	2,399	12	16,833	21
Fen	1,135	6	6,037	7
Swamp	196	1	699	1
Marsh	12	0.1	128	0.1
Total Area	**3,742**	**19**	**23,697**	**29**

When compared to the overall distribution of wetlands within the TQK North Study Area (Table 5.30), the proportion of wetlands within the Project Area is consistently lower. This reflects the results of the high-level desktop analysis conducted during preliminary project planning, which used available wetland, terrain, and land cover datasets to inform early layout design, strategically siting Project components to minimize wetland interaction.

TQK Central

Within TQK Central, bogs have the greatest coverage and overall proportionately less wetland coverage than TQK North (Table 5.31). A review of the CWIM identified a total of 2,202 ha of wetland habitat within TQK Central which is similar to the 2,017 ha of wetland habitat identified by the VCM (Section 5.6). Wetland coverage from both models indicates a proportionate coverage between 17% to 19%. Wetland coverage is proportionately higher within the Project Area than within TQK Central as a whole, suggesting a higher rate of intersection with Project infrastructure.

This elevated overlap is largely attributable to the preliminary application of large buffer zones around infrastructure associated with the Industrial Facilities. Through detailed engineering the footprint of these buffers will be reduced and the potential interaction with wetlands will be reduced correspondingly.

Table 5.31: Wetland Coverage by Class and Relative Percent Interaction for TQK Central

Wetland Class	Project Area		TQK Central	
	Wetland Coverage (ha)	Wetland Coverage (%)	Wetland Coverage (ha)	Wetland Coverage (%)
Bog	825	24	1772	15
Fen	57	2	175	2
Swamp	10	0.3	20	0.2
Marsh	98	3	236	2
Total Area	**990**	**28**	**2,202**	**19**

TQK South

TQK South exhibits the lowest proportion of wetland coverage of all three sections of the Study Area (Table 5.32). Total wetland coverage within TQK South identified by the CWIM is 1,215 ha, the majority of which is bogs. This is much less than the total wetland habitat identified by the VCM of 3,753 ha. The VCM classifies wetland coverage within the TQK South (15.5%) as only slightly lower than TQK Central.

Table 5.32: Wetland Coverage by Class and Relative Percent Interaction for TQK South

Wetland Class	Project Area		TQK South	
	Wetland Coverage (ha)	Wetland Coverage (%)	Wetland Coverage (ha)	Wetland Coverage (%)
Bog	119	3	1021	4
Fen	20	0.5	121	0.5
Swamp	4	0.1	27	0.1
Marsh	5	0.1	46	0.2
Total Area	**148**	**3**	**1,215**	**5**

5.7.5 Field Assessment Methodology

A preliminary field assessment was completed to ground truth existing wetlands identified through Canvec as well as to identify any unmapped wetlands within TQK Central. The field component of the work was conducted by a qualified biologist and at least one other field technician. Assessment locations were selected based on the desktop findings, with a total of 26 sites designated. Wetland assessments were conducted using accepted industry standards as described by the Corps of Engineers Wetlands Delineation Manual - Technical Report Y-87-1, U.S. Army Corps of Engineers (1987), and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region, U.S. Army Corps of Engineers (2012). This included identifying the presence of dominant hydrophytic vegetation, hydric soils, and any hydrological indicators such as surface water, soil saturation, and drainage patterns. Additional data recorded is described below:

- Universal Transverse Mercator (UTM) coordinates of the wet pit locations.
- Record of disturbances (ATV's, boats, predators, significant weather changes, etc.)
- Global Positioning System (GPS) tracks.
- Time-stamped photos.

The results of this assessment will be presented during the EA process.

5.7.6 Potential Interactions

The expected potential interactions between the Project and wetlands by Project phase (construction, operation, and decommissioning) are presented in Table 5.33. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.33: Potential Project-Wetland Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	-
Turbine Operation	-
Water Withdrawal	X
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	

Infrastructure Removal	X
Site Reclamation	X

The Project may have effects on wetlands during the construction, operation, and decommissioning stages, and these effects may result in habitat loss, hydrological changes, erosion and sedimentation, the introduction of invasive species, and/or compaction. Infilling, earth moving, and substrate replacement can alter wetland area or function. These can affect wetlands by means of direct loss, sediment loading from the development of infrastructure and transport on gravel roads, changes to hydrology created from infrastructure or operations, and the introduction of invasive species. Changes to surface water or groundwater flow patterns can affect microclimate and suitability for plant and animal species resulting in changes to the wetland classification and function. Invasive species can be introduced from machinery which are not properly cleaned before being introduced to the Project Area. This can cause habitat degradation within wetlands by impacting the natural cycle of the native species found within wetlands.

Excavation and Infilling

Excavation and infilling within wetlands would result in loss of wetland habitat. Loss of wetlands may fragment wildlife corridors, potentially isolating species and lowering species richness. Wetland loss may also disrupt vital habitat characteristics that support vulnerable species, which contribute to the overall function and characteristics of the wetland. Further, the removal or infilling of wetland habitat may impact the hydroperiod of neighbouring wet areas (Mitsch & Gosselink, 2001).

Excavation and infilling adjacent to wetland habitat may result in timing and quantity of flow, potentially change the hydrology of a wetland. Hydrological changes may impact species composition, water treatment capability, and nutrient export (Mitsch & Gosselink, 2001). Further, disruption to the hydrology of one area may hinder the hydrological connectivity to other areas, thus resulting in impacts being felt in neighbouring wet areas.

Erosion and Sedimentation

Erosion and sedimentation may occur throughout the lifecycle of the Project, including during construction efforts, routine road maintenance, and daily traffic. The accumulation of sediment within wetland environments may cause shifts in ecological integrity, including the plant species composition and subsequent nutrient retention potential, hydrological storage capabilities, and habitat suitability for vulnerable species (Tilman et al., 1997).

Introduction of Invasive Species

Project activities may introduce invasive species through placement of materials containing seeds or invasive species, or inadvertently by detaching from machinery or equipment. The colonization of invasive species may result in detrimental impacts on wetland environments, including alterations to evapotranspiration rates, increased biomass accumulation from reduced decomposition rates, and ultimately a reduction in the complexity of the wetland and its subsequent species richness (Zedler & Kercher, 2004). The creation of roadways can act as a vector for invasive species, with the potential for seed dispersal increasing with both vehicular and animal traffic. Further, with many invasive species being partial to disturbed soils, routine maintenance of roadways may provide ideal conditions for their establishment (Trombulak & Frissell, 2000).

Compaction

Compaction can hinder both the vegetative and hydrological structure of a wetland, with a loss of pore space restricting root growth and groundwater infiltration (Duiker, 2004). This impacts the absorption of moisture and nutrients, thus impacting the ecological integrity of the wetland and the ecosystem services it provides. Further, compaction can decrease percolation rates, resulting in prolonged periods of saturation, and increasing the potential for flooding (Duiker, 2005).

5.7.7 Mitigations

The following potential mitigations are proposed to eliminate or reduce the Project's impacts on wetlands:

- Avoid impacts to wetlands to the extent possible.
  - Flag wetlands to avoid unnecessary interference with wetland habitat, to the extent possible. Where unavoidable, wetlands will be mapped at the 1:50,000 scale and subject to a Permit to Alter a Body of Water, as Per NL ECC Policy for Development in Wetlands.
  - Design wetland crossings to occur at the narrow part of the wetland or the wetland's edges, to the extent possible.
- Design wetland crossings to avoid permanent diversion, restriction or blockage of natural flow, such that hydrologic function of wetlands will be maintained.
- Develop a site-specific erosion and sedimentation control plan during the detail design phase.
  - The plan will address the type of control structures, proper installation techniques, grading, maintenance and inspection, timing of installation, and revegetation.
  - Avoid surface run-off containing suspended materials or other harmful substances.
  - Direct run-off from construction activities away from wetlands.
- Limit the area of exposed soil and the length of time soil is exposed without mitigation (e.g., mulching, seeding, rock cover).
- Use the existing roads and access routes to the extent feasible.
- Avoid travel through wetlands. If travel through wetlands is required:
  - Use anti-rutting mitigation (e.g., mud mats), as appropriate.
  - Cross the wetland at the narrowest portion, where possible.
  - Time work to occur during frozen ground conditions, where possible.
- Maintain existing vegetation cover, where possible.
- Use quarried, crushed materials for road construction to reduce the introduction of invasive vascular plant species, where possible.

- Prior to arrival on site equipment will be cleaned and inspected to prevent the introduction of invasive/non-native species.
- Train staff on the requirements for work in and around wetlands.

5.8 Mammals

5.8.1 Overview

The objective of the mammals assessment was to collect the information necessary to assess potential interactions between the Project and mammals. This was accomplished using the following approach:

- Identify potential mammals within the Study Area using desktop resources.
- Use the information collected to identify potential Project interactions and inform possible mitigation measures.

5.8.2 Regulatory Context

Management and protection of mammals, as with other fauna, are regulated both federally and provincially in Newfoundland and Labrador. Legislation relevant to terrestrial fauna and their habitat includes:

- *Species at Risk Act*, S.C. 2002, c. 29
- *Canada Wildlife Act*, R.S.C. 1985, c. W-9
- *Canadian Environmental Protection Act, S.C. 1999, c. 33*
- *Wild Life Act*, R.S.N.L. 1990, c. W-8
- *Endangered Species Act,* S.N.L. 2001, c. E-10
- *Environmental Protection Act*, S.N.L. 2002, c. E-14.2
- *Wilderness and Ecological Reserves Act*, R.S.N.L 1990, c. W-9

5.8.3 Desktop Assessment Methodology

The desktop analysis was conducted using the following data sources:

- Atlantic Canada Conservation Data Centre (ACCDC) reports for Chance Cove (ACCDC, 2022a), Clarenville (ACCDC, 2022b), and Come By Chance (ACCDC, 2022c)
- NLFFA Zone 1 (NLFFA, 2021b) and Zone 2 (NLFFA, 2021a) forestry operation plans
- Government and other documents cited herein

5.8.4 Desktop Assessment Results

The ACCDC Data Reports for the Study Area (ACCDC, 2022c, 2022b, 2022a) indicate that the pine marten (Table 5.34) may occur within a 20 km radius of the individual point associated with TQK North (see ACCDC methods for details).

Table 5.34: SAR/SOCC Mammal Species Recorded Within a 20 km Radius of the Project Area in ACCDC Records

Common Name	Scientific Name	COSEWIC Status[1]	S-Rank (2015)[2]	SARA Status[1]	NL ESA Status[3]
Newfoundland (pine) marten	*Martes americana atrata*	Special Concern	S3	Threatened	Vulnerable

Source: [1] (ECCC, 2022b), [2](ACCDC, 2025),[3] (NLFFA, n.d.-c).

A review of available literature and Government sources identified the 13 game and furbearer species, and 13 non-game species as potentially occurring across the Study Area (Table 5.33). The five bat species are further discussed in Section 5.9.

Table 5.35: Potential Mammal Species occurring throughout the Study Area

Group	Common Name	Scientific Name
Game species and Furbearers	Beaver	*Castor canadensis*
	Black bear	*Ursus americanus*
	Coyote	*Canis latrans*
	Lynx	*Lynx canadensis*
	Mink	*Neogale vison*
	Moose	*Alces alces*
	Muskrat	*Ondatra zibethicus*
	Red fox	*Vulpes vulpes*
	River otter	*Lontra canadensis*
	Snowshoe hare	*Lepus americanus*
	Red squirrel	*Tamiasciurus hudsonicus*
	Short-tailed weasel	*Mustela erminea*
Non-game species	Little brown bat	*Myotis lucifugus*
	Northern long-eared bat	*Myotis septentrionalis*
	Hoary bat	*Lasiurus cinereus*
	Eastern red bat	*Lasiurus borealis*
	Silver-haired bat	*Lasionycteris noctivagans*
	Eastern chipmunk	*Tamias striatus*
	Meadow vole	*Microtus pennsylvanicus*
	Red-backed vole	*Clethrionomys gapperi*
	Deer mouse	*Peromyscus maniculatus*
	Norway Rat	*Rattus norvegicus*
	House mouse	*Mus musculus*
	Masked shrew	*Sorex cinereus*

Source: (Dodds, 1983), (NLFFA, n.d.-a)

TQK North has the potential to contain two SAR/SOCC mammals that are not identified as occurring in either TQK Central or TQK South. These two mammal species are:

- Caribou (*Rangifer tarandus caribou*) – Special concern (Federal),
- Newfoundland marten (*Martes americana atrata*) – Threatened (Federal), Vulnerable (Provincial)

Marten

The Newfoundland marten is a geographically unique sub population of the American marten often referred to as the pine marten. Pine martens are dependent on forested habitat for all life stages and most resources, and their decline is linked to habitat loss through forestry activities. In combination with trapping that began in the 18th century, pine marten saw a sharp decrease in population and distribution across Newfoundland (Newfoundland and Labrador, 2010), especially in the 20th century as human effects on marten habitat became widespread. Pine marten was first recognized for its growing scarcity through federal designation in 1986 as threatened (COSEWIC, 2022). Population estimates in 2007 found between 286 to 556 individuals from the sub population in Newfoundland.

Provisions to protect marten habitat, reduce incidental capture through trapping and snaring, and other management practices are considered to have contributed to a rebounding of the pine marten population on Newfoundland. The 2022 COSEWIC reassessment of the marten cited population estimates from the late 2010s found populations to range from approximately 2,500 to 2,800 individuals. This, combined with the overall population trend and successful implementation of protective measures, resulted in the marten's downlisting from threatened to special concern (COSEWIC, 2022). Additionally, pine marten was downlisted from threatened to vulnerable under the provincial ESA (NLFFA, n.d.-c). This designation recognizes that the population, while more secure than before, would become threatened once again if not properly managed.

In addition to total population, the overall distribution of marten across Newfoundland has improved greatly between the 2007 and 2022 COSEWIC assessments. The 2022 assessment states that marten occur in most designated forest management districts and in both national parks on Newfoundland. Terra Nova National Park, north of the Project Area, has seen population reestablishment following translocation initiatives in the late 20th century (COSEWIC, 2022). The Project Area does not overlap with pine marten critical habitat to the north in Terra Nova National Park, to the northwest of Ocean Pond, or on the Avalon Peninsula (Newfoundland and Labrador, 2010).

Woodland Caribou

Caribou are a culturally important species for diverse stakeholders, holding significance for harvest, cultural, recreational, and ecological value on the island of Newfoundland. The Newfoundland population of caribou are currently listed as Special Concern under Schedule 1 of SARA (Canada, 2002). Although no caribou herds on the island of Newfoundland are listed under the ESA, three caribou herds in Labrador are currently listed as Threatened (Newfoundland and Labrador, 2001).

The Avalon and Bay du Nord Wilderness Reserves were established to provide refuge for mammals including caribou (COSEWIC, 2014b). Whether as a consequence of these reserves or other factors, the Middle Ridge herd, which overlaps the Bay du Nord and Middle Ridge Wildlife Reserves, is the most abundant sub-population on the island (COSEWIC, 2014b). Recent population estimates place the herd size at approximately 10,290 individuals (NLFFA 2018). The herd's range includes Caribou Management Area 64, a regulated harvest zone with a fall quota of 270 individuals (NLFFA, 2025a).

The TQK Project Area is located only at the fringe of Management Area 64, with limited overlap restricted primarily to the western extent of TQK North. The remainder of the Project Area, including TQK Central and TQK South, lies outside known caribou ranges. This limited geographic overlap reduces the likelihood of substantial interaction with the core population range or movement corridors.

Research from Newfoundland suggests that open barrens and shrub land are particularly important to caribou (Bastille-Rousseau et al., 2018; Schaefer et al., 2016). At broader spatial scales, caribou typically avoid dense coniferous forests. At finer spatial scales, they tend to spend less time in these forests, which suggests such areas may serve primarily as movement corridors rather than as foraging grounds.(Bastille-Rousseau et al., 2018; Schaefer et al., 2016). Based on these patterns, it is anticipated that wetland and barren/shrubland habitats within the Project Area, particularly in TQK North, may be occasionally used by caribou, though overall use is expected to be limited given the Project's fringe location relative to the core range of the Middle Ridge herd.

Moose

Moose are not a SAR or SOCC but are culturally important to Newfoundland. An introduced species to the island of Newfoundland, just four specimens were released in 1904 with the hopes of developing a big-game hunting industry and a food source for interior resource industries (Heritage NL, 2025). The population has seen two significant peaks followed by declines tied to hunting activities and resource limitations, but the abundance of suitable habitat and lack of natural predators means that moose populations have not struggled to recover, and hunting continues today (NLFFA, 2022).

The Project Area lies within moose management areas 28 and 44 (Newfoundland and Labrador, 2024c), with estimated populations of 1727 and 580, respectively, based on provincial aerial surveys and modelling (NLFFA, 2022). These two management areas had a combined 400 moose tags allocated in the 2024-25 hunting season (Newfoundland and Labrador, 2024c). Hunting quotas for both management areas have been reduced in recent years to reduce pressure on the population, increase density, and increase the proportion of bulls in the population, although both management areas currently exceed the target density of 1 moose per km^2 (NLFFA, 2022).

Muskrat

Muskrat are native to the island of Newfoundland but represent a unique genetic population, *Ondatra zibethicus obscurus*, from muskrats found on the mainland (Rigby & Threlfall, 1982). Morphological differences between island and mainland muskrat are largely attributed by researchers to the lack of their preferred food source, cattails (*Typha* spp.), and dependence on inferior nutritional sources such as sedge (*Carex* spp.), water horsetail (*Equisetum fluviatile*), and bullhead-lily (*Nuphar variegatum*), among others (Soper & Payne, 1997).

Despite the invasive mink (*Neogale vison*) causing some negative effects on muskrat populations (Soper & Payne, 1997), their overall numbers remain high enough to permit ongoing harvests. Newfoundland has an open, island-wide muskrat trapping season from mid October to mid March (NLFFA, 2025a).

As per the provincial survey protocols, key muskrat habitat includes slow-flowing or still waterbodies with 50–80% emergent vegetation cover, shallow water depths (0.5–1.5 m), and soft, clay-rich shorelines suitable for burrowing (Newfoundland Muskrat Distribution and Population Survey, n.d.). The Project has been intentionally sited to avoid such areas through the application of defined setbacks from wetlands, waterbodies, and riparian zones. As a result, the Project anticipates minimal risk of adverse impacts to muskrat populations. Based on this demonstrated avoidance, no targeted muskrat surveys are currently proposed.

5.8.5 Potential Interactions

The expected potential interactions between the Project and mammals by Project phase (construction, operation, and decommissioning) are presented in Table 5.36. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.36: Potential Project-Mammal Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X

Project Phase	Potential for Interaction
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	X
Turbine Operation	X
Water Withdrawal	X
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

The Project may have effects on mammals during the construction, operation, and decommissioning stages, and these effects may result in direct mortality, habitat alteration or loss, increased accessibility from hunters, sensory disturbance, and more.

Direct Mortality

The most likely mechanism of direct mortality to mammals throughout the Project's lifecycle is vehicular collisions. This is already a frequent occurrence with Moose in Newfoundland, with a reported 422 to 641 collisions per year over the past decade (NLFFA, 2022). With access roads running through habitat for a variety of mammals, this is a likely occurrence, and not limited to moose, but any animal that crosses or follows the road. Roads that permit periodic access to Project infrastructure for maintenance and repair may also afford hunters, trappers, and other resource gatherers greater access to the Project Area and its surroundings, especially after the construction phase is complete. This will have a variety of effects, including compounding the risk of vehicular collisions and increasing the likelihood of hunting and trapping in previously inaccessible, or poorly accessible areas. Additionally, machinery and supplies brought to the Project Area may carry invasive species, bringing pests with limited mobility to previously inaccessible areas; this could affect the health of some mammals.

Habitat Alteration

Habitat alterations are required for construction of the Project, to prepare the landscape for a variety of infrastructure, and any change to land cover may represent a loss of habitat for some species, depending on their unique life history requirements. Alterations will occur during preparation for and construction of facilities, infrastructure, roads, turbine pads, laydown areas, PV clearing, transmission lines, and sub stations. These activities may have indirect effects as well, causing changes to surface or groundwater deposits or their movement that alter habitat suitability, possibly reducing the total are available for species to rest, seek refuge, find food, mate, or rear young.

Edge Effects

In addition to direct mortality and habitat alterations, the Project may cause a variety of effects that render the Project Area and its surroundings less desirable for use by mammals. These could include edge effects, which may alter species' use of areas near newly established roads and clearings for infrastructure. This may have both positive and negative effects on moose, caribou, and pine marten. All require different landscape types to fulfill different needs. Marten, for example, often avoid road edges (Woollard et al., 2024) but also frequent edges near newly established forest clearings for potential resource gathering (Buskirk & Zielinski, 1997). Some research has found that large mammals benefit from increased edges and roadside zones (where traffic is infrequent and not fast) through the creation of new browsing areas (Helldin et al., 2012).

Sensory Disturbance

Sensory disturbance, during both construction and operation, may affect landscape utilization by mammals. Construction noise such as blasting, grading, heavy equipment operation, and increased traffic into formerly remote areas may cause some mammals to avoid the Project Area. During the operations phase, operational wind turbines may cause sensory disturbance to some mammals, although research has found a limited impact from visual and acoustic signals created by operational turbines, and rapid acclimatization to turbines by many species (Helldin et al., 2012).

Light emitted from equipment and infrastructure during construction, operations and maintenance, and decommissioning may affect terrestrial fauna through changes to circadian patterns, seasonal patterns, movement and distribution, and community interactions and composition (Pauwels, 2018).These impacts can result in disorientation, attraction or avoidance, and behavioural changes that can affect the success of foraging, reproduction, and communication (Longcore & Rich, 2004a). Artificial light can also disrupt habitat connectivity and indirectly create habitat fragmentation (Bliss-Ketchum et al., 2016a). Schirmer et al. (2019) found that light had differing impacts on nocturnal and diurnal species. While both were impacted by increased artificial lighting, generally nocturnal species exhibited a delayed, compressed active period, while the active period for diurnal species was extended. These changes in circadian patterns can cause the suppression of melatonin in mammals, particularly in nocturnal species (Schroer & Hölker, 2017). However, there is limited data available for larger mammalian species.

5.8.6 Mitigations

Potential mitigation measures for mammals include:

- Scientifically informed, carefully considered project design process to ensure no extraneous areas are cleared for the Project's development.
- All site personnel shall receive environmental awareness training, including a review of any protection and mitigation plans developed specifically for caribou, moose, and other species listed above.
- Project personnel will be required to report any sightings or interactions with wildlife including time and location.
- If caribou are observed within 500 m of Project activities any blasting or elevated noise activities will be delayed until animals have left the area.
- New and temporary access road construction will be minimized.
- Restrict on-site lighting, especially at night, to limit disturbance.
- Use shrouded/directional lights at industrial facilities.

- Disturbance to ground-level vegetation, e.g., herbs, shrubs, and lichens, will be minimized.
- Any identified sensitive habitats, e.g., mineral licks, unique habitat features, will be avoided and provided with a buffer zone where feasible.
- Site remediation activities shall be executed to promote natural vegetation by recovering and distributing overburden and organic material and decompacting soils where possible.
- Any injured caribou or moose or vehicular collisions will be reported to the NLFFA Wildlife Division.
- All Project participants shall be prohibited from hunting at the Project site.
- Wildlife shall not be fed and all measures shall be taken to avoid inadvertent feeding.
- Wildlife shall not be chased, caught, diverted, followed or otherwise harassed by project personnel.
- Equipment and vehicles shall be maintained in good working order to minimize noise and air pollution.
- Recreational use of all-terrain vehicles and snowmobiles by Project staff will be strictly prohibited on site.
- Use of personal vehicles on site will be prohibited.
- Project personnel will always yield to wildlife.
- Multi-passenger vehicles will be prioritized to reduce collision risk.
- Enforce site speed limits on Project roads to reduce collision risk.

5.9 Bats

5.9.1 Overview

The objective of the bat assessment was to collect the information necessary to assess potential interaction to assess potential interactions between the Project and bats. This was accomplished using the following approach:

- Identify known bat observations in the Study Area using desktop resources.
- Identify locations that bats could potentially occupy within the Study Area using desktop resources.
- Use the information collected to identify potential pathways of effects and inform mitigation.

5.9.2 Regulatory Context

Management and protection of bats is regulated both federally and provincially in Newfoundland and Labrador. Legislation relevant to bats and their habitat includes:

- *Species at Risk Act,* S.C. 2002, c. 29
- *Canada Wildlife Act*, R.S.C. 1985, c. W-9
- *Canadian Environmental Protection Act, S.C. 1999, c. 33*
- *Wild Life Act*, R.S.N.L. 1990, c. W-8
- *Endangered Species Act*, S.N.L. 2001, c. E-10
- *Environmental Protection Act*, S.N.L. 2002, c. E-14.2

5.9.3 Desktop Assessment Methodology

The desktop analysis was conducted using the following data sources:

- ACCDC reports for Chance Cove (ACCDC, 2022a), Clarenville (ACCDC, 2022b), and Come By Chance (ACCDC, 2022c)
- COSEWIC reports (COSEWIC, 2013, 2024)
- Government and other documents cited herein

A review of government and scientific research publication was conducted to identify known characteristics of habitat suitable for the potential bat species occurring on the Island of Newfoundland. Provincial forestry and geology data was classified based on the results of the literature review, and habitat maps were generated to identify potential foraging, hibernation, and roosting habitats. These results were then compared between the Study Area and the Project Area.

Habitat Suitability Mapping

Provincial geology and FRI data was used to determine the proportion of habitat within the Project and Study Areas suitable for bat species. Landscape feature potentially supporting hibernacula were identified based on the surficial geology layer, including specific classes such as "rock", "rock ridge" and "rock eroded and dissected". These landscape features were overlayed by the Project Area to determine areas of potential interactions.

5.9.4 Desktop Assessment Results

Based on assessment of desktop resources, bat species that may potentially be found in the Study Area are outlined in Table 5.37.

Table 5.37: Potential Bat Species in the Study Area and Their Status

Common Name	Scientific Name	Species Status			
		SARA	NL ESA	COSEWIC	S-Rank
Little brown myotis	*Myotis lucifugus*	Endangered	Endangered	Endangered (2013)	S1S3
Northern myotis	*Myotis septentrionalis*	Endangered	Endangered	Endangered (2013)	S1S3
Hoary bat	*Lasiurus cinereus*	-	Endangered	Endangered (2023)	SUM
Eastern red bat	*Lasiurus borealis*	-	Endangered	Endangered (2023)	SNA
Silver-haired bat	*Lasionycteris noctivagans*	-	Endangered	Endangered (2023)	SNR

The ACCDC Data Reports (ACCDC, 2022c, 2022b, 2022a) do not show observations of any bat species within the Study Area (Appendix C).

The little brown myotis and northern myotis are resident bat species that reside in Newfoundland year-round. The hoary bat, eastern red bat, and silver-haired bat are migratory species that overwinter in southern United States. Sightings of migratory bats in Newfoundland are limited and likely due to exploratory migration outside of the individuals range (Tessa McBurney, 2018). Within Newfoundland, identified critical habitat for the little brown myotis and northern myotis is located north of Hampdon, NL, approximately 240 km from the northern boundary of the Project Area (Government of Canada, 2018).

Resident bat species (little brown myotis and northern myotis) overwinter in habitat features known as hibernacula. Hibernacula are typically found in underground openings such as caves, tunnels, and abandoned mines with temperatures between 2 and 10°C and high humidity (relative humidity >80%) (Government of Canada, 2018). Due to the limited availability of hibernacula with these suitable conditions, myotis species typically use the same locations for consecutive years. Additionally, multiple species can occur in the same hibernacula at once (Government of Canada, 2018).

In general, bat species prefer old growth forests with snags and decaying trees for roosting, however *myotis lucifugus* often form maternity colonies in building (Broders & Forbes, 2004), Maternity colonies for most temperate bat species can range in size up to groups of greater than 100 individuals, with the size of the colony directly influencing temperature roost temperature (Garroway & Broders, 2008). For tree roosting bats, warmers roosts tend to be located in larger, taller diameter trees, close to the canopy (Crampton & Barclay, 1998). Myotis species commute along waterways, forest edges and above the canopy (COSEWIC, 2013).

Little brown myotis

Little brown myotis is found throughout Canada, including Newfoundland, and occupies boreal forest habitat (Government of Canada, 2018). This species is one of few bat species that roost in both man-made structures (e.g. buildings, bat boxes, bridges) and natural cavities like trees, foliage and cliffs (Government of Canada, 2018). Females roost in large maternal colonies with other females and their young, typically in trees large in diameter (Government of Canada, 2018). Males primarily roost in conifer dominated stands with many snags (Government of Canada, 2018). Little brown myotis bats are nocturnal insectivores whose diet varies based on environmental factors, location and time of year. The species foraging activities are associated with open habitat like ponds and roads (Government of Canada, 2018).

Northern myotis

The northern myotis can be found in all Canadian provinces and occupies boreal and montane forests (Government of Canada, 2018). Northern myotis roosts in smaller groups compared to the little brown myotis. They have a preference to roost in trees but can also be found in man-made structures like in the roofs of buildings. In Newfoundland, maternity roost are associated with larger than average trees that are showing signs of decay and in proximity to streams (Government of Canada, 2018). Males roost alone under raised tree bark or within cavities of decaying trees (Government of Canada, 2018). Northern myotis tend to forage along the edges of or within forests and feed on a variety of insects (Government of Canada, 2018) and travel over areas of still water, rivers, and along trails (COSEWIC, 2013).

Hoary bat

The hoary bat has one of the widest ranges for terrestrial mammals in the western hemisphere. This migratory species spans across Canada, however, there are few records of this species in NL (COSEWIC, 2024). A study that analyzed acoustic data collected in western Newfoundland supported that hoary bats are infrequent vagrants to the island of Newfoundland (Washinger et al., 2020). Hoary bats are generally found south of Canada for most of the year and migrate during spring to more northern locations (COSEWIC, 2024). The hoary bat requires the availability of suitable trees for roosting and, unlike other bat species, the hoary bat is less selective, choosing sites in either deciduous or coniferous forest of any age class (COSEWIC, 2024). They forage in open habitat like wetlands and fields with sparse trees (COSEWIC, 2024).

Eastern red bat

The eastern red bat is a long-distance migrant generally found east of the Rocky Mountains in Canada and has recently been confirmed to occur in Newfoundland (COSEWIC, 2024). The northern extent of their range is uncertain due to limited survey data (COSEWIC, 2024). Eastern red bat appears to overwinter in the southeastern United States and disperse north during the summer (COSEWIC, 2024). This species, like the hoary bat, is also less selective than other bat species and will roost in any type of forest habitat. They forage in either forested or non-forested habitat, in open or semi cluttered habitat, and above or below the canopy (COSEWIC, 2024).

Silver-haired bat

The silver-haired bat occurs across most of Canada and was recently confirmed in Newfoundland, however, generally appears to be less common within Atlantic Canada (COSEWIC 2024). This migratory species roosts under bark or in tree cavities meaning that they need habitat with large decaying trees available. Deciduous trees in the *Populus* genus often have these valued characteristics and are particularly useful. Silver-haired bats are also known to use old woodpecker cavities as roosting habitat (COSEWIC, 2024). They can forage in a variety of habitat like forest openings but are primarily found foraging within forests or at forest edges (COSEWIC, 2024).

White Nose Syndrome and Other Threats

White nose syndrome is caused by a highly pathogenic fungus – *Pseudogymnoascus destructans* – that affects hibernating bats and is cited as the leading cause for bat population decline in Canada (COSEWIC, 2013). The *P. destructans* fungus was first recorded in Canada in 2010 and since then a population decline >90% has been observed in northeastern US for northern myotis and little brown myotis. A decline of 94% of all *Myotis* species in hibernacula was observed in Ontario, Quebec, New Brunswick, and Nova Scotia specifically (COSEWIC 2013). *P. destructans'* presence in Newfoundland was confirmed in 2017 on the West coast of the Island (CWHC, 2022). Other threats to resident *Myotis* species include wind turbines, colony eradication due to public concerns regarding disease transmission and other conflicts, and other disturbances (COSEWIC 2013).

Habitat Suitability Mapping

A total of 6,582 ha of habitat potentially supporting the presence of hibernacula were identified in the Study Area, and a total of 2,044 ha were identified in the Project Area. This represents a proportion of the total Study Area and Project Area of 65% and 2% respectively. As this habitat mapping is based on coarse scale geology features of the Provincial data, this mapping does not represent a fine scale assessment of potential hibernacula, rather a coarse scale assessment of landscape features that may support the presence of hibernacula. Drawings 26, 27, and 28 outline the mapped habitat within the Project Area. Further assessment of these areas will be conducted during the EA process and further informed by the results of other surveys.

5.9.5 Field Assessment Methodology

In 2023 and 2024, GEMTEC staff collected ultrasonic acoustic data for TQK Central and TQK South using Ultrasonic Song Meter SM4 Bat Monitors and Song Meter Mini Bat 2 autonomous recording units (ARUs). A total of 13 ARUs were deployed in June 2023 and were retrieved in November 2023. In 2024, 32 ARUs were deployed May to June and were retrieved between November to December (with the exception of two that were retrieved in July). All ARUs were deployed via truck, ATV, helicopter, and on foot, in strategically selected habitat types identified in initial desktop studies to maximize species detection.

ARUs were programmed to actively record starting 45 minutes before sunset and continue recording until 45 minutes after sunrise. SM4 Bat Monitors were securely attached to trees using a locking cable, with an SM2 microphone fitted with a wind cover placed on a 2.5 m telescopic pole, positioned either facing the sky or towards open waterbodies and/or wetlands to enhance detection in selected locations. Mini Bat 2 Monitors were securely attached to trees using cable ties and strategically placed in optimal surroundings to capture the most accurate acoustics at each site. GPS coordinates were recorded for each deployment, and general habitat characteristics, along with photographs, were documented.

5.9.6 Field Assessment Results

ARUs were deployed across varied habitats in 2023 and 2024 (Drawing s 29,30, and 31, Table 5.38). In 2024, selected habitat types were expanded to include unique habitats such as anthropogenic feature (e.g., houses, farmland, transmission lines) and unique geological features (e.g., sea caves) that may support bat occurrence.

Table 5.38: ARUs Deployed in 2023 and 2024

Field ID	Habitat Description
2023	
ABO-BAT-01	Softwood Forest
ABO-BAT-02	Bog
ABO-BAT-03	Mixed-wood Forest
ABO-BAT-04	Softwood Forest
ABO-BAT-05	Softwood Forest
ABO-BAT-06	Softwood Forest
ABO-BAT-07	Scrubland
ABO-BAT-08	Rock Barren
ABO-BAT-09	Scrubland
ABO-BAT-010	Scrubland
ABO-BAT-011	Scrubland
ABO-BAT-012	Mixed-wood Forest
ABO-BAT-013	Rock Barren
2024	
SM4BAT-01	Pond/Bog
SM4BAT-02	Pond/Bog
SM4BAT-03	Scrub/Pond
SM4BAT-04	Pond
SM4BAT-05	Pond
SM4BAT-06	River/Transmission Line
SM4BAT-07	Pond
SM4BAT-08	Bog
SM4BAT-09	Forest/Stream
SM4BAT-10	Bog
SM4BAT-11	Scrub/Pond
SM4BAT-12	Mine/Sea Cave
SM4BAT-13	Forest
SM4BAT-14	Mature Forest

Field ID	Habitat Description
SM4BAT-15	Farm/Old House
SM4BAT-15B	Farm/Old House
SM4BAT-16	Farmland/Open field
SM4BAT-17	Pond Edge/Softwood Forest
SM4BAT-18	Lake
SM4BAT-19	Forest
SM4BAT-20	Bog/Forest
SM4BAT-20B	Farm/Old House
miniBAT-01	Hardwood Forest
miniBAT-02	Dry Coniferous Scrubland
miniBAT-03	Rock Barren
miniBAT-04	Bog
miniBAT-05	Softwood Forest
miniBAT-06	Softwood Forest
miniBAT-07	Mixed-wood Forest
miniBAT-08	Mixed-wood Forest
miniBAT-09	Rock Barren
miniBAT-10	Rock Coniferous Scrubland

Preliminary results from Kaleidoscope (Wildlife Acoustics, 2024) indicate that bats may be present in the two study areas where ARUs were deployed.

Further data collection, analysis and manual verification of the results will be presented during the EA process.

5.9.7 Potential Interactions

The expected potential interactions between the Project and bats by Project phase (construction, operation, and decommissioning) are presented in Table 5.39. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. The table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.39: Potential Project-Bat Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	

Industrial Facilities Operation	X
Turbine Operation	X
Water Withdrawal	
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	

The Project may have effects on bats during the construction, operation, and decommissioning stages, and these effects may result in direct mortality, habitat alteration or loss, edge effects, and increased sensory disturbance.

Direct Mortality
Direct mortality of bats may occur due to wind turbines. In Canada the number of mortalities differs depending on species present and location of turbines (Government of Canada, 2018) Bats are at risk through mortality from direct collisions with turbine blades or from barotrauma caused by a large drop in air pressure that occurs near turbine blades (Government of Canada, 2018). In general, long distance migratory species are most at risk from turbine mortalities, however, mortality of resident species does occurs (COSEWIC, 2013). The results of a study that quantified the impacts of wind turbines on bat species based on data from 64 wind farms across various Canadian provinces demonstrated that long-distance migratory species are typically most affected, with the hoary bat (34%), silver-haired bat (25%), and eastern red bat (15%) accounting for the majority of recorded fatalities. As for resident species, little brown myotis (13%) had the highest proportion of total bat mortality due to wind turbines followed by northern myotis (1%) (R. J. Zimmerling & Francis, 2016). However, the data used in this study was predominantly collected in Ontario. Therefore, while the study offers valuable insights, its applicability to the TQK Project in Newfoundland should be interpreted with caution. Site-specific studies will be completed as part of the EA process to inform potential interactions and mitigations.

Since migratory bats are understood to be rare vagrants in Newfoundland, the risk of mortality due to turbine interactions for those species is anticipated to be low. However, some risk remains for resident species, in particular little brown myotis, which appears to be affected by turbines more that the northern myotis (J. Zimmerling & Francis, 2016). Other activities throughout the Project can cause direct mortality such as vehicle-bat collisions (Fensome & Mathews, 2016). Mitigation strategies outlined below are designed to reduce these risks and will be refined through additional site-specific studies.

Habitat Alteration
Habitat alteration is required for construction of the Project, including land clearing for turbine pads, roads, laydown areas, transmission lines, substations, and potential solar infrastructure. While any change in land cover may affect bats, not all habitat types are of equal value. In particular, sites such as maternity roosts and hibernacula require specific conditions to be present. Unlike foraging areas, which are generally more widespread and resilient to

disturbance, hibernacula and maternity roosts are rare and often spatially constrained. These specialized habitats can be repeatedly used by bats year after year, and their disturbance can be consequential for local populations (COSEWIC, 2013).

In addition, habitat alteration can also impact the availability of prey through secondary impacts such as reduced soil moisture or the removal of vegetation that supports insect populations. Such impacts are predicted to have a medium to high impact on hoary bat, eastern red bat, and silver-haired bat (COSEWIC, 2013).

Edge Effects

Edge effects refer to how species interact with either natural or artificial edges between habitat types. Vegetation clearing may increase the proportion of edge habitat within the Project Area and will likely create more abrupt edges than what is found naturally. New roads or clearing of rights-of-way for transmission lines will also create more edge habitat within the Project Area. Species are impacted differently with an increase of edge habitat, some benefiting from this change. Research into the effects of edges on bat species in Canada found that bats (including hoary bat, little brown myotis, and silver-haired bat) were most active at the edge between forests and fields compared to the interior of either habitat type (Jantzen and Fenton, 2013). It is also suggested that abrupt, "hard" edges are occupied more frequently than "soft" edges like those produced by natural succession of a forests edge (Jantzen & Fenton, 2013).

Edges also provide habitat for bats to commute (e.g., between roosting and foraging sites), therefore, it is possible bat activity will increase in areas with artificial edges created by clearing land. However, more activity in open areas may in turn increase the risk of human-bat interactions.

Sensory Disturbance

Sensory disturbance, during both construction and operation, may affect landscape utilization by bat species. Construction noise such as blasting, grading, heavy equipment operation, and increased traffic into formerly remote areas may result in sensory disturbance, altering activity and/or feeding behaviours (Finch et al., 2020). High-impact construction activities (e.g., heavy equipment, blasting, and pile-driving) may affect roosting bats in the immediate area, potentially causing roost abandonment; however, bats are well adapted morphologically, physiologically, and behaviourally, to avoid acoustic trauma because they are often exposed to the exceptionally loud sounds of their own (and other bat) echolocation signals (California Department of Transportation, 2016).

Light pollution may also impact bats likelihood to use existing habitat. Certain species, such as the little brown myotis, are known to avoid areas they would otherwise occupy when light levels are increased during night (Seewagen et al., 2023b). Lighting has been found to impact bats through the disruption of day-night cycles, foraging activity, habitat connectivity and movement (Seewagen et al., 2023a). The effects of lighting vary across bat species as some species are attracted to lights due to insect concentration, while others (most notably the *Myotis* species) are light-adverse.

5.9.8 Mitigations

The following potential mitigations may eliminate or reduce the Project's impacts on bats:

- Carefully considered Project design process to ensure no extraneous areas are cleared for the Project's development.
- All site personnel shall receive environmental awareness training, including a review of protection and mitigation plans developed for bats.
- Project personnel will be required to report any sightings or interactions with bats including time and location to NLFFA Wildlife Division. This includes injured or deceased bats found on site.
- Any potential observations of hibernacula or roosting sites will be recorded and reported to the NLFFA Wildlife Division.
- Any light besides what is necessary will be dimmed during night to prevent negative interactions with habitat.
- Clearing of old growth forest, particularly with decaying trees, snags and trembling aspen will be avoided to the extent possible.
- Site remediation activities shall be executed to promote natural vegetation by recovering and distributing overburden and organic material and decompacting soils where possible.
- Wildlife shall not be chased, caught, diverted, followed or otherwise harassed by Project personnel.
- Equipment and vehicles shall be maintained in good working order to minimize noise and air pollution.
- Recreational use of all-terrain vehicles and snowmobiles by Project staff will be strictly prohibited on site.
- Multi-passenger vehicles will be prioritized to reduce collision risk.
- A Wildlife Management Plan will be developed, containing mitigation, monitoring, and reporting procedures.

Operational Curtailment Mitigation Strategies

Implementing curtailment strategies for operating wind turbines is widely recognized as one of the most effective mitigation measures to reduce bat mortality. These strategies often involve modifying turbine cut-in speeds, particularly during fall migration period when bat activity peaks and environmental conditions (such as temperature, precipitation, and wind speed) are favorable for bat movement. A decade-long review synthesized curtailment studies across North America and found a consistent reduction in bat fatalities, reaffirming curtailment as a practical and ecologically effective strategy (Whitby et al., 2024). Research in this area continues across multiple countries as turbine models and technologies evolve.

It is important to note that while these studies demonstrate positive results across the continent, much of the data was derived from regions with different species and distributions than in Newfoundland, and historical turbine models in comparison to those proposed for the Project.

As such, TQK proposes to evaluate the necessity and applicability of operational curtailment as a mitigation measure by conducting a pre-construction acoustic monitoring program. This program will be designed to understand seasonal species activity, wind speed, and weather data, all of which are specific to the Project Area in question. This information will inform whether an operational curtailment mitigation strategy is warranted. If so, it will be designed using the best available local science data to ensure it is appropriately tailored to the region's ecological context.

Should NL issue prescribed guidelines or guidance documents with respect to pre-construction acoustic monitoring or mitigation strategies, TQK is committed to work with the NLFFA Wildlife Division to review Project-specific data and propose operational curtailment mitigation strategies applicable to the region and proposed Project.

5.10 Avifauna

5.10.1 Overview

The objective of the avifauna assessment was to collect the information necessary to assess potential interactions between the Project and avifauna. This was accomplished using the following approach:

- Identify potential SAR/SOCC avifauna within the Study Area and Project Area using desktop resources.
- Assess observations, species diversity, and habitat utilization of avian species within the Project Area during peak seasons.
- Use the information collected to identify potential Project interactions and inform mitigation measures.

5.10.2 Regulatory Context

The Project has potential to interact with avifauna species that are protected under federal and provincial legislation, which the avifauna surveys explained herein were designed to detect. Legislation that may direct resource development and conservation of avifauna species and their habitat include:

Federal Legislation:

- SARA, S.C. 2002, c. 29
- *Canada Wildlife Act*, R.S.C. 1985, c. W-9
- *Migratory Birds Convention Act*, 1994, S.C. 1994, c. 22
- *Canadian Environmental Protection Act, S.C. 1999, c. 33*

Provincial Legislation:

- *Wild Life Act*, R.S.N.L. 1990, c. W-8
- *Endangered Species Act*, S.N.L. 2001, c. E-10
- *Environmental Protection Act*, S.N.L. 2002, c. E-14.2

CEPA (1999) provides protection of the federal environment through pollution prevention, toxic substance control, waste management, and emissions management. Similarly, the *Environment Act* (1995) supports and promotes the protection, enhancement, and use of the provincial environment while maintaining ecosystem integrity and sustainable development, along with pollution prevention and reduction.

The MBCA (1994) protects all migratory birds while they are present in Canadian Jurisdiction, including on land, in the air, and on the water. NL ESA and SARA prohibit harm to listed SAR along with their habitually occupied spaces and core/critical habitat. Species are listed and protected by SARA based on recommendations by the COSEWIC.

The NL *Wildlife Act* (1990) refers to legislation aimed at protecting and managing wildlife and their habitats. This act covers various aspects, including hunting regulations and the establishment of wildlife areas.

The NL ESA provides provincial protection for species designated as Endangered, Threatened, or Vulnerable in NL. The NL ESA ranks species based on the recommendations of the provincial Species Status Advisory Committee (SSAC) and the Federal SARA, which is based on recommendations provided by COSEWIC.

The Project is also driven by policies, guidelines, and standards that provide guidance on the development of the Project and the survey design for all project types (e.g., wind, quarry, etc.). These guidance documents and policies include but are not limited to:

- Environment and Climate Change Canada's Canadian Wildlife Service (Atlantic Region) – Wind Energy & Birds Environmental Assessment Guidance Update (2022a)
- Wind Turbines and Birds - A Guidance Document for Environmental Assessment, Canadian Wildlife Service (2007)
- Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (ECCC, 2007)

5.10.3 Desktop Assessment Methodology

Desktop information was utilized to gain insight into protected avifauna habitats, species presence, and to identify avian SAR and SOCC potentially occurring at or within Study Area using the following sources:

- Important Bird Areas (IBAs) (IBA Canada, 2025)
- ACCDC

- SARA Recovery strategies
- CWS Waterbird Colony Database (Atlantic Region)
- Newfoundland Breeding Bird Atlas (NLBBA) (2020-2024)
- Habitat classes delineated in the Vegetation community model (VCM)
- eBird, iNaturalist, or other publicly available data sources

5.10.4 Desktop Assessment Results

Avifauna SAR listed under the NL ESA were reviewed to determine likelihood of occurrence in the Project Area. The following SAR were targeted during the desktop review: barn swallow, barrow's goldeneye, bobolink, grey-cheeked thrush, olive-sided flycatcher, red crossbill, red knot, and short-eared owl. Table 5.40 outlines the NL ESA SAR species listings, as well as COSEWIC and SARA listings.

Table 5.40: Avifauna COSEWIC, SARA, and NL ESA Listings

Common Name	Scientific Name	COSEWIC	SARA	ESA
Barn Swallow	*Hinrundo Riparia*	Special Concern	Special Concern	Vulnerable
Barrow's Goldeneye	*Bucephala islandica*	Special Concern	Special Concern	Vulnerable
Bobolink	*Dolichonyx oryzivorus*	Special concern	Threatened	Vulnerable
Gray Cheeked Thrush	*Catharus minimus*	Threatened	Under consideration	Threatened
Harlequin Duck	*Histrionicus histrionicus*	Special Concern	Special Concern	Vulnerable
Lesser Yellowlegs	*Tringa Flavipes*	Threatened	Under consideration	Threatened
Olive-sided Flycatcher	*Contopus cooper*	Special Concern	Special Concern	Vulnerable
Red Crossbill	*Loxia curvirostra*	Threatened	Threatened	Threatened
Red Knot	*Calidris canutus rufa*	Endangered	Endangered	Endangered
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Special Concern	Vulnerable
Short-eared owl	*Asio Flammeus*	Threatened	Special Concern	Threatened

Barn Swallow

Barn swallows are a medium-sized passerine with metallic blue- and cinnamon-colored underparts, and a chestnut throat and forehead. Its most recognizable feature is a deeply forked tail with long outer feathers. Prior to anthropogenic features Barn swallows largely nested on fissures in cliffs, rock overhangs, and caves. Thereafter, their preferred nest sites became human-made structures, including barns, stables, houses, sheds, and bridges. Barn swallows prefer to forage over open spaces such as grasslands, agricultural fields, shorelines, woodland clearings, wetlands, sand dunes, and roads. Currently the major concerns effecting Barn swallow decline are thought to be modifications to the natural system (indirect threats such as pesticides and habitat loss reducing prey quality and quantity), climate change, housing and commercial development, roads and pollution (COSEWIC 2021).

Barrow's Goldeneye

Barrow's goldeneye is a medium-sized diving duck. Breeding males have a contrasting black and white plumage characterized by a purplish black head with a white crescent-shaped patch at the base of the bill. Females have a dark chocolate brown head, a greyish brown back and whitish flanks and belly. The adult female has a bright orange bill in winter and spring. Barrow's goldeneyes feed mostly on aquatic insects and crustaceans in inland waters during the breeding season, and on molluscs (blue mussels, periwinkles) and crustaceans in coastal waters. This species forages in shallow water along shorelines, rarely in water deeper than 4 m. The barrow's goldeneye is protected under the Migratory Birds Convention Act and accompanying regulations pertaining to hunting (COSEWIC, 2000).

Bobolink

The bobolink is a medium-sized passerine. Males are black on the lower half and lighter above, while females are light beige streaked with brown and could be mistaken for a sparrow species. The bobolink has a conical bill, rigid, sharply pointed tail feathers and long hind toenails. Bobolinks prefer grasslands, prairies and meadows. The primary causes of decline include incidental mortality due to agriculture practices, habitat fragmentation and loss of habitat (COSEWIC, 2010).

Newfoundland Grey-cheeked Thrush

This songbird subspecies breeds only in dense montane forests of the Newfoundland archipelago and south coastal Labrador, with small numbers on coastal islands of Nova Scotia and on the French islands of Saint-Pierre-et-Miquelon. Once abundant across the island of Newfoundland, it is now largely restricted to high-elevation habitats and some coastal islands. This is primarily due to nest depredation by a squirrel species introduced to Newfoundland in 1963. Other low-level threats include ecosystem changes related to introduced herbivores and control of insect outbreaks, energy development, mining, and effects of agriculture and logging on wintering habitat (COSEWIC, 2023).

Harlequin Duck

The Harlequin duck is a small sea duck. Breeding males have a slate blue colour highlighted by streaks of white, copper, and black. Females are brown, with a pale belly, plus three white spots on each side of their head. During the breeding season, Harlequin Ducks occupy clear, fast-flowing rivers and streams. Their wintering habitat is rugged, outer-marine coastline. The original decline in Harlequin Duck numbers was attributed primarily to hunting. A hunting ban has been in place in most regions of eastern Canada since 1990, but an unknown amount of incidental and subsistence hunting could still be limiting recovery (COSEWIC, 2013).

Lesser Yellowlegs

Lesser yellowlegs is a small, slender shorebird with greyish plumage, a long neck, a straight black bill that is roughly the same length as its head, and long, bright-yellow legs. Lesser yellowlegs nests on dry ground near peatlands, marshes, ponds, and other wetlands in the boreal forest and taiga. In winter and during migration, the species frequents coastal salt marshes, estuaries and ponds, as well as lakes, other freshwater wetlands, and anthropogenic wetlands. Key concerns include the loss of wetland and intertidal habitat used on migration and in winter, and hunting for sport and subsistence. Additionally, emerging threats from climate change include increased risk of drought in breeding areas, coastal flooding, and greater severity of hurricanes during fall migration (COSEWIC, 2020).

Red Crossbill

A small finch with a crossed bill adapted for eating seeds. Red crossbill prefers mature forested areas across the island of Newfoundland. The *percna* subspecies is unique to the island of Newfoundland and appears to have become rare in recent years, likely related to loss of mature forested habitats, as this species relies on cone crops as its food source (NLFFA, 2025c).

Red Knot

A medium-sized shorebird with a typical "sandpiper" characteristic – long bill, relatively small head and long legs, and long tapered wings. The species is known to use coastal mudflats, salt marshes, sandy estuaries, and sand flats within the island of Newfoundland. The *rufa* subspecies has been designated as endangered due to a 70% decline in population in the past 15 years (NLFFA, 2025c).

Short-Eared Owl

A medium-sized owl with short ear tuffs and yellow eyes, known for its active preying of small mammals especially during dusk and dawn. Its presence is mostly documented in tundra, coastal barrens, sand dune, and bog habitats within the island of Newfoundland, and most coastal areas and nearshore islands are suitable habitat (NLFFA, 2025c). Increased developmental and recreational use of coastal areas may have caused some habitat loss; however, it is likely that the species are limited by prey abundance, predation, competition, and human disturbance (NLFFA, 2025c).

Habitat Classification and Potential SAR Presence

A habitat classification summary was developed from the NLFFA Land Cover database as well as an ELC (Drawings 20-25). The purpose of defining the vegetation communities within the Study Area was to determine what communities are present, what habitats and avifauna species they can support, and if unique or critical habitats are present. The results of the Habitat Classification summary are outlined in Table 5.41. The Habitat Classification indicates a mix of habitat types throughout the Study Area. The dominant habitats are Wetland, Coniferous scrub, Softwood and Barrens.

Wetlands are preferred habitats for some SAR which utilize shoreline, bog or grassy habitats. These species include the short-eared owl, lesser yellowlegs, red knot, rusty blackbird, barrows goldeneye and harlequin duck. As there is an abundance of wetland habitat in the Study Area there is potential to encounter these species. The bobolink prefers grasslands and meadows and would also likely be found in wetland habitats, as well as coniferous scrub habitats which have higher levels of vegetation. The grey-cheeked thrush and red crossbill prefer forested habitats which, while not as abundant are present in the Study Areawith the highest amount of forested habitat being softwood. Barren habitats are utilized by short-eared owl who prefer coastal barrens, they can also be utilized as habitat for barn swallows which have a preference for open areas.

Table 5.41: Habitat Communities Summary

Habitat Class	Study Area (ha)			Total (ha)	Total (%)
	TQK North	TQK Central	TQK South		
Softwood	7,555	1,608	2,861	12,024	11.44
Mixed wood	2,647	1,528	2,824	6,999	6.66
Hardwood	280	24	1	305	0.29
Wetland	39,254	2,017	3,753	45,024	42.85
Coniferous scrub	16,894	3,454	6,021	26,369	25.10
Deciduous scrub	1,640	210	552	2,402	2.29
Regenerating forest	269	58	133	460	0.43
Barrens	6,127	748	3,598	10,473	9.97
Anthropogenic	85	413	523	1,021	0.97
Total	**72,832**	**10,062**	**20,267**	**105,077**	**100**

Atlantic Canada Conservation Data Centre

Status ranks (S-ranks) from ACCDC were used to determine whether a species is a SOCC based on the time of year in which the species was observed. Species ranked S1, S2, or any combination thereof (i.e., S2S3) were considered SOCC. Species ranks may differ depending on whether a species is observed in the breeding season (B), the non-breeding (N), or during migration (M). If a species has only one seasonal ranking, such as S2B, it was considered a SOCC regardless of the time of year it was observed. If a species has an alternate seasonal ranking, such as S2B and S5N simultaneously, the species was considered a SOCC only if observed during the breeding season.

The ACCDC Data Report (Appendix C) identified 4 SOCC and 10 SAR avifauna species. Field survey data will inform species presence in the area. Results of the ACCDC Review are listed in Table 5.42.

Table 5.42: ACCDC Results

Common Name	Scientific Name	S Rank (2015)	Years observed	ESA
Barn Swallow	*Riparia Riparia*	S1S2B,SUM	1953	Threatened
Black Scoter	*Melanitta nigra*	S2B,S2N,SUM	2020	Not listed
Barrow's Goldeneye	*Bucephala islandica*	S1N, SUM	1993	Vulnerable
Bobolink	*Dolichonyx oryzivorus*	S1B, SUM	2019	Vulnerable
Caspien Tern	*Hydroprogne caspia*	S2B,SUM	1989	Not Listed
Gray Cheeked Thrush	*Catharus minimus*	2B,SUM	1990	Threatened
Gyrfalcon	*Falco rusticolus*	S2S3N,SUM	2011	Not Listed
Harlequin Duck	*Histrionicus histrionicus*	S3B, S2N, SUM	2019	Vulnerable
Lesser yellowlegs	*Tringa flavipes*	S3M	2018, 2021	Threatened
Northern Gannet	*Morus bassanus*	S2B, S2M	2019	Not Listed
Olive-sided Flycatcher	*Contopus cooper*	S3B, SUM	2003	Threatened
Red Crossbill	*Loxia curvirostra*	S1S2	2003,2006, 2019	Threatened
Red Knot	*Calidris canutus*	S2M	1999, 2000, 2003, 2004,2005, 2006, 2007, 2008, 2009 ,2010, 2011, 2015, 2016, 2017, 2018, 2020, 2021	Endangered
Rough-legged Hawk	*Buteo lagopus*	S2S3	2002	Not Listed
Rusty Blackbird	*Euphagus carolinus*	S2S3B,SUM	2006, 2009	Vulnerable
Semipalmated Plover	*Charadrius semipalmatus*	S1B,S4M	2016, 2017, 2020, 2021	Not Listed
Short-eared owl	*Asio Flammeus*	S3B, SUM	2015	Vulnerable

Important Bird Areas (IBA)

The closest IBA is the Bay du Nord Wilderness Reserve and Middle Ridge Wildlife Reserve (NF018), which intersects the northwestern extent of the TQK North Study Area. This IBA represents inland habitat, including softwood forest, wetlands (e.g., fens and bogs), barrens, and rivers/streams. This IBA is known to support a variety of waterfowl and game bird species(e.g., various geese, duck, and ptarmigan species; IBA Canada, 2025).

The second closest IBA is Placentia Bay (NF028) in Argentia, Newfoundland. Placentia Bay stretches from the coast of Argentia to the coast of Saint Bride's and borders the southern extent of the TQK South Study Area (Drawing 32). Placentia Bay was known to support habitats for foraging, including local breeding birds such as northern gannet (*Morus bassanus*), black-legged kittiwake (*Rissa tridactyla*), and common murre (*Uria aalge*) (IBA Canada, 2024).

Newfoundland Breeding Bird Atlas

The most recent edition of the NLBBA was completed between 2020 and 2024. The Atlas divided the island of Newfoundland into 10 km by 10 km grid squares, which are systematically surveyed for evidence of breeding birds (Birds Canada, 2025b). Approximately 31 grid squares covered the Study Area, with the level of coverage within the Study Area variable due to accessibility and the remote nature of some areas. A total of 367 bird species were observed, with red crossbill as the only SAR observed.

eBird

Available eBird data results were analyzed, and the review consisted of all records observed in or near the Study Area for the range of 2015 to 2023. The data was filtered based on potential SAR and the following species were identified within the Study Area or within 5 km of the Study Area: barn swallow, bobolink, gray-cheeked thrush, peregrine falcon (*Falco peregrinus*), piping plover (*Charadrius melodus*), red crossbill, red knot, and short-eared owl. There were no occurrences of either barrow's goldeneye, chimney swift (*Chaetura pelagica*), common nighthawk (*Chordeiles minor*), or rusty blackbird in the past decade for the eBird online dataset, and only one count of rusty blackbird was recorded in 2023 approximately 22 km from the Study Area.

CWS Waterbird Colony Database (Atlantic Region)

The CWS Waterbird Colony Database (Wilhelm and Mahoney, 2021) was reviewed to identify waterbird colonies near the Project. In total, 57 waterbird colonies were identified within a 5 km buffer of the Project Area. A total of 47 of the identified colonies were concentrated around the western and southwestern extent of the Study Area, and were noted as supporting herring gull (*Larus argentatus*), great black-backed gull (*Larus marinus*), black guillemot (*Cepphus grylle*), common tern (*Sterna hirundo*), black-legged kittiwake, ring-billed gull (*Larus delawarensis*), Arctic tern (*Sterna paradisaea*), and double-crested cormorant (*Phalacrocorax auritus*). On the eastern side of the Study Area, ten colonies were identified supporting black-legged kittiwake, herring gull, black-backed gull, ring-billed gull, common tern, Caspian tern (*Hydroprogne caspia*), and Arctic tern (*Sterna paradisaea*).

5.10.5 Field Assessment Methodology

The Proponent had retained GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) in 2023/2024 to conduct initial desktop assessments and field surveys to gather information on avian species and associated habitat in the assessed area. The area assessed by GEMTEC included TQK Central and TQK South (Drawings 29-31, 33-34); therefore, any results derived from field studies focus on species composition and activity within the TQK Central and TQK South areas.

Several types of survey methods were employed to assess the avian species which utilize the TQK Central and TQK South. Prior to conducting field surveys, a preliminary desktop survey design (i.e., vegetation communities, historical SAR) was developed to target suitable habitats for avifauna species or groups of interest. Survey methods were consistent with the following guidelines: Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (2007) and A habitat-based point-count locations protocol for terrestrial birds, emphasizing Washington and Oregon (2000). These documents provided instructions in the following areas: survey site selection, survey location spacing, number of point counts, survey duration, and season selection.

Based on desktop review, CWS guidelines and results from the SAR/SOCC species list and the ACCDC report, the following avifauna survey types were determined by GEMTEC for the Project Area in 2023 and 2024. Table 5.43 provides a detailed breakdown of survey types and dates

Table 5.43: Avifauna Field Surveys and Timings

Survey Type	Dates
Spring/Fall migration	April 21 and May 30, 2023 July 25 to October 3, 2023
Breeding Bird	June 13 to July 12, 2023 June 6 to July 8, 2024
Songbird Acoustic Recording	Jun 15 to November 16, 2023 May 03 to December, 2024
Short-eared Owl	June 13, June 26, July 11, September 25, 2023
Waterfowl	July 24 to October 02, 2024
Shorebird	April 20 to June 9, 2024 July 20 to November 20, 2024
Overwintering Coastal	January 25, January 26, March 16, March 17, 2024

Survey dates were strategically selected to capture key periods in the annual cycle of bird activity. By distributing surveys across distinct timeframes such as spring migration, breeding season, and fall migration, a broader range of bird species and behaviors could be documented. This approach ensures a comprehensive representation of avifauna presence and use of the area.

Habitat descriptions were recorded, and each location was georeferenced by a handheld GPS. General observations including temperature, visibility, wind speed, date and start and end time were also recorded during each survey. Bearings were recorded for SAR/SOCC species observed during dedicated survey periods and incidentally.

The specific methods used for each type of survey are described in detail below.

Spring and Fall Migration Surveys

The province of Newfoundland lies within the North American Atlantic Flyway zone, which increases the important for migration surveys. Flyways represent generalized migration movements of birds with most using only portions of the flyways. Actual regions of flyways used by migratory birds are dependent on species breeding and wintering locations. Species that use the North American Atlantic Flyway generally have a stronger presence along the North Atlantic Coastline (La Sorte et al., 2014). Migrants fly at lower heights in coastal areas compared to central regions (Horton et al., 2016). Migratory species that have been identified as being particularly susceptible to mortality associated with wind farms include raptors and nocturnal migrants.

The ECCC CWS (Atlantic Region) - Wind Energy & Birds EA Guidance Update (ECCC, 2022) and the CWS document 'Recommended Protocols for Monitoring Impacts of Wind Turbine on Birds' (2007) were referenced to develop the migratory bird survey protocols and for risk category determination. Due to the size of the proposed Project, and the anticipated turbine heights, the Project risk level is Category 4 (highest risk level). Category 4 projects require 1-2 year intensive baseline studies with targeted studies for issues of concern and intensive follow-up studies (post-construction) for a minimum of two years with targeted follow-up studies for issues of concern.

Single position surveys were conducted whereby an observer remained in one location for one to six hours and performed regular sky scans for avifauna. These high point of land locations were chosen to give panoramic views. Surveyors identified species, flight direction, and height wherever possible. All birds identified (auditory and/or visual) were recorded by species, including age and sex if known. Five study locations were chosen based on accessibility, observational visibility, and the presence of geographic features that concentrate landbird movements (i.e., coastlines, ridges, headlands).

Other migratory surveys used an atlas style approach whereby transects were walked or driven with ATV or truck. Avifauna spotted along the transects were identified and opportunistic 10-minute fall point counts (PC) were conducted, as well, when groups of feeding birds were spotted. A total of 63 locations were designated as fall point count locations over the duration of the atlas style surveying.

Breeding Bird Surveys

Breeding bird surveys were conducted between June and July in 2023 and 2024 to determine the composition and abundance of bird species that are using the TQK Central and TQK South for breeding. The surveys were conducted on the mornings of June 13 to 22, July 1 to July 3, July 7, and July 10 to July 12, 2023, and July 4 to July 8, 2024. A total of 50 PC locations were completed in 2023, and an additional 70 PC locations were completed in 2024, with 67 locations receiving two visits with a minimum of 10 days between each visit. Surveys were conducted using the protocols outlined in the CWS guidance (2007) and A habitat-based point-count protocol for terrestrial birds, emphasizing Washington and Oregon guidance (2000).

Point count surveys were conducted during favourable weather conditions (e.g., little to no precipitation and wind levels that will not inhibit surveyor's auditory identification ability) beginning one hour before sunrise until approximately five hours after sunrise (10:00 AM). Two personnel listened for 10 minutes at each location, noting encountered species, number of identified individuals, any evidence of breeding behaviour, sex (where possible), and habitat descriptions. Breeding status of each species was determined using the criteria outlined by the NLBBA (2025b). Evidence of breeding birds such as nests, territorial displays, alarm calling, individuals flushed, mating, and aggressive defending of territories were recorded in addition to weather parameters, such as temperature, wind speed, cloud cover and noise level at each location (e.g., wind noise, anthropogenic noise, etc.).

Songbird Acoustic Recording Surveys

Songbird acoustic recording surveys were conducted in 2023 and 2024 to passively collect recordings of songbirds in the TQK Central and TQK South Study Areas. Passive recordings were collected using Wildlife Acoustic Song Meter SM4, Song Meter Mini 2, and Song Meter Mini 2 Bat equipped with optional acoustic stub microphones. ARUs were deployed in 2023 between June15 and November 16, and again in 2024 with deployments occurring in May-June, and retrieval sin November-December.

ARUs recording avifauna were programmed to record 10-minute recordings every 30 minutes starting 1-hour prior to sunrise and continue until 5 hours after sunrise. Each Song Meter Mini Bat 2 was programmed to record non-ultrasonic acoustic activity following a one-day cycle with the same daily schedules as described above. Song Meter SM4's were securely attached to trees with a locking cable for stability. All Song Meter Mini 2's were securely attached to trees using cable ties and strategically placed in optimal surroundings to capture the most accurate acoustics at each site. GPS coordinates were recorded for each deployment, and general habitat characteristics, along with photographs, were documented. Recording data was manually reviewed for species identification.

Short-eared owl Surveys

A targeted program for short-eared owl was conducted during the 2024 monitoring period to potentially capture the presence of the SAR within the TQK Central and TQK South. A desktop analysis was conducted to identify suitable habitat across these areas and to review historical occurrence records. Data sources consulted includedthe ACCDC, NLBBA, Christmas Bird Count (2024), Atlantic Canada Colonial Survey (2025a), ACSS (2017), and the Atlantic Canada Nocturnal Owl Survey (2025a). Two management plans, including a management plan for the short-eared owl (*Asio flammeus flammeus*) in NL (2005) and Short-eared owl survey protocol (2015), were also used as sources to identify potential short-eared owl habitat and study methodology.

Surveys were conducted at five locations within the TQK Central and TQK South with four visits to each location throughout the summer and fall of 2024. Surveys were 10 minutes each, with the observer playing a short-eared owl call at each location and then allocating 2-5 minutes for a vocal or visual response. Additional recorded data included the start and end times of survey, weather conditions, GPS coordinates and tracks, and habitat descriptions.

Waterfowl Surveys

A desktop assessment was completed to identify potential survey points, including shorelines and inland waterbodies, to assess the presence of waterfowl species within and near the TQK Central and TQK South. Survey points were chosen based on the presence of habitat used by waterfowl for nesting, staging, and migratory stopover purposes and suitable vantage point for observers.

A total of 44 sites were chosen throughout the TQK Central and TQK South. Waterfowl surveys were conducted in compliance with the CWS guidelines (2007), with a focus on inland pond sites from mid-July to mid-September in addition to some earlier surveys completed in May. Furthermore, coastal surveys were completed during a 7 to 10-day period from mid-May to late September in Arnold's Cove, Southern Harbour, and Sunnyside. Some waterfowl surveys were integrated with shorebird surveys, as certain coastal locations supported both species. Survey efforts were adjusted based on favourable weather conditions, as previously described.

Surveys were conducted with observation periods ranging from 15 to 30 minutes per location. All observed species and the number of individuals were recorded, including aerial foragers (e.g., raptors, aerial insectivores, etc.) and flyovers. Additional data recorded included date, start and end time, GPS coordinates, habitat description, and weather (temperature, wind speed, cloud cover, precipitation).

Non-Breeding Shorebird Surveys

A desktop assessment was completed to identify shoreline survey points and to assess the potential presence of shorebird species within the TQK Central and TQK South. The program used several data sources, including the ACCDC, Program for Regional and International Shorebird Monitoring (PRISM) – Atlantic Canada Shorebird Survey (ACSS) (2017), NL *ESA*, and SARA to determine SAR and SOCC historically recorded or potentially found in the area. Additional data from available sources, such as LiDAR and topographic maps, were used to aid in the survey design. Survey locations were chosen based on previously surveyed ACSS sites with additional locations to enhance spatial coverage across the TQK Central and TQK South. Selected sites included Arnold's Cove, Bellevue, Come By Chance, Chance Cove, Little Chance Cove, Southern Harbour and Sunnyside.

Surveys were completed on a 10-day cycle capturing both spring and fall migration (April 2 to June 9, 2024, and July 20 to November 20, 2024, respectively) and occurred within a two to three hours period before, during, or after the lowest tide with adequate visibility (i.e., limited fog) to ensure consistency (ECCC, 2017). Similar to other survey types, surveys were conducted based on available favorable weather conditions, as previously described.

A total of 12 survey locations were completed within the coastal areas. Surveys were conducted with two qualified personnel the data recorded included the observed species, age and sex (whenever possible), number of individuals (in case where actual numbers were unidentifiable, systematic estimates were extrapolated to the total group), start and end time of survey, weather conditions, and GPS coordinates and GPX tracks.

Overwintering Coastal Surveys

GEMTEC completed a land-based point-count survey at 10 locations along coastal areas within and adjacent to the TQK Central and TQK South Study Areas. The overwintering survey also included an aerial survey via helicopter. The ariel survey followed a track approximately 200-250 m from the shoreline along the coastlines of Trinity Bay and Placentia Bay in the area adjacent to the TQK Central and TQK South Study Areas. All birds in flight, on water or diving were identified when possible and all birds encountered were recorded. Land and aerial surveys were divided into two survey periods, with the first round of surveys occurring in late January 2024, and the second round of surveys occurring in mid-March 2024.

5.10.6 Field Assessment Results

Based on data sources examined during desktop review (e.g., ACCDC, NLBBA, eBird, iNaturalist, etc.), the bird species observed during field surveys were consistent with what was expected for this area throughout the spring migration, breeding, and fall migration seasons.

ACCDC S-ranks were used to determine whether a species is a SOCC, based on the time of year in which the species was observed. If a species has only one seasonal ranking, such as S2B, it was considered a SOCC regardless of the time of year it was observed. However, if the species had an alternate ranking, such as an S-rank of S2S3B, S5N, the species was considered a SOCC if observed during the breeding season. Outside of breeding season, this species was not considered a SOCC.

During data compilation of field results, any estimate of observations was rounded up to the nearest increment of five (i.e., +20 to 25) for the purpose of quantitative analysis.

Spring Migration Surveys

Four spring migration surveys were completed on May 21 and May 30, 2024, during which 16 birds were observed, comprising of 11 different species. Savannah sparrow (*Passerculus sandwichensis*) was the most observed species and no SAR or SOCC were observed during this time. A summary is provided in Table 5.44.

Table 5.44: Spring Migration Results Summary

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank
American Pipit	*Anthus rubescens*	---	---	---	S3B,S4M
Blackpoll Warbler	*Setophaga striata*	---	---	---	S5B
Common Loon	*Gavia immer*	---	---	---	S5B,S4N,SNRM
Great Black-backed Gull	*Larus marinus*	---	---	---	S4
Herring Gull	*Larus argentatus*	---	---	---	S4
Northern Waterthrush	*Parkesia noveboracensis*	---	---	---	S5B
Ruby-crowned Kinglet	*Corthylio calendula*	---	---	---	S5B

Savannah Sparrow	*Passerculus sandwichensis*	---	---	---	S5B
White-throated Sparrow	*Zonotrichia albicolis*	---	---	---	S5B
Yellow Warbler	*Setophaga petechia*	---	---	---	S5B
Yellow-rumped Warbler	*Setophaga coronata*	---	---	---	S5B

The surveys were primarily completed in habitats characterized as barrens and rock outcrops, with some locations adjacent to pond or on a high point. Most species observed during these surveys were passerines; however, some shorebirds, such as herring gull and great black-backed gull, and waterfowl species, such as common loon (*Gavia immer*), were also noted.

Fall Migration Surveys

A total of 67 fall migration surveys were completed on July 25, August 26 to 28, September 15 to 18, 24 to 27, and October 3, 2024 (Drawings 33-34). During this survey period, approximately 1,160 birds were observed, comprising of 57 different species. The species composition also included five unknown species. White-throated sparrow, ring-billed gull, and herring gull were the most commonly observed species. No SOCC were observed during this period, and lesser yellowlegs were the only SAR observed. A summary is provided in Table 5.45.

Table 5.45: 2024 Fall Migration Surveys Results Summary

Common Name	Scientific Name	COSEWIC	*SARA*	*ESA*	ACCDC S-Rank
American Crow	*Corvus brachyrhynchos*	---	---	---	S5
American Goldfinch	*Spinus tristis*	---	---	---	S5
American Goshawk	*Accipiter atricapillus*	---	---	---	S3
American Robin	*Turdus migratorius*	---	---	---	S5B
Bald Eagle	*Haliaeetus leucocephalus*	---	---	---	S4
Belted Kingfisher	*Megaceryle alcyon*	---	---	---	S4B,S3N,SUM
Black-and-white Warbler	*Mniotilta varia*	---	---	---	SNA
Black-capped Chickadee	*Poecile atricapillus*	---	---	---	S5
Blackpoll Warbler	*Setophaga striata*	---	---	---	S5B
Black-throated Green Warbler	*Setophaga virens*	---	---	---	S5B
Blue Jay	*Cyanocitta cristata*	---	---	---	S5
Boreal Chickadee	*Poecile hudsonicus*	---	---	---	S4

Common Name	Scientific Name	COSEWIC	*SARA*	*ESA*	ACCDC S-Rank
Brown Creeper	*Certhia americana*	---	---	---	S3
Canada Jay	*Perisoreus canadensis*	---	---	---	S5
Common Loon	*Gavia immer*	---	---	---	S5B,S4N,SNRM
Common Raven	*Corvus corax*	---	---	---	S5
Common Tern	*Sterna hirundo*	---	---	---	S4B,SUM
Common Yellowthroat	*Geothlypis trichas*	---	---	---	S5B
Dark-eyed Junco	*Junco hyemalis*	---	---	---	S5
Downy Woodpecker	*Dryobates pubescens*	---	---	---	S4
Fox Sparrow	*Passerella iliaca*	---	---	---	S5B
Golden-crowned Kinglet	*Regulus satrapa*	---	---	---	S5B,S4N,SUM
Great Black-backed Gull	*Larus marinus*	---	---	---	S4
Greater Yellowslegs	*Tringa melanoleuca*	---	---	---	S3B,S4M
Green-winged Teal	*Anas crecca*	---	---	---	S4B,SUM
Hairy Woodpecker	*Picoides villosus*	---	---	---	S4
Hermit Thrush	*Catharus guttatus*	---	---	---	S5B
Herring Gull	*Larus argentatus*	---	---	---	S4
Lesser Yellowlegs	*Tringa flavipes*	Threatened	---	Threatened	S2S3M*
Lincoln's Sparrow	*Melospiza lincolnii*	---	---	---	S5B
Merlin	*Falco columbarius*	---	---	---	S4S5B,SUM
Northern Flicker	*Colaptes auratus*	---	---	---	S4
Northern Harrier	*Circus cyaneus*	---	---	---	S3B,SUM
Northern Shrike	*Lanius borealis*	---	---	---	S3N,SUM
Northern Waterthrush	*Parkesia noveboracensis*	---	---	---	S5B
Osprey	*Pandion haliaetus*	---	---	---	S4S5B,SUM
Palm Warbler	*Setophaga palmarum*	---	---	---	S4B
Pine Siskin	*Spinus pinus*	---	---	---	S4S5
Red-breasted Nuthatch	*Sitta canadensis*	---	---	---	S5
Ring-billed Gull	*Larus delawarensis*	---	---	---	S4B,SUM
Ruby-crowned Kinglet	*Regulus calendula*	---	---	---	S5B
Ruffed Grouse	*Bonasa umbellus*	---	---	---	SNA

Common Name	Scientific Name	COSEWIC	*SARA*	*ESA*	ACCDC S-Rank
Savannah Sparrow	*Passerculus sandwichensis*	---	---	---	S5B
Semipalmated Sandpiper	*Calidris pusilla*	---	---	---	S3M
Song Sparrow	*Melospiza melodia*	---	---	---	S4B,SUM
Swamp Sparrow	*Melospiza georgiana*	---	---	---	S5B
White-throated Sparrow	*Zonotrichia albicollis*	---	---	---	S5B
Willow Ptarmigan	*Lagopus lagopus*	---	---	---	S5
Wilson's Warbler	*Cardellina pusilla*	---	---	---	S5B
Yellow Warbler	*Setophaga palmarum*	---	---	---	S5B
Yellow-bellied Flycatcher	*Empidonax flaviventris*	---	---	---	S5B
Yellow-rumped Warbler	*Setophaga coronata*	---	---	---	S5B
Unknown		---	---	---	
Unknown Diver sp.		---	---	---	
Unknown Raptor		---	---	---	
Unknown Sparrow sp.		---	---	---	
Unknown Warbler Sp.		---	---	---	

*SAR or SOCC

The surveys were primarily completed in habitats characterized as barrens and rock outcrops, with some locations marked as open edge habitats and open canopy habitats. Most species observed during these surveys were passerines; however, shorebirds contributed to the highest species count. Raptor species, such as osprey (*Pandion haliaetus*), merlin (*Falco columbarius*), and northern harrier (*Circus hudsonius*), were also noted.

Breeding Bird Surveys

A total of 50 PC locations were surveyed in 2023, and 70 PC locations were surveyed in 2024, with all surveys occurring in June and July (Drawings 33-34). Across the two survey periods, approximately 3,334 individuals were observed, representing 64 different species (Table 5.46).

Passerines (primarily warblers and sparrows) accounted for the majority of the species observed. White-throated sparrow (*Zonotrichia albicolis*), yellow-bellied flycatcher (*Empidonax flaviventris*), hermit thrush (*Catharus guttatus*), blackpoll warbler (*Setophaga striata*), fox sparrow (*Passerella iliaca*), and northern waterthrush (*Parkesia noveboracensis*) were the most commonly observed species. Three unknown species were documented, one being identified as a potential seabird/shorebird, another as a species of gull. One SAR, red crossbill, was observed during both periods with one individual observed in 2023 and six individuals observed in 2024.

Table 5.46: Breeding Bird Survey Results Summary

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank[1]
Alder Flycatcher	*Empidonax alnorum*	---	---	---	S4B,SUM
American Black Duck	*Anas rubripes*	---	---	---	S4B,S4N
American Crow	*Corvus brachyrhynchos*	---		---	S5
American Goldfinch	*Spinus tristis*	---	---	---	S5
American Redstart	*Setophaga ruticilla*	---	---	---	S5B
American Robin	*Turdus migratorius*	---	---	---	S5B
Belted Kingfisher	*Megaceryle alcyon*	---	---	---	S4B,S3N,SUM
Black-and-White Warbler	*Mniotilta varia*	---	---	---	S5B
Black-backed Woodpecker	*Picoides arcticus*	---	---	---	S4
Black-capped Chickadee	*Poecile atricapillus*	---	---	---	S5B
Blackpoll Warbler	*Setophaga striata*	---	---	---	S5B
Black-throated Green Warbler	*Setophaga virens*	---	---	---	S5B
Blue Jay	*Cyanocitta cristata*	---	---	---	S5
Boreal Chickadee	*Poecile hudsonicus*	---	---	---	S4
Common Loon	*Gavia immer*	---	---	---	S5B,S4N,SNRM
Common Raven	*Corvus corax*	---	---	---	S5
Common Tern	*Sterna hirundo*	---	---	---	S4B,SUM
Common Yellowthroat	*Geothlypis trichas*	---	---	---	S5B
Dark-eyed Junco	*Junco hyemalis*	---	---	---	S5
Downy Woodpecker	*Dryobates pubescens*	---	---	---	S4
Eastern Wood-pewee	*Contopus virens*	---	---	---	SNA
Fox Sparrow	*Passerella iliaca*	---	---	---	S5B
Golden-crowned Kinglet	*Regulus satrapa*	---	---	---	S5B,S4N,SUM
Gray Jay	*Perisoreus canadensis*	---	---	---	S5
Great Black-backed Gull	*Larus marinus*	---	---	---	S4
Greater Yellowlegs	*Tringa melanoleuca*	---	---	---	S3B,S4M

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank[1]
Hairy Woodpecker	*Dryobates villosus*	---	---	---	S4
Hermit Thrush	*Catharus guttatus*	---	---	---	S5B
Herring Gull	*Larus argentatus*	---	---	---	S4
Lincoln's Sparrow	*Melospiza lincolnii*	---	---	---	S5B
Magnolia Warbler	*Setophaga magnolia*	---	---	---	S5B,SUM
Mallard	*Anas platyrhynchos*	---	---	---	S3B,SUM
Mourning Warbler	*Geothlypis philadelphia*	---	---	---	S4B,SUM
Northern Flicker	*Colaptes auratus*	---	---	---	S4
Northern Goshawk	*Accipiter gentilis*	---	---	---	
Northern Harrier	*Circus hudsonius*	---	---	---	S3B,SUM
Northern Waterthrush	*Parkesia noveboracensis*	---	---	---	S5B
Osprey	*Pandion haliaetus*	---	---	---	S4S5B,SUM
Palm Warbler	*Setophaga palmarum*	---	---	---	S4B
Pine Grosbeak	*Pinicola enucleator*	---	---	---	S5
Pine Siskin	*Spinus pinus*	---	---	---	S4S5B,SUM
Purple Finch	*Haemorhous purpureus*	---	---	---	S5
Red Crossbill	*Loxia curvirostra*	Threatened	Threatened	---	S1S2[2]
Red-breasted Nuthatch	*Sitta canadensis*	---	---	---	S5
Ring-billed Gull	*Larus delawarensis*	---	---	---	S4B,SUM
Ring-necked Duck	*Aythya collaris*	---	---	---	S5B
Ruby-crowned Kinglet	*Corthylio calendula*	---	---	---	S5B
Ruffed Grouse	*Bonasa umbellus*	---	---	---	SNA
Savannah Sparrow	*Passerculus sandwichensis*	---	---	---	S5B
Song Sparrow	*Melospiza melodia*	---	---	---	S4B,SUM
Swainson's Thrush	*Catharus ustulatus*	---	---	---	S5B
Swamp Sparrow	*Melospiza georgiana*	---	---	---	S5B
Tree Swallow	*Tachycineta bicolor*	---	---	---	S4B,SUM
White-throated Sparrow	*Zonotrichia albicollis*	---	---	---	S5B
White-winged Crossbill	*Loxia leucoptera*	---	---	---	S5
Willow Ptarmigan	*Lagopus lagopus*	---	---	---	S5
Wilson's Snipe	*Gallinago delicata*	---	---	---	S5B
Wilson's Warbler	*Cardellina pusilla*	---	---	---	S5B
Yellow Warbler	*Setophaga petechia*	---	---	---	S5B

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank[1]
Yellow-bellied Flycatcher	*Empidonax flaviventris*	---	---	---	S5B
Yellow-rumped Warbler	*Setophaga coronata*	---	---	---	S5B
Unknown seabird/shorebird	---	---	---	---	---
Unknown gull	---	---	---	---	---
Unknown species	---	---	---	---	---

[1]ACCDC S-rank is provided wherever possible and is left blank when species does not have a S-rank.
[*]SAR or SOCC

During the 2023 survey period, most birds were observed in softwood forest (32%) and barren habitat (26%). These habitats also observed the highest species abundance, with wetland habitat also recording high species abundance. One unknown gull species and one unknown seabird species were observed during the 2023 survey period, with both observed within the barren habitat. The red crossbill was observed in a barren habitat.

During the 2024 survey period, most birds were also observed in softwood forest (44%), wetland habitat (including wet forest) (19%), and barren habitat (12%). These habitats also observed the highest abundance of species, with the balsam fir dominant forest type and wetland observing the highest abundance across all recorded habitats. In contrast to the red crossbill observed in 2023, the three individuals observed during the 2024 survey period were recorded within softwood forest, specifically the balsam fir forest and softwood shrublands.

Songbird Acoustic Recording Surveys

Seven ARUs were deployed in 2023 in 2024, a total of 27 ARUs were deployed to record potential songbird species, including the Mini Bat 2s with optional stub microphones. In 2023, a total of 106 species were identified with two unknowns. No SAR or SOCC were identified during this survey. The data from 2024 has not yet been processed therefore results of the 2024 surveys will be presented during the EA process.

Table 5.47: Songbird Acoustic Recording Results Summary

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank
American Robin	*Turdus migratorius*	---	---	---	S5B
Belted Kingfisher	*Megaceryle alcyon*	---	---	---	S4B,S3N,SUM
Black-and-white Warbler	*Mniotilta varia*	---	---	---	S5B
Black-backed Woodpecker	*Picoides arcticus*	---	---	---	S4
Black-capped Chickadee	*Poecile atricapillus*	---	---	---	S5
Blackpoll Warbler	*Setophaga striata*	---	---	---	S5B
Blue Jay	*Cyanocitta cristata*	---	---	---	S5
Boreal Chickadee	*Poecile hudsonicus*	---	---	---	S4
Common Loon	*Gavia immer*	---	---	---	S5B,S4N,SNRM

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank
Common Raven	*Corvus corax*	---	---	---	S5
Common Yellowthroat	*Geothlypis trichas*	---	---	---	S5B
Dark-eyed Junco	*Junco hyemalis*	---	---	---	S5
Downy Woodpecker	*Picoides pubescens*	---	---	---	S4
Fox Sparrow	*Passerella iliaca*	---	---	---	S5B
Hermit Thrush	*Catharus guttatus*	---	---	---	S5B
Herring Gull	*Larus argentatus*	---	---	---	S4
Mallard	*Anas platyrhynchos*	---	---	---	S3B,SUM
Merlin	*Falco columbarius*	---	---	---	S4S5B,SUM
Northern Flicker	*Colaptes auratus*	---	---	---	S4
Northern Waterthrush	*Parkesia noveboracensis*	---	---	---	S5B
Pine Siskin	*Spinus pinus*	---	---	---	S4S5
Red-breasted Nuthatch	*Sitta canadensis*	---	---	---	S5
Ruby-crowned Kinglet	*Regulus calendula*	---	---	---	S5B
Savannah Sparrow	*Passerculus sandwichensis*	---	---	---	S5B
Swamp Sparrow	*Melospiza georgiana*	---	---	---	S5B
White-throated Sparrow	*Zonotrichia albicollis*	---	---	---	S5B
White-winged Crossbill	*Loxia leucoptera*	---	---	---	S5
Wilson's Snipe	*Gallinago delicata*	---	---	---	S5B
Wilson's Warbler	*Cardellina pusilla*	---	---	---	S5B
Yellow-bellied Flycatcher	*Empidonax flaviventris*	---	---	---	S5B
Yellow-rumped Warbler	*Setophaga coronata*	---	---	---	S5B
Unknown Flycatcher	---	---	---	---	---
Unknown Sparrow	---	---	---	---	---
Unknown Warbler	---	---	---	---	---

Short eared Owl Surveys

Five survey stations were established based on historical records and habitat suitability and were surveyed on June 13 and 26, July 11, and September 25, 2024. Each location was visited four times during the monitoring period. Survey stations were situated in open areas across a range of habitats, including open woodlands, grasslands, and forest edges adjacent to coastal zones. No short-eared owls were observed during any of the surveys.

Waterfowl Surveys

Waterfowl surveys were completed at 44 locations throughout the TQK Central and TQK South on May 13, 21, and 30, June 19, July 12 and 25, August 7, 16, 26, and 27, and September 13, 14, 23, 24, 26 and 27 in 2024. (Drawings 33-34). There were 27 observed during the waterfowl survey period. The results of these surveys are summarized in Table 5.48.

Table 5.48: Waterfowl Surveys Summary

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank
American Black Duck	*Anas rubripes*	---	---	---	S4B,S4N
American Crow	*Corvus brachyrhynchos*	---	---	---	S5
American Goldfinch	*Spinus tristis*	---	---	---	S5
Arctic Tern	*Sterna paradisaea*	---	---	---	S4B,SUM
Bald Eagle	*Haliaeetus leucocephalus*	---	---	---	S4
Black-headed Gull	*Chroicocephalus ridibundus*	---	---	---	S1B,S3N,SUM*
Black-legged Kittiwake	*Rissa tridactyla*	---	---	---	S5B
Canada Goose	*Branta canadensis*	---	---	---	S4B
Common Loon	*Gavia immer*	---	---	---	S5B, S4N,SNRM
Common Tern	*Sterna hirundo*	---	---	---	S4B,SUM
European Starling	*Sturnus vulgaris*	---	---	---	SNA
Great Black-backed Gull	*Larus marinus*	---	---	---	S4
Greater Yellowlegs	*Tringa melanoleuca*	---	---	---	S3B,S4M
Green-winged Teal	*Anas crecca*	---	---	---	S4B,SUM
Herring Gull	*Larus argentatus*	---	---	---	S4
Least Sandpiper	*Calidris minutilla*	---	---	---	S3B,S4M
Lesser Yellowlegs	*Tringa flavipes*	Threatened	---	Threatened	S2S3M*
Merlin	*Falco columbarius*	---	---	---	S4S5B,SUM
Northern Waterthrush	*Parkesia noveboracensis*	---	---	---	S5B
Ring-billed Gull	*Larus delawarensis*	---	---	---	S4B,SUM
Ring-necked Duck	*Aythya collaris*	---	---	---	S5B
Semipalmated Plover	*Charadrius semipalmatus*	---	---	---	S1B,S4M*
Semipalmated Sandpiper	*Calidris pusilla*	---	---	---	S3M
Short-billed Dowitcher	*Limnodromus griseus*	---	---	---	S3M
Spotted Sandpiper	*Actitis macularius*	---	---	---	S4B,SUM
Tree Swallow	*Tachycineta bicolor*	---	---	---	S4B,SUM
Yellow Warbler	*Setophaga petechia*	---	---	---	S5B

*SAR or SOCC

American black duck, American crow (*Corvus brachyrhynchos*), and ring-billed gull were the most commonly observed species. Black-headed gull and semipalmated plover were the SOCC observed during the survey period and lesser yellowlegs and the only SAR observed. Notably, there were higher observations of juveniles and breeding pairs during the months of June and July, suggesting the highest peak of breeding activity during the 2024 monitoring period.

Shorebird Surveys

A total of 12 PC locations were completed between May and September, with the locations conducted at multiple positions at Arnold's Cove, Bellevue, Come By Chance, Chance Cove, Little Chance Cove, Southern Harbour and Sunnyside (Drawings 33-34). Approximately 6,122 individuals were observed, representing 54 different species. The species composition also included two unknown species, with one species identified as an unknown sandpiper. It is noted that within the large groupings of greater yellowlegs (*Tringa melanoleuca*) observed at the observation sites, there were also potential lesser yellowlegs (Table 5.49).

Table 5.49: Shorebird Surveys 2024 Results Summary

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank[1]
American Black Duck	*Anas rubripes*	---	---	---	S4B,S4N
American Crow	*Corvus brachyrhynchos*	---	---	---	S5
American Golden Plover	*Pluvialis dominica*	---	---	---	
American Goldfinch	*Spinus tristis*	---	---	---	S5
American Pipit	*Anthus rubescens*	---	---	---	S3B,S4M
American Robin	*Turdus migratorius*	---	---	---	S5B
American Wigeon	*Mareca americana*	---	---	---	S43B,SUM
Arctic Tern	*Sterna paradisaea*	---	---	---	S4B,SUM
Baird's Sandpiper	*Calidris bairdii*	---	---	---	SNA
Bald Eagle	*Haliaeetus leucocephalus*	---	---	---	S4
Barn Swallow	*Hirundo rustica*	Special Concern	Vulnerable	---	S2B,SUM*
Belted Kingfisher	*Megaceryle alcyon*	---	---	---	S4B,S3N,SUM
Black-bellied Plover	*Pluvialis squatarola*	---	---	---	S3M
Black-headed Gull	*Chroicocephalus ridibundus*	---	---	---	S1B,S3N,SUM*
Black-legged Kittiwake	*Rissa tridactyla*	---	---	---	S5B
Blue Jay	*Cyanocitta cristata*	---	---	---	S5
Bonaparte's Gull	*Chroicocephalus philadelphia*	---	---	---	SNA
Canada Goose	*Branta canadensis*	---	---	---	S4B
Common Loon	*Gavia immer*	---	---	---	S5B,S4N,SNRM
Common Ringed	*Charadrius hiaticula*	---	---	---	SNA

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank[1]
Plover					
Common Tern	*Sterna hirundo*	---	---	---	S4B,SUM
Double-crested Cormorant	*Nannopterum auritum*	---	---	---	S5B
Dunlin	*Calidris alpina*	---	---	---	S4M
European Starling	*Sturnus vulgaris*	---	---	---	SNA
Fox Sparrow	*Passerella iliaca*	---	---	---	S5B
Great Black-backed Gull	*Larus marinus*	---	---	---	S4
Greater Yellowlegs	*Tringa melanoleuca*	---	---	---	S3B,S4M
Green-winged Teal	*Anas crecca*	---	---	---	S4B,SUM
Herring Gull	*Larus argentatus*	---	---	---	S4
House Sparrow	*Passer domesticus*	---	---	---	SNA
Least Sandpiper	*Calidris minutilla*	---	---	---	S3B,S4M
Lesser Yellowlegs	*Tringa flavipes*	Threatened	---	Threatened	S2S3M*
Mallard	*Anas platyrhynchos*	---	---	---	S3B,SUM
Merlin	*Falco columbarius*	---	---	---	S4S5B,SUM
Osprey	*Pandion haliaetus*	---	---	---	S4S5B,SUM
Pectoral Sandpiper	*Calidris melanotos*	---	---	---	S3M
Red Knot	*Calidris canutus*	Endangered	Endangered	---	S2M*
Red-breasted Merganser	*Mergus serrator*	---	---	---	S4B,SUN,SUM
Ring-billed Gull	*Larus delawarensis*	---	---	---	S4B,SUM
Ruby-crowned Kinglet	*Corthylio calendula*	---	---	---	S5B
Ruddy Turnstone	*Arenaria interpres*	---	---	---	S2S3M*
Sanderling	*Calidris alba*	---	---	---	S2N,S3M*
Semipalmated Plover	*Charadrius semipalmatus*	---	---	---	S1B,S4M*
Semipalmated Sandpiper	*Calidris pusilla*	---	---	---	S3M
Short-billed Dowitcher	*Limnodromus griseus*	---	---	---	S3M
Song Sparrow	*Melospiza melodia*	---	---	---	S4B,SUM
Spotted Sandpiper	*Actitis macularius*	---	---	---	S4B,SUM
Tree Swallow	*Tachycineta bicolor*	---	---	---	S4B,SUM
White-rumped Sandpiper	*Calidris fuscicollis*	---	---	---	S3M
White-throated Sparrow	*Zonotrichia albicollis*	---	---	---	S5B
Wilson's Warbler	*Cardellina pusilla*	---	---	---	S5B
Yellow Warbler	*Setophaga petechia*	---	---	---	S5B
Unidentified Sandpiper	*Calidris sp.*	---	---	---	N/A

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank[1]
Unknown species	*Unknown sp.*	---	---	---	N/A

[1]ACCDC S-rank is provided wherever possible and is left blank when species does not have a S-rank.
[*]SAR) or SOCC

The most commonly observed species were greater yellowlegs, followed by herring gull, ring-billed gull and great black-backed gull. Avian abundance and species diversity was highest at Bellevue. Most species observed were shorebirds (53%), followed by other landbirds (28%). SOCC observed including black-headed gull, ruddy turnstone (*Arenaria interpres*), sanderling (*Calidris alba*), and semipalmated plover. Three SAR, barn swallow, lesser yellowlegs, and red knot, were also observed during the survey period. Notably, one lesser yellowlegs was observed in July, which was uncommon for the species' breeding range. Two barn swallows were observed at the 2024-ABO-SB-Arnold's Cove B location, potentially migrating through the area. In contrast, 14 immature red knots were observed together at 2024-ABO-SB-Bellevue E location, which indicates migratory movement after breeding season.

Overwintering Coastal Surveys

In 2023, land based and aerial overwintering surveys yielded a total of 32 identified species. Of the 32 identified species, no SAR individuals were identified. Two SOCC species were identified including the Northen Fulmar (*Fulmarus glacilais*) and the Manx shearwater (*Puffinus puffinus*).

Table 5.50: Overwintering Coastal Surveys Results Summary

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank
American Black Duck	Anas rubripes	---	---	---	S4B, S4N
American Crow	Corvus brachyrhynchos	---	---	---	S5
American Robin	Turdus migratorius	---	---	---	S5B
Bald Eagle	Haliaeetus leucocephalus	---	---	---	S4
Great Black-backed Gull	Larus marinus	---	---	---	S4
Black-legged Kittiwake	Rissa tridactyla	---	---	---	S5B
Bonaparte's Gull	Chroicocephalus philadelphia	---	---	---	SNA
Canada Goose	Branta canadensis	---	---	---	S4B
Common Eider	Somateria mollissima	---	---	---	S5B, S5N
Common Goldeneye	Bucephala clangula	---	---	---	S4B, SUN
Common Merganser	Mergus merganser	---	---	---	S4B, S5N
Common Raven	Corvus corax	---	---	---	S5
Common Tern	Sterna hirundo	---	---	---	S4B, SUM
Dark-eyed Junco	Junco hyemalis	---	---	---	S5
Double-Crested Cormorant	Nannopterum auritum	---	---	---	S5B
Dovekie	Alle alle	---	---	---	---
European Starling	Sturnus vulgaris	---	---	---	SNA
Northern Fulmar	Fulmarus glacialis	---	---	---	S1B
Glaucous Gull	Larus hyperboreus	---	---	---	S5N
Great Cormorant	Phalacrocorax carbo	---	---	---	S3B, S3N
Herring Gull	Larus argentatus	---	---	---	S4

Common Name	Scientific Name	COSEWIC	SARA	ESA	ACCDC S-Rank
Hooded Merganser	Lophodytes cucullatus	---	---	---	SUB
House Sparrow	Passer domesticus	---	---	---	SNA
Iceland Gull	Larus glaucoides	---	---	---	S5N
Mallard	Anas platyrhynchos	---	---	---	S3B, SUM
Manx Shearwater	Puffinus puffinus	---	---	---	S1B
Puffin	Fraterculs arctica	---	---	---	S5B
Red-breasted Merganser	Mergus serrator	---	---	---	S4B, SUN, SUM
Ring-billed Gull	Larus delawarensis	---	---	---	S4B, SUM
Snow Bunting	Plectrophenax nivalis	---	---	---	S2N, S5M
Song Sparrow	Melospiza melodia	---	---	---	S4B, SUM
White-winged Crossbill	Loxia leucoptera	---	---	---	S5
Duck Species	Anatidae	---	---	---	
Gull Species	Larus sp.	---	---	---	
Murr Species	Uria sp.	---	---	---	
Tern Species	Sterna sp.	---	---	---	
Storm Petrel	Hydrobates sp.	---	---	---	

5.10.7 Potential Interactions

The expected potential interactions between the Project and avifauna by Project phase (construction, operation, and decommissioning) are presented in Table 5.51. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. The table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.51: Potential Project-Avifauna Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	X
Industrial Facilities Operation	X
Turbine Operation	X
Water Withdrawal	-
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	-

The Project may have effects on avifauna during the construction, operation, and decommissioning stages, and these effects may result in habitat loss and fragmentation, edge effect, direct mortality, injury risk, and sensory disturbances.

Habitat Loss and Fragmentation

Across all seasons, it is evident that the Project Area supports a variety of avian species due to the diversity of habitats present in the area. Overall, survey locations that represented edge habitat (i.e., forested habitat on the edge of clear-cut, wetland, lake, or coastal area) had the highest numbers of avian abundance and species diversity. Forests type were mostly softwood forests, and the age of the forest varies.

Habitat alterations are required for construction of the Project to prepare the landscape for a variety of infrastructure, and any change to land cover may represent a loss of habitat for avifauna, particularly in habitats used for nesting and foraging. Alterations will occur during preparation for and construction of facilities, infrastructure, roads, turbine pads, laydown areas, solar project clearing, transmission lines, and substations.

Direct Mortality and Injury Risk

Bird strikes are a primary concern when considering the interactions of avifauna with the Project. Turbine blades spin at high speeds within the rotor swept area (RSA), which overlaps with the flight paths of a variety of species at varying altitudes. Collisions may involve direct strikes with rotating blades or impacts with stationary structures such as towers or nacelles, potentially resulting in injury or mortality..

Collision mortality is influenced by abundance, frequency of passage, flight behaviour, weather, and topography (De Lucas et al., 2008). The prediction of collision risk by migratory birds with turbines using pre-construction data is complex and has not been well established in Atlantic Canada. The best indicator of risk is the volume of birds migrating through the RSA, though only a small fraction of the birds migrating at this height are likely to experience collisions. Verification of collision rates is confirmed through post-construction mortality monitoring.

Ferrer et al. (2011) further suggests there is clear evidence that the likelihood of bird collisions with turbines depends critically on species behaviour and topographic factors, not solely on local abundance. Birds do not move over the area at random, but follow main wind currents, which are affected by topography. Therefore, certain locations of turbines could be harmful for birds even where there is a relatively low density of birds, whereas other locations would be relatively risk-free with higher densities of birds (Ferrer et al., 2011).

The risk to avian species for collision with turbines is highest during migration periods (AEP, 2020). Fatalities can also occur from collisions with MET towers and guywires, or through nest mortality/disturbance due to vegetation clearing and habitat loss (Band et al., 2007). Bird fatalities due to turbine collision have been identified as an ecological challenge in wind energy; however, mitigation is complex due to the complexity of factors influencing collisions. Collision risk is affected by species, turbine height, and site elevation, but is not significantly linked to turbine type or positioning within an array (Drewitt & Langston, 2006; De Lucas et al., 2008).

Increased road traffic during construction and operation may also heighten risks to ground-dwelling birds such as ruffed grouse or spruce grouse, which may use roadways for nesting or movement. However, traffic noise could simultaneously deter some species from the immediate area.

Due to the variability of collision risk across species, seasons, and environmental conditions, post-construction monitoring is essential to evaluate actual impacts and inform any necessary mitigation measures.

Edge Effects

Edge effects refer to how species interact with either natural or artificial edges between habitat types. Clearing of land for Project infrastructure can increase the proportion of edge habitat within the Project Area, likely creating more abrupt edges than what is found naturally. New roads or clearing of rights-of-way for transmission lines will also create more edge habitat within the Project Area. Species are impacted differently by an increase of edge habitat, with some benefiting from the change. Research into the effects of edges on bird species found that edge effect positively affected abundances of tree- and shrub-breeding birds, but did not affect ground breeders or the nest predation of ground nests (Batáry et al., 2014).

Edges also provide habitats for birds to commute and forage (between nesting and foraging sites) which can also benefit species occurrences (Terraube et al., 2016). Therefore, it is possible that bird activity will increase in areas with artificial edges created by tree clearing. However, more activity in open areas may increase the risk of human-bird interactions and increase the risk of direct and indirect mortality.

Sensory Disturbances

Sensory disturbances, during both construction and operation, may affect landscape utilization by birds. Light sensory disturbance that can impact birds includes behavioural effects such as disorientation, avoidance, or attraction (Longcore & Rich, 2004b). In turn, these behavioural changes can affect the success of foraging, reproduction, and communication of wildlife and can disrupt habitat connectivity (Bliss-Ketchum et al., 2016b; Longcore & Rich, 2004b).

Night-time lighting from exterior structures such as substations, buildings, or floodlit equipment can attract birds, particularly during migration periods, and has been associated with mortality events. Migratory birds in the spring and fall are especially vulnerable to light attraction from tall structures. To mitigate these risks, the timing, intensity, and placement of lighting can be modified to reduce potential impacts on birds.

Ambient noise levels caused by Project activities is another potential form of sensory disturbance. Sensory disturbance from noise can impact birds in a number of ways. Notably, birds can exhibit greater susceptibility to noise impacts as many species rely on vocal communication (Blickley & Patricelli, 2010). Avifauna may be displaced from areas adjacent to the Project from construction related noise. Impacts can also differ between acute and chronic noise sources. Chronic exposure may degrade auditory cues, feedback, and vocal development over time, important for predator/prey detection, communication breeding, and orientation (Blickley & Patricelli, 2010; Marler et al., 1973; Shannon et al., 2016). Noise and vibrations are provincially regulated under the Occupational Health and Safety regulations (2012) under the *Occupational Health and Safety Act* to protect the health and safety of site workers and the general public, which will help mitigate any negative impacts to bird species. A direct physiological impact causing a temporary decrease in auditory sensitivity can occur at acute noise levels above 93 dBA, while permanent damage to avian auditory systems is not recorded until 125 to 140 dBA (Blickley & Patricelli, 2010).

Some bird species may not be impacted by sensory disturbances. For example, a study examining the effects of logging truck traffic found no measurable impact on nesting at noise levels of 53 dBA (Grubb et al., 1998). It was also found that noise tolerant species had increased nesting success through decreasing nest predation (Francis et al., 2009). A literature review conducted by Shannon et al. (2016) found that birds have the potential to exhibit changes in song characteristics, reproduction, abundance, stress levels, and species richness at levels greater than 45 dBA. All noise attenuates (diminishes) with distance from the source (CDT, 2016). This occurs through geometric spreading and signal reduction from ground and atmospheric absorption. Noise from point sources (i.e., construction equipment) travelling through a soft site (e.g., a forest or meadow), are reduced by attenuation rates of 7.5 dBA for each doubling of distance (i.e., based on 50 feet) (CDT, 2016). The Project sound attenuation during construction, with the exception of intermittent blasting (if required) or intermittent truck horns, is expected to meet the 45 dBA range as stated in the Project information sections.

5.10.8 Mitigations

The following potential mitigations may eliminate or reduce the Project's impacts on avifauna:

The primary mitigation for avifauna is avoidance in the siting of infrastructure, including:

- Avoidance of topographic funnels, such as within valleys, for turbine placement to reduce the likelihood of interactions with concentrated bird movements.
- Avoidance, to the extent possible, of important bird habitats, such as wetlands, waterbodies, watercourses, old-growth forests, etc., to reduce the impact of habitat changes (e.g., riparian buffers). This includes siting Project infrastructure within areas with existing disturbances, such as existing roads and cutover areas of forest.

Mitigations to reduce effects on avifauna include:

- Adhere to ECCC recommendations on clearing windows for nesting migratory birds, if possible, vegetation and tree clearing activities will be conducted outside of the nesting/breeding period that is generally from April 1 to September 30 each year. Timing of clearing activities is generally dependent on seasonal conditions:
    - If vegetation and tree clearing activities during the nesting/breeding season cannot be avoided, nest sweeps will be conducted by a qualified avian biologist in advance of the activity. These surveys will identify any active nests or recently fledged juveniles, which must be avoided in accordance with applicable regulations and best management practices.
    - Regulatory bodies will be contacted, when necessary, to receive advice on construction buffers for any avian activity that must be avoided during the nesting/breeding season.
- When vegetation and tree clearing activities take place during the non-nesting/breeding season, crew must be aware and look out for nests protected year-round under the 2022 update to the Migratory Bird Regulations (under the MBCA).
- Avoid the attraction of ground- or burrow-nesting species by limiting stockpiles or exposed areas/banks and, should they initiate breeding activities within stockpiles or exposed areas, nests will not be disturbed until chicks can fly, and the nesting areas are no longer being used.
- Service construction equipment and vehicles regularly and muffle loud machinery.
- Incorporate a lighting plan for construction-related activities into any future management plan.
- Maintain good housekeeping practices during construction to avoid indirectly feeding birds and potentially attracting any nuisance wildlife.
- Develop a spill response plan, and an emergency response plan to mitigate the impacts of spills, hazardous substances, and other emergencies. Equip site machinery with spill kits and instruct site personnel on their use.
- Revegetate disturbed areas, as appropriate.
- Minimize lighting, to the extent possible (e.g., downward facing lights and motion activated lighting).

5.11 Land and Resource Use

5.11.1 Overview

The objective of the land and resource assessment was to collect the information necessary to assess potential impacts to land and resource use resulting from the Project. This was accomplished using the following approach:

- Identify potential land resource uses within the Study Area using desktop resources
- Use the information collected to identify potential pathways of effects
-

5.11.2 Regulatory Context

Management and protection of Crown land and associated resources are managed through several departments. Legislation relevant to land and resource use includes:

- *Fisheries Act, R.S.C. 1985, c. F-14*
- *Forestry Act*, R.S.N.L. 1990, c. F-23
- *Mineral Act*, RSNL 1990 c. M-12
- *Lands Act*, S.N.L. 1991, c. 36
- *Towns and Local Service Districts Act*, S.N.L. 2023, c. T-62
- *Urban and Rural Planning Act*, S.N.L. 2000, c. U-8
- *Wild Life Act*, R.S.N.L. 1990, c. W-8
- *Water Resources Act*, S.N.L. 2002, c. W-4.01
- *Environmental Protection Act*, S.N.L. 2002, c. E-14.2
- *Wilderness and Ecological Reserves Act*, R.S.N.L 1990, c. W-9

5.11.3 Desktop Assessment Methodology

An initial assessment of land and resource use was completed through a review of desktop resources, including publicly available mapping tools and literature, as well as consideration of feedback received during public engagement. This approach helped to evaluate how the Project may interact with land and resource use. The following resources and regulatory instruments were reviewed:

- Public mapping resources.
- Literature review of land uses in and around the Project Area using publicly available, online sources.
- Feedback from public and stakeholder engagement.

5.11.4 Desktop Assessment Results

The Project will be on Crown Lands and, within the constraints of technical and operational requirements, positioned to minimize potential impacts on local land users. The Project is entirely located within the Clarenville-Bonavista rural secretariat region. All identified parks, ecological reserves, and sensitive wildlife or stewardship areas in the region have been previously excluded from the Project Area (Section 2.3.2). Access roads and trails within the Project Area (especially in the eastern portions of TQK North) are frequented by recreationalists for snowmobiling, hunting, and ATV use (as documented during public engagement sessions; Section 4.0). The following section outlines important land use activities that may occur within the Study Area but are not necessarily overlapped by the Project Area. Constraints have been applied to the Project Area with consideration to many of the land use activities as detailed in Section 2.3.

Public Protected Water Supply Areas

Surface or ground water may serve as a source of water for human use, potentially receiving protection under provincial law. The status of water supplies is conveyed in the NL public water supplies database (NLECC, 2024e). Public Protected Water Supply Areas (PPWSAs) are areas of land surrounding a public drinking source that are protected under Section 39 of the NL *Water Resources Act* (Newfoundland and Labrador, 2002) to prevent degradation of potable water. Unprotected water supplies may be used as a public water supply source but have not been designated under law. Potential water supplies are not currently used as a public water supply but may be used in the future. Both unprotected and potential water supplies' areas include the natural drainage area of the supply.

Nine water supplies are overlapped by or contained within the Study Area (Table 5.52; Drawing 13, 16, and 18). Six of the total ground and surface water supplies are designated PPWSAs, one as potential, and two are listed as unprotected (NLECC, 2024e). Two of the protected surface water boundaries within TQK Central intersect the Project Area, while in TQK South the Project Area intersects one protected ground water zone.

Table 5.52: Source Water Supplies Intersecting the Study Area

Source Name	Protection Status	Supply Type
#5B Albert Rowe Well	Protected	Ground Water
Brigades Pond	Protected	Surface Water
Butcher's Brook	Protected	Surface Water
Deep Bight River	Protected	Surface Water
Steve's Pond	Protected	Surface Water
Unnamed Brook	Protected	Surface Water
Trout Pond - Chance Cove	Potential	Surface Water
Unnamed Pond	Unprotected	Surface Water
Water Pond	Unprotected	Surface Water

Bolded Source Name: Public water supply intersecting the Project Area

Protected Areas

The Study Area abuts or overlaps with three currently designated protected areas. These protected areas are Jack's Pond Provincial Park Reserve, the NL T'Railway Provincial Park and Bay du Nord Wilderness Reserve (Drawing 35). Jack's Pond is encompassed within the Study Area, although the Project Area does not include the park and is separated from it by the Trans-Canada Highway to the east and a buffer of over 600 m from the protected area's boundaries to the south. The Project Area intersects the NL T'Railway Provincial Park at several locations within IQK Central and TQK South. There is no overlap of the Project Area with the Bay du Nord Wilderness Reserve's eastern boundary.

Jack's Pond Provincial Park Reserve

Provincial park reserves protect significant natural features and landscapes, while not offering any visitor services (ParksNL, n.d.). Jack's Pond Provincial Park Reserve is located between the Avalon, Burin, and Bonavista peninsulas and close to the town of Arnold's Cove. The reserve hosts maritime barrens, wetlands, and a forested stream valley with a variety of rare plants.

NL T'Railway Provincial Park

The T'Railway Provincial Park includes over 800 km of gravel trails extending across the province. This multi-use provides recreational opportunities for users throughout all seasons. The maintenance of the park is jointly managed through a partnership between ParksNL, the Newfoundland and Labrador Snowmobile Federation, and the Newfoundland T'Railway Council. This park has an associated 50 m buffer that must be maintained undisturbed between any buildings and the T'Railway boundary. While the Project Area in TQK North does not overlap the T'Railway or its associated buffer, several of the linear features, such as access roads and transmission corridors, in TQK Central and TQK South do intersect the park and its associated buffers. A Temporary Vehicle Access permit and a Construction and Use Permit are required if the Project Area is to be accessed from the T'Railway.

TQK is committed to ensuring compliance with all ParksNL requirements. Coordination with ParksNL will be maintained throughout the EA process and project planning stages to identify all permit triggers and ensure the protection of the T'Railway's recreational, historical, and environmental value.

Bay du Nord Wilderness Reserve

In Newfoundland and Labrador, ecological reserves are large areas (greater than 1,000 km^2) "designed to protect significant natural features and landscapes, and provide opportunities for low-impact outdoor recreation" (NLECC, 2006, p. 2). Entry permits are required for the use of these designated areas. Bay du Nord Wilderness Area is the island's largest protected area, protecting 2,895 km^2 of the Bay du Nord River's watershed (NLECC, 2006). Low-impact recreational activities are permitted in the protected area that hosts a caribou population of approximately 10,290 (Section 5.8.4).

TQK has intentionally sited the Project Area to ensure no overlap with the Bay du Nord Wilderness Reserve. Early-stage planning and layout refinement incorporated provincial protected area boundaries to avoid any encroachment on this ecologically significant landscape. TQK will continue to coordinate closely with provincial authorities throughout the EA process and detailed design to ensure full compliance with all applicable legislation and to uphold the integrity of adjacent protected areas.

Forestry

The Project Area lies within provincial Forest Management Zones 1 and 2 (Districts 1 and 2, with a small overlap into District 3) on the island of Newfoundland (NLFFA, 2024a). Zone 1 and 2 forest management uses clear cuts to emulate the natural disturbance regime that is dominated by stand-replacing events, resulting in even-aged stands (NLFFA, 2021a, 2021b). Strategies to increase productivity in commercial harvest areas include irregular clearings, buffers to protect ecologically important features, and limiting viewshed impacts of harvest.

The Project Area overlaps with lands designated for both commercial harvesting and domestic use. Domestic harvest areas are recognized as important to local land users, as they support traditional and subsistence woodcutting activities for heating and other household uses (NLFFA, 2021a, 2021b). TQK is aware of ongoing domestic and commercial woodcutting, as well as silvicultural practices, within the area and acknowledges their long-standing value to local communities.

TQK has initiated communication with representatives from Forest Management Districts 1 and 2 to understand current harvesting plans and identify opportunities for alignment. TQK is committed to working collaboratively with relevant forestry authorities, land users, and local stakeholders to avoid potential land-use conflicts and to explore synergies that support sustainable forest management within the broader region.

Agriculture

Across the extent of the Study Area, there is no overlap with agricultural lands according to the Newfoundland and Labrador Land Use Atlas (Newfoundland and Labrador, n.d.-c).

Tourism

The northwest Avalon Peninsula and Clarenville/Bonavista Peninsula areas are popular tourism destinations with both day and overnight visitors (NLTCAR, 2025). Visitors to Newfoundland and Labrador in general are interested in landscapes and coastline scenery, with top experiences including hikes and visiting sites of natural beauty (NLTCAR, 2025). Cultural sites are another popular reason for tourism to Newfoundland and Labrador.

In addition to specific destinations within these areas, with most tourists arriving by air travel and about half renting vehicles (NLTCAR, 2024), the Trans-Canada highway that runs through much of the Project Area, especially TQK South, is a common means of conveyance for tourists.

Hunting and Trapping

Harvest of big game and small game species are important activities of land users throughout Newfoundland and Labrador. During public engagement sessions (Section 4.0), community members indicated the importance of hunting (e.g., moose, ptarmigan, grouse etc.) in the region. The Project Area is located within Newfoundland and Labrador big game (moose and black bear) management areas 28 and 44 (Newfoundland and Labrador, 2024c). In addition, the Project Area is within the Avalon/Swift Current and remainder of island small game management areas for willow and rock ptarmigan (Newfoundland and Labrador, 2024d).
In big game management areas 28 and 44 moose harvest season is generally open from mid-September to late December. Black bear have two harvesting seasons, one in the spring (May–July) and one in the fall (September–November), although management area 44 is closed for bear hunting (Newfoundland and Labrador, 2024a). Ptarmigan species are harvested in the fall (September–November) and grouse species in the fall and winter (September–December) each year.

Newfoundland furbearing species are allowed to be trapped within season, including beaver, Canada lynx, American marten, mink, muskrat, otter, red squirrel, wolf (*Canis lupus*), red fox, eastern coyote, and weasel species. Beaver trapping is restricted to beaver fur zones and traplines to support management of the species(Newfoundland and Labrador, 2024b). The Project Area falls within the Newfoundland and Labrador trapping beaver fur zones 2, 3, and 5. (NLFFA, n.d.-b).

As noted, TQK has been actively engaging with local hunters and trappers to better understand important hunting and trapping areas, seasonal patterns of land use, and periods of heightened activity. These discussions are helping to inform environmental planning efforts and the development of mitigation strategies that aim to minimize potential land use conflicts. TQK remains committed to continued dialogue with these user groups throughout the life of the Project to ensure that planning remains responsive to recreational and commercial land uses. Where potential disruptions are identified, TQK will work collaboratively with stakeholders to develop appropriate mitigations and adaptive management strategies.

Fisheries

Commercial, recreational, and Indigenous fisheries occur on the Isthmus of Avalon, within or adjacent to the Project Area. Additional details on fish species community and aquatic resource use are outlined in Section 5.5

Inland Fisheries

Freshwater fisheries target Atlantic salmon, ounaniche (i.e., landlocked Atlantic salmon), brook trout, brown trout, rainbow trout (*Oncorhynchus mykiss*), American eels, and rainbow smelt (*Osmerus mordax*). Trout and rainbow smelt fisheries typically extend throughout spring, summer, and fall (DFO, 2025a) and occur in both waterbodies and watercourses.

The Atlantic salmon fishery carries social, economic, and cultural value. The Study Area overlaps under the salmon fishing zones 5, 6, 7, and 10 (DFO, 2025a), and the Project Area intersects four scheduled salmon rivers. Atlantic salmon recreational fishing season opens June 1 and closes September 7 for all management zones (DFO, 2025a). Fish may only be harvested inland if caught via angling (including fly fishing) (DFO, 2025a)In 2020, 20,574 Atlantic salmon were retained in all of Newfoundland and 25,704 were released (DFO, 2022b). Retention of salmon is not permitted for Atlantic salmon caught in coastal waters or in non-scheduled waters.

American eel are targeted by commercial, recreational, and Indigenous fisheries (DFO, 2024a). Fishing may occur within the Study Area for this species, given its known presence in the region. However, there are no trapping records within or adjacent to the Study Area. The closest trapping record is near Burgeo in southwest Newfoundland (Qualipu First Nation, n.d.). Few fishing licenses remain active, and distribution of new licenses has ceased [Qalipu Environment and Natural Resources (QENR) 2024]. Across the Maritimes, the number of active commercial licenses have decreased to less than one-tenth of the number that were active a decade ago (DFO, 2024a). Most landings of American eel originate from the commercial sector. The recreational American eel fishery is open between November 1 and March 31. Indigenous fisheries are regulated under the Aboriginal Communal Fishing Licences Regulations (2006).

Marine Fisheries

The Study Area borders both the North Atlantic Fisheries Organization (NAFO) 3Ps division to the west and 3L division to the east (DFO, n.d.). Placentia Bay and Trinity Bay are both active coastal and offshore commercial fishing locations. Coastal fisheries include the American lobster (*Homarus americanus*) fishery, where the Project boarders the Newfoundland Lobster Fishing Area 6 and 10 (DFO, 2021). The lobster fishery is open 8-10 weeks in the spring and is controlled via licenses and trap limits. Traps are generally deployed in waters <20 m deep.

Scallops are another coastal fishery targeted by commercial, Indigenous, and recreational fisheries, where the commercial fishery targets both Icelandic scallops (*Chlamys islandica*) and sea scallops (*Placopecten magellanicus*). The Isthmus of Avalon also borders the Newfoundland Scallop Fishing Areas 6 and 10. In 2018, there are 771 commercial inshore scallop fishing licenses in Newfoundland and Labrador (DFO, 2019). The fishery is typically open April to December, with most fishing activity occurring in October.

Other marine commercial fisheries in the region include groundfish fisheries (e.g., Atlantic cod), Atlantic herring, snow crab, whelk, capelin, mackerel, bluefin tuna, lumpfish, redfish, winter flounder, Greenland halibut, Atlantic halibut, squid, and sea cucumber (NAFO, 2025). Atlantic cod (*Gadus morhua*) and capelin (*Mallotus villosus*) are also targeted by recreational fishers. Atlantic cod, queen crab (*Chionoecetes opilio*), and whelks (*Buccinum undatum*) account for the top three species caught in commercial fisheries in the 3Ps NAFO division (Figure 5.2). Queen crab, capelin, and northern prawn are the top three species caught in commercial fisheries in the 3L NAFO division (Figure 5.3).

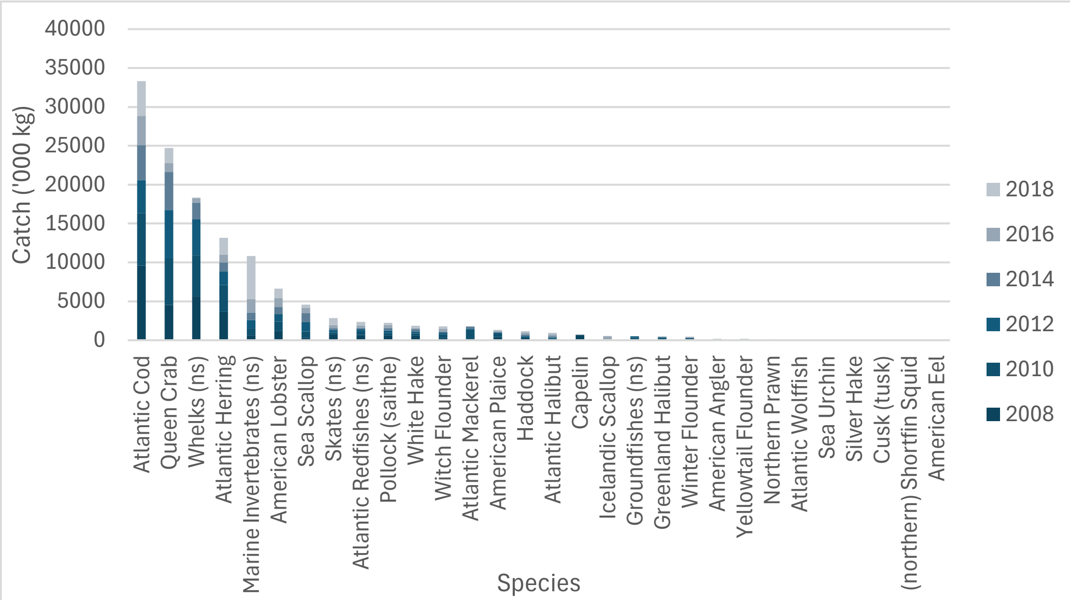


Figure 5.2: Fish Species Captured in Commercial Fisheries in NAFO 3Ps Between 2008-2018 (NAFO, 2025)

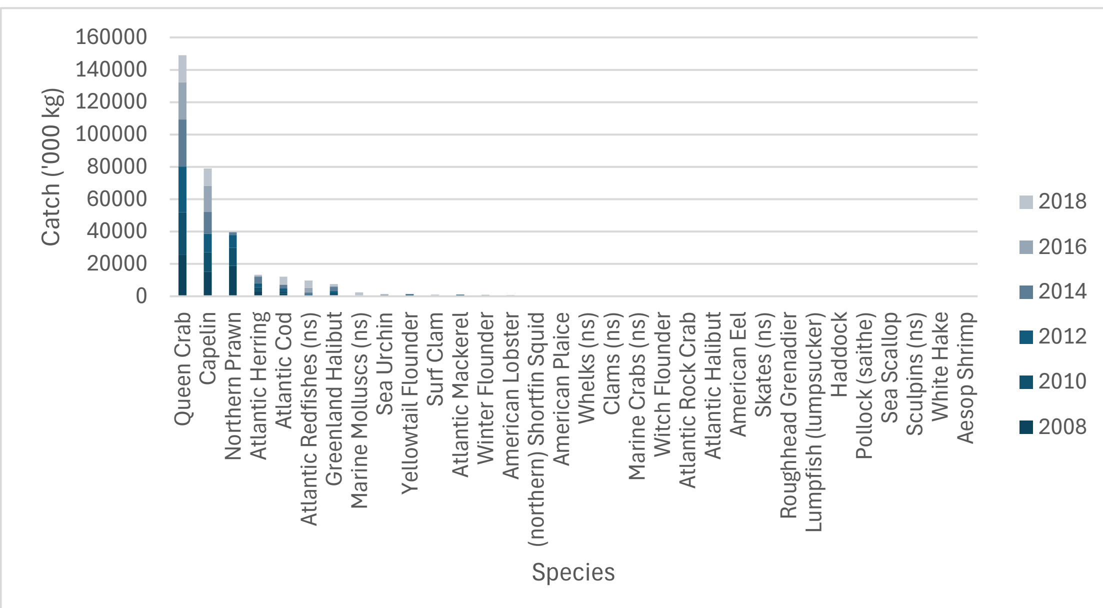


Figure 5.3: Fish Species Captured in Commercial Fisheries in NAFO 3L Between 2008-2018 (NAFO 2024)

Aquaculture

There are no licensed aquaculture facilities within the Study Area or within 5 km. However, within 50 km of the Study Area, there are seven active aquaculture licenses in Placentia Bay. Six are Grieg NL Nurseries Ltd. Atlantic salmon aquaculture sites, and one is a Merasheen Oyster Farms Inc. blue mussel (*Mytilus edulis*) aquaculture site (NLFFA, 2023)

Industrial Activities

While much of the Project Area is remote with small rural communities within and adjacent, there are industrial sites within and adjacent to the TQK Central Project Area. Industrial activities occurring around this portion of the Project include petrochemical refining and marine trans-shipment. The Braya Renewable Fuels refinery in Come By Chance produces up to 18,000 barrels of renewable diesel per day (Braya Renewable Fuels, 2024). The Newfoundland Transhipment Limited terminal near Arnold's Cove is capable of handling suezmax-class vessels and storing up to 3.2 million barrels of petrochemicals in its six storage tanks (NTL, 2025).

Mineral Lands

The Project Area intersects with a total of 25 staked claims. Four of the staked claims are located in TQK North, four are located in TQK Central, with the remaining 17 claims located in TQK South. Nine active quarry permits are located within the Study Area. However, of those nine, only three intersect the Project Area with one quarry located in TQK Central and two located in TQK South. No quarry leases intersect either the Study Area or Project Area.

Indigenous Land Use

The province of Newfoundland and Labrador is home to four peoples of Indigenous ancestry: the Mi'kmaq, Innu, Inuit and the Southern Inuit of NunatuKavut. The Mi'kmaq live on the island of Newfoundland and are descendants of Algonkian-speaking hunter-gathers from various parts of what is now Atlantic Canada (Newfoundland and Labrador, 2025a).

On the island of Newfoundland there are two Mi'kmaq First Nations: Miawpukek First Nation formerly known as the Conne River Indian Reserve, and the Qalipu First Nation. The Miawpukek control the reserve of Samiajij Miawpukek in Bay d'Espoir. Qalipu First Nation established in 2011 is what Indigenous and Northern Affairs Canada calls a "landless band," meaning that Qalipu First Nation does not have any designated reserve lands. Qalipu First Nation's membership is spread across 67 traditional Newfoundland Mi'kmaq communities including Swift Current (Qalipu First Nation, n.d.).

TQK is committed to continuing engagement, learning, and the consideration of Indigenous feedback in the planning and implementation of this Project. Further information regarding Indigenous Engagement is discussed in Section 4.

Foraging

While precise foraging locations are not currently known, the Project recognizes the importance of this traditional and recreational activity. As part of ongoing engagement efforts, the Project will continue to work with Indigenous groups, local communities, and land users to gather additional information about foraging practices. This information will help inform project planning and mitigation measures, particularly in areas where construction or land access may overlap with culturally important harvesting areas.

5.11.5 Potential Interactions

The expected potential interactions between the Project and land and resource use by Project phase (construction, operation, and decommissioning) are presented in Table 5.53. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.53: Potential Project-Land and Resource Use Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	X
Turbine Operation	X
Water Withdrawal	X
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

The Project may have effects on land, resource, and recreational use during the construction, operation and maintenance, and decommissioning stages. A full assessment of the potential effects of the Project on Land and Resource Use will be completed during the EA process.

Changes to Land Use

The Project may change current and future land use by occupying land that may have been used for other activities or change land availability for potential future developments. Changes to land use activities by locals, tourists, and Indigenous peoples may occur during Project construction and operation activities. Nearby residences may be affected by disturbances associated with Project activities and infrastructure. Additionally, changes to land use activities may result from increased access due to road construction.

Changes to Resource Use

The Project may influence resource harvesting use. Changes to community composition of harvested species may result in changes to local harvesting activities. Additionally, changes to the accessibility of the Project Area may result in changes to harvesting activities.

Changes to Recreational Use

The Project may influence recreational use of the area by changing landscapes through construction of Project infrastructure for both Indigenous and non-Indigenous users. Recreational land may be removed for facilities infrastructure, solar farm, and wind turbines. New road construction may provide access to new areas for recreational activities such as hunting, fishing, berry picking, ATVing, and snowmobiling.

5.11.6 Mitigations

The following potential mitigations may eliminate or reduce the Project's impacts on Land and Resource Use

- Continue community engagement and consultation throughout the planning process to identify and address resident concerns.
- Conduct viewshed analysis to minimize the potential effects to view scape
- Establishment of land buffers or transition zones between Project areas and cabin areas.
- Work with local community groups to ensure continued access for recreation and hunting/trapping/fishing.
- Develop monitoring and response programs to address emerging issues related to land use conflicts.
- Work with local Outfitters and the Newfoundland and Labrador Outfitters Association to develop an Outfitter Environmental Effects Monitoring Plan.
- Continue coordinating with provincial forestry authorities and engaging with both local and commercial wood harvesters to understand existing activities and avoid potential land use conflicts throughout Project development.
- Continue working with the Mineral Lands Division and engaging directly with mineral rights holders whose claims intersect with the Project Area to better understand existing or planned exploration activities and to minimize potential land use conflicts wherever possible.

5.12 Heritage and Cultural Resources

5.12.1 Overview

The objective of the heritage and cultural resources assessment was to collect the information necessary to assess potential interactions between the Project and heritage and cultural resources. This was accomplished using the following approach:

- Identify existing archaeological and ethnographic sites within or near the Study Area using desktop resources.

- Review the historical significance of the region where the Project is proposed.
- Use the information collected to identify potential Project interactions and inform mitigation measures.

5.12.2 Regulatory Context

The Arts and Heritage Division of the Department of Tourism, Culture, Arts, and Recreation with the Government of Newfoundland and Labrador is responsible for supporting the preservation and management of arts and heritage across the province, including the operation of the Provincial Archaeology Office (PAO). The Division is guided by the *Historic Resources Act, RSNL 1990, c H-4,* with a mandate to protect historic resources and paleontological resources. A permit is required for any archaeological or paleontological investigations. The PAO reviews the need for historic resources impact assessments through the review of land use referrals submitted by government agencies and the private sector, including the Environmental Assessment Division.

5.12.3 Desktop Assessment Methodology

In preparation for writing this report, all available literature on archaeological research in the Project Area was reviewed. The PAO was consulted, and a series of maps were prepared by the PAO, locating all known archaeological and ethnographic sites near the Project Area. Associated Archaeological Site Record forms were also provided by the PAO.

5.12.4 Desktop Assessment Results

Since the early 1970s, archaeologists working near the Project Area have recorded 48 sites and seven ethnographic sites, mostly between Bull Arm in Trinity Bay and in the inner reaches of Placentia Bay, particularly near Swift Current and on Long Island (Figure 2, Appendix D). Urve Linnamae, working with the National Museum, was the first professional archaeologist to have surveyed some of the islands at the north end of Placentia Bay in the summer of 1970. Linnamae recorded several pre-contact Indigenous sites associated with Pre-Inuit and First Nations groups (Linnamae 1971, 1975). Since that time, several archaeological surveys have taken place in the region where seventeen Indigenous sites have been recorded within 25 km of the Project Area, including nine Beothuk sites (Figure 2, Appendix D). Rising sea levels have obscured some of the older Maritime Archaic sites and every so often, their stone tools are retrieved from the tidal zone that once were on dry land (Rast 1999: 63 & 96). Pre-Inuit sites are often small and found on exposed locations on the islands in the bay and along the shoreline. At the northwest end of Placentia Bay, Indigenous and non-Indigenous sites were found deep in Swift Current, around the area known as Piper's Hole, less than a kilometre from the Project Area (McLean 2013).

There are several very significant Indigenous archaeological sites in Bull Arm, also within a kilometre of the Project Area, including the multi-component Stock Cove site (CkAl-03), with occupations dating back nearly 5000 years and continuing into the seventeenth century A.D. (Robbins 1986; Holly et. al. 2015). Stock Cove is about one half of a kilometer from the Project Area. Frenchman's Island, just a couple of kilometres from Sunnyside in another important multi-component site. Archaeological investigations on Frenchman's Island in the early 1980s uncovered Indigenous occupations spanning over 1800 years (Evans 1981, 1982).

Much of the interior of Newfoundland has not been investigated archaeologically, however, where surveys have occurred, along the rivers and lakes in Bonavista and Notre Dame Bays, Indigenous sites have been found. Aside from the path traversing the Isthmus of Avalon, which are known to have been used by Indigenous groups, there is a strong possibility that the navigable waterways were used to access the interior of Trinity Bay, near Random Island, where the Project Area extends off the Avalon Peninsula.

Historical Significance

The Isthmus of Avalon is the narrow neck of land linking the Avalon Peninsula to the rest of the island of Newfoundland. At about 2.5 km wide at its narrowest place, it has long been used by various Indigenous populations, and later also non-Indigenous groups, to traverse between Trinity Bay to the north and Placentia Bay to the south. Archaeological sites at both sides of the isthmus date back thousands of years, suggesting this route was in use for millennia. As with the rest of Newfoundland, the cultural history of this region is close to 5000 years old. Members of every pre-contact Indigenous population who lived on the island of Newfoundland[2] utilized the rich marine and terrestrial resources of Trinity Bay and Placentia Bay. See Appendix D for a list of the archaeological sites along the coast adjacent to the Project Area. Additional evidence of ancient Indigenous habitations has also been recorded on the islands at the bottom of Placentia Bay, within 25 km of the Project Area. It should be noted that the actual Project Area has not been surveyed archaeologically.

Until relatively recently, Newfoundland-based archaeologists limited their research to the coastline and on the nearby islands. This limitation has skewed the perception that Indigenous groups only lived along the water's edge. In recent decades, archaeologists working in the near interior (within 30 km of the coast) uncovered Indigenous sites along major waterways and lakes, proving that there is potential for finding similar sites within the Project Area (Holly 2013 Schwarz 1984, also see Figure 2, Appendix D). One area of high potential for finding archaeological resources would be Piper's Hole River, which reaches over 30 km from the coast, beginning at the head of Swift Current and continuing deep into the Study Area.

5.12.5 Potential Interactions

The expected potential interactions between the Project and heritage and cultural resources by Project phase (construction, operations and maintenance, and decommissioning) are presented in Table 5.54. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. The table will be updated during the EA process to include a final list of Project-VC interactions.

[2] Maritime Archaic, Pre-Inuit, Cow Head, Beaches and Little Passage. Beothuk is the name given to the historic period Little Passage people.

Table 5.54: Potential Project-Heritage and Cultural Resources Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	-
Turbine Operation	-
Water Withdrawal	-
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

The Project may have effects on heritage and cultural resources during the construction, operations and maintenance, and decommissioning stages, and these effects may result in disturbance or destruction of archaeological sites and loss of contextual integrity. A full assessment of the potential effects of the Project on Communities will be completed during the EA process.

Disturbance or Destruction of Archaeological Sites

Construction, excavation, or grading can disturb or destroy sites containing artifacts, features or burial remains. Archaeological sites are often located beneath the surface and may not be immediately visible. Activities such as excavation, trenching, grading, road-building, or foundation-laying can physically disrupt or destroy these sites. Digging for foundations or turbine bases may cut through cultural layers, destroying artifacts. Heavy machinery use can crush fragile materials such as pottery or bone in non-compacted soils, and logging operations can displace or scatter subsurface deposits. Destruction may be irreversible as once a site is disturbed without documentation; it may be difficult to reconstruct the archaeological information it contained.

Loss of Contextual Integrity

Even if artifacts are preserved, disturbing their original context may affect the interpretation of the artifact by destroying stratigraphic and spatial information. Artifacts and features gain meaning not just from what they are, but from where and how they are found based on their association with other items, their stratigraphic position (layering in the soil), and their spatial orientation. Even if objects are not destroyed, moving them without careful recording of their location may change the understanding of their relationship to other items. Factors that may alter the soil such as trenching, erosion, or land grading can mix layers of soil, blending items from different time periods and destroying the stratigraphy. Without context, the interpretive power of an archaeological site may be diminished.

5.12.6 Mitigations

The following potential mitigations are proposed to eliminate or reduce the Project's impacts on historical and cultural resources:

- Conduct an archaeological investigation to help identify any specific high potential areas for archaeological resources prior to construction.
- An archaeological research permit will be requested from the PAO and specific requirements for the archaeological investigation will be reviewed with the PAO.
- Archaeological investigations will adhere to the guidelines and requirements of the Archaeological Investigation Permit Regulations and *Historic Resources Act*.
- Maintain avoidance of sites of high and moderate potential for archaeological sites where possible in detailed design.
- Conduct shovel testing when sites of high potential archaeological resources cannot be avoided.
- Conduct vegetation removal within areas of potential archaeological resources (especially within the transmission corridors) by hand-clearing and make use of swamp mats where heavy machinery must transit these areas to minimize ground disturbance.
- Develop an incidental discovery procedure in the contingency plan related to the potential unexpected discovery of archaeological items or sites during construction. This would include halting any work immediately upon discovery of suspected resources and contacting NL PAO.
- Conduct additional archaeological assessment if, during the detailed design phase, it is determined that ground disturbance is required in areas not previously assessed.

5.13 Communities

5.13.1 Overview

The objective of the communities assessment was to collect the information necessary to assess potential impacts to communities resulting from the Project. This was accomplished using the following approach:

- Identify potential communities within the Study Area using desktop resources.
- Use the information collected to identify potential pathways of effects.

5.13.2 Regulatory Context

Management of communities is legislated through several Acts. Legislation relevant to communities includes:

- *Towns and Local Service Districts Act*, S.N.L. 2023, c. T-62
- *Urban and Rural Planning Act*, S.N.L. 2000, c. U-8

5.13.3 Desktop Assessment Methodology

The assessment of communities includes consideration of local demographics, healthcare and recreation facilities, as well as the contributions of the Project to communities through a review of the following resources:

- Census of Population (Statistics Canada, 2023)
- Public mapping resources

5.13.4 Desktop Assessment Results

The Project is within the boundaries of Newfoundland and Labrador Census Divisions 1, 2, and 7. There are 11 census subdivisions within these three divisions that will be used herein as the basis for comparisons of demographics throughout the area within or adjacent to the Project Area (Drawing 36)

Population

A comparison of population statistics from the 2016 and 2021 censuses demonstrates population trends in the region of the Project Area (Table 5.55, sorted on population by census subdivision in 2021). Overall, the census subdivisions that are overlapped by the Project Area saw a slight decrease in population between 2016 and 2021. Subdivisions with fewer than 10 people per km^2 account for 95.5% of the total land area and 44.7% of the total population of this subset of subdivisions, indicating the highly rural nature of this area.

Table 5.55: Local Population by Census Subdivision

Census Subdivision	Population				Area (km^2)	% of Total Area	Dwellings (2021)	Population Density (2021, per km^2)
	2016	2021	% change	% of total (2021)				
Clarenville	6291	6704	6.6	43.1	139.91	3.0	3123	47.9
Division No. 7, Subd. E	2649	2573	-2.9	16.6	1631.51	35.4	1571	1.6
Division No. 7, Subd. M	1966	1856	-5.6	11.9	450.25	9.8	1094	4.1
Division No. 7, Subd. K	1275	1153	-9.6	7.4	484.96	10.5	679	2.4
Arnold's Cove	949	964	1.6	6.2	5.25	0.1	547	183.8
Division No. 1, Subd. A	666	653	-2	4.2	772.38	16.7	562	0.8
Division No. 2, Subd. K	558	502	-10	3.2	1027.96	22.3	457	0.5
Sunnyside	396	407	2.8	2.6	39.02	0.8	271	10.4
Southern Harbour	395	313	-20.8	2.0	5.39	0.1	209	58.1
Chance Cove	256	213	-16.8	1.4	18.14	0.4	129	11.7
Come By Chance	228	208	-8.8	1.3	39.55	0.9	108	5.3
Total	**15629**	**15546**	**-0.5**	**100**	**4614.32**	**100**	**8750**	**3.4**

Source: (Statistics Canada, 2023)

A comparison of age demographics for the census subdivisions overlapped by the Project Area compared to provincial values demonstrates differences between the overlapped census subdivisions and the province as a whole (Table 5.55, sorted on 2021 total population). The only census subdivision with a median age under the provincial median age is Clarenville, which, along with Come By Chance, also has a mean age below the provincial average (Statistics Canada, 2023). Among subdivisions with a population density greater than 10 people per km^2 (Table 5.56), Chance Cove has the highest median age at 63.2, with Southern Harbour the next highest at 58.0.

Table 5.56: Age Distribution by Census Subdivisions Intersecting with Project Area

Census Subdivision	Total Population (2021)	Population by Age Group (in years)			Mean Age	Median Age
		0-14	15-64	>65		
Clarenville	6704	1040	4155	1505	43.5	45.2
Division No. 7, Subd. E	2573	285	1555	735	50.0	55.2
Division No. 7, Subd. M	1856	180	1020	650	52.9	58.0
Division No. 7, Subd. K	1153	140	710	305	48.0	52.8
Arnold's Cove	964	125	565	280	48.6	52.4
Division No. 1, Subd. A	653	25	360	265	57.3	62.0
Division No. 2, Subd. K	502	25	260	215	58.0	61.6
Sunnyside	407	55	225	125	48.4	52.0
Southern Harbour	313	30	185	100	52.2	58.0
Chance Cove	213	5	110	95	59.8	63.2
Come By Chance	208	25	150	30	44.4	49.2
Provincial	**510550**	**68190**	**321750**	**120610**	**45.5**	**48.4**

Source: (Statistics Canada, 2023)

Schools

There are six grade school education facilities within the census subdivisions overlapped by the Project Area (Table 5.57), two of which are inside of or within 5 km of the Project Area (NLSA, n.d.).

Table 5.57: Grade Schools and Locations near the Project Area

School	Grades	Location	Within/Near Project Area
Southwest Arm Academy	K to 12	Little Heart's Ease	
Swift Current Academy	K to 12	Swift Current	<1 km
Tricentia Academy	K to 12	Arnold's Cove	<1 km
Riverside Elementary	K to 6	Shoal Harbour	
Clarenville High School	10 to 12	Clarenville	
Clarenville Middle School	7 to 9	Clarenville	

Source: (NLSA, n.d.)

Judicial

The nearest RCMP detachment is located in Clarenville, approximately 7 km west of the Project Area. The next closest detachments are in Whitbourne (~22 km), Placentia (~21 km), and Bay Roberts (~36 km). There are no offices located within the Project Area. Clarenville also hosts the nearest courthouse, a Provincial Court with a variety of services.

Health Centres and Medical Facilities

The nearest hospital to the Project Area is in Clarenville, the Dr. G.B. Cross Memorial Hospital. The next closest health services to the Project Area is the Dr. William H. Newhook Community Health Centre in Whitbourne (NLSA, n.d.). There are no health centers within the Project Area itself.

Fire Emergency Facilities

There are 18 fire departments in census subdivisions overlapped by the Project Area (Table 5.58), including three within the Project Area in or near the communities of Come By Chance, Arnold's Cove, and Fair Haven.

Table 5.58: Fire Departments Near the Project Area

Location	Fire Department Name
Arnold's Cove	Arnold's Cove Fire Department
Bellevue	Bellevue-Thornlea-Bellevue Beach Fire Department
Bunyan's Cove	Bunyan's Cove Fire Department
Burgoyne's Cove	Burgoyne's Cove Fire Department
Chance Cove	Chance Cove Fire Department
Charlottetown	Charlottetown Fire Department
Clarenville	Clarenville Fire Department
George's Brook	George's Brook-Milton Fire Department
Harcourt	Smith Sound Fire Department
Come-By-Chance	Come-By-Chance Fire Department
Come-By-Chance (Non-municipality Fire Department)	North Atlantic Refining
Fairhaven	Fairhaven Fire Department
Hodge's Cove	Southwest Arm Fire Department
Lethbridge	Lethbridge & Area Fire Department
Hillview	Northern Bight Fire Department
Southern Harbour	Southern Harbour Fire Department
Sunnyside	Sunnyside, Trinity Bay Fire Department
Swift Current	Swift Current-Black River Fire Department

Source: (NLSA, n.d.)

TQK is actively engaging with several local volunteer fire departments to better understand their capacity, response capabilities, and any challenges they may face as the Project progresses. These departments are critical stakeholders in ensuring the safety of both the Project and the surrounding communities during construction, operations and maintenance, and decommissioning.

This engagement is ongoing and TQK will continue to work alongside this and other emergency response teams to ensure the emergency response plan is effective, community-informed, and suited to the unique needs of the Project and its supporters.

Recreation Facilities, Museums, and Activities

There are various libraries, museums, and recreational facilities within census subdivisions overlapped by the Project Area according to provincial records (NLSA, n.d.) and other online sources. Services in this area are concentrated in the communities of Clarenville, Arnold's Cove, Southern Harbour, and Sunnyside (Table 5.59).

Table 5.59: Recreation facilities, museums and activities near the Project Area

Activity type	Name	Location
Libraries	Arnold's Cove Public Library	Arnold's Cove
	Clarenville Public Library	Clarenville
	Southern Harbour Public Library (temporarily closed)	Southern Harbour
Museums	Drake Heritage House	Arnold's Cove
	Clarenville Heritage & Railway Museum	Clarenville
	Sunnyside Viewpoint	Sunnyside
Adult Recreation	Royal Canadian Legion, Clarenville (Branch No. 27)	Clarenville
	Brookside Golf Course	Hatchet Cove
Outdoor Activities	Tilley's Road Ball Field	Clarenville
	Clarenville High School Ball Field	Clarenville
	Shoal Harbour Ball Field	Shoal Harbour, Clarenville
	Clarenville Middle School Soccer Pitch	Clarenville
	Clarenville Tennis & Basketball Courts	Clarenville
	Clarenville skateboard parks	Clarenville

Sources: (Clarenville, 2022; NLSA, n.d.)

TQK engaged with the Clarenville Heritage Society and confirmed there are no identified concerns or anticipated impacts from the Project at this time.

TQK also engaged with the Come By Chance Heritage Society to better understand important historical sites within this area. Based on these conversations, the Project design was adapted to include site-specific buffers, ranging from 700 to 1400 m depending on each site's location. These efforts reflect our ongoing commitment to protecting the cultural and historical landscape valued by the community.

5.13.5 Potential Interactions

The expected potential interactions between the Project and communities by Project phase (construction, operations and maintenance, and decommissioning) are presented in Table 5.60. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.60: Potential Project-Communities Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	X
Industrial Facilities Operation	X
Turbine Operation	X
Water Withdrawal	-
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

The Project may have effects on communities during the construction, operations and maintenance, and decommissioning stages, and these effects may result in changes to housing, changes to traffic volumes, and changes to local service and infrastructure. A full assessment of the potential effects of the Project on communities will be completed during the EA process.

Changes to Housing

Employment and procurement of goods and services can result in an in-migration of Project workers. Increased labour force in the region could result in changes to the availability of existing accommodations for Project staff and residents. This may also result in a change to the number of newly built accommodations to accommodate changes in local labour forces.

Changes to Traffic Volumes

Demand for local transportation infrastructure may be affected by Project activities and Project related population growth. Supply chain logistics for consumables and regionally/locally supplied goods can change the volumes of commercial transportation on local roads and within local communities. Changes to the workforce can result in changes to traffic volumes and flows both day-to-day and throughout the Project. These changes to overall traffic volumes and weight may result in changes to the traffic infrastructure within the region to support the Project.

Changes to Local Services and Infrastructure

Demand for local services and infrastructure may be affected by Project activities and Project-related population growth. Changes to local population growth may result in changes to access or availability of local services such as teacher-student ratios and hospital bed occupancy. Changes to local infrastructure may also occur in response to changes in Project-related population growth, which may affect access of availability to services such as fire and emergency services, waste management, and recreation services.

5.13.6 Mitigations

The following potential mitigations are proposed to eliminate or reduce the Project's impacts on communities:

- Establish worker accommodations within the Project Area to house workers travelling to site.
- Develop a Transportation Management Plan to address shipment of Project cargos on public roads.
- Schedule the transportation of oversized loads during off-peak periods when transport on public roads and highways is required.
- Consolidate cargos in storage yards near final installation locations to reduce traffic volumes on public roads and highways.
- Transport workers between Project accommodations and worksites by bus.
- Engage with local Towns and Service Districts to identify opportunities to support local infrastructure development.
- Develop benefits agreements with local communities to support in community growth.
- Identify areas of potential risk or increased emergency service demand.
- Determine whether additional emergency services equipment, training, or resources may be required.
- Incorporate local fire departments' input into the development of the Project's Emergency Response Plan.
- Strengthen coordination between Project teams and emergency service providers.

5.14 Economy, Employment, and Business

5.14.1 Overview

The objective of the economy, employment and business assessment was to collect the information necessary to assess potential impacts to economy, employment and business resulting from the Project. This was accomplished using the following approach:

- Identify potential economy, employment and business data within the Study Area using desktop resources.
- Use the information collected to identify potential pathways of effects.

5.14.2 Regulatory Context

Legislation relevant to economy, employment and business includes:

- *Labour Standards Act* RSNL1990 c. L-2

5.14.3 Desktop Assessment Methodology

The assessment of economy, employment, and business includes consideration of local demographics and employment statistics, as well as the contributions of the Project to communities through a review of the following resources:

- Census of Population (Statistics Canada, 2023)
- Public mapping resources

5.14.4 Desktop Assessment Results

Median housing costs and individual total incomes for the census subdivisions overlapped by the Project Area are generally lower than the provincial and national figures (Table 5.61). Clarenville has both higher median dwelling value and median total income than provincial values, but lower than national median values (Statistics Canada, 2023).

Table 5.61: Housing Costs and Average Individual Income within Key Communities in Project Area

Jurisdiction	Median Value of Dwellings	Median Total Income (2020)
Clarenville	$250,000	$37,200
Division No. 7, Subd. E	$160,000	$30,600
Division No. 7, Subd. M	$150,000	$30,400
Division No. 7, Subd. K	$160,000	$32,400
Arnold's Cove	$150,000	$37,200
Division No. 1, Subd. A	$150,000	$31,200
Division No. 2, Subd. K	$100,000	$30,000
Sunnyside	$150,000	$31,400
Southern Harbour	$100,000	$33,600
Chance Cove	$125,000	*NA**
Come By Chance	$150,000	*NA**
Newfoundland & Labrador	**$240,000**	**$36,800**
Canada	**$472,000**	**$41,200**

Source: (Statistics Canada, 2023)
* Not disclosed due to confidentiality requirements of the census

Most census subdivisions overlapped by the Project Area have lower employment and participation rates than the province and Canada (Table 5.62). Industry of employment varies greatly by census subdivision but particularly prominent sectors in individual subdivisions include construction, manufacturing, public administration, retail trade, health care and social assistance, and agriculture, forestry, fishing, and hunting (Table 5.63).

Table 5.62: Labour Force Statistics 2021 Census, 25% Sample Data

Jurisdiction	Participation Rate	Employment Rate	Unemployment Rate
Clarenville	62.1	54.0	13.0
Division No. 7, Subd. E	49.8	37.4	24.9
Division No. 7, Subd. M	41.1	32.1	21.7
Division No. 7, Subd. K	45.9	42.3	8.9
Arnold's Cove	56.7	47.6	15.1
Division No. 1, Subd. A	40.8	33.3	28.6
Division No. 2, Subd. K	42.4	33.3	21.4
Sunnyside	47.6	35.7	25.0
Southern Harbour	52.9	41.2	25.9
Chance Cove	36.6	24.4	26.7
Come By Chance	53.3	43.3	31.3
Newfoundland & Labrador	58.3	52.5	10.0
Canada	65.5	61.3	6.3

Source: (Statistics Canada, 2023)

Table 5.63: Top Industries for the Employed Labour Force

Jurisdiction	% of Total Labour Force by Industry										
	Health Care and Social Assistance	Retail Trade	Educational Services	Accommodation and Food Services	Construction	Manufacturing	Transportation and Warehousing	Public Administration	Agriculture, Forestry, Fishing, and Hunting	Mining, Quarrying, and Oil and Gas Extraction	Real Estate and Rental and Leasing
Clarenville	17.6	18.5	7.2	7.3	7.2	5.5	5.4	7.2	0.9	2.4	0.7
Division No. 7, Subd. E	9.6	11.4	4.8	7.4	19.7	8.3	5.2	5.7	7.0	1.3	0.9
Division No. 7, Subd. M	15.3	12.4	2.9	7.3	18.2	9.5	2.2	2.9	9.5	3.6	--
Division No. 7, Subd. K	16.5	27.5	--	8.8	9.9	2.2	2.2	5.5	5.5	--	--
Arnold's Cove	5.4	9.7	5.4	4.3	9.7	24.7	9.7	4.3	7.5	--	--
Division No. 1, Subd. A	10.0	--	--	6.0	6.0	18.0	6.0	16.0	10.0	--	--
Division No. 2, Subd. K	20.9	9.3	4.7	14.0	11.6	7.0	4.7	7.0	4.7	--	--

Jurisdiction	% of Total Labour Force by Industry										
	Health Care and Social Assistance	Retail Trade	Educational Services	Accommodation and Food Services	Construction	Manufacturing	Transportation and Warehousing	Public Administration	Agriculture, Forestry, Fishing, and Hunting	Mining, Quarrying, and Oil and Gas Extraction	Real Estate and Rental and Leasing
Sunnyside	10.0	--	--	12.5	12.5	27.5	5.0	7.5	--	5.0	--
Southern Harbour	--	--	7.4	--	14.8	18.5	7.4	--	37.0	--	--
Chance Cove	14.3	--	--	--	14.3	35.7	--	14.3	--	--	--
Come By Chance	--	--	--	--	11.8	29.4	11.8	--	--	11.8	17.6
Newfoundland & Labrador	16.5	12.3	7.1	6.3	8.0	4.8	4.9	8.9	3.9	4.0	0.9
Canada	12.7	11.1	7.3	5.6	7.6	8.0	5.1	6.2	2.3	1.2	1.8

Source: (Statistics Canada, 2023)

5.14.5 Potential Interactions

The expected potential interactions between the Project and economy, employment, and business by Project phase (construction, operations and maintenance, and decommissioning) are presented in Table 5.64. The identification of the potential interactions has been completed based on an understanding of baseline conditions confirmed through desktop assessment and the Project description. This table will be updated during the EA process to include a final list of Project-VC interactions.

Table 5.64: Potential Project-Economy, Employment, and Business Interactions

Project Phase	Potential for Interaction
Site Preparation and Construction (5 years)	
Tree Clearing and Grubbing	X
Access Roads, Laydown Yards, Turbine Pads, Site Preparation	X
Temporary Works – Quarries, Batch Plants, Accommodations	X
Transmission Line Installation and Commissioning	X
Turbine Assembly, Erection, and Commissioning	X
Substation Assembly, Installation, and Commissioning	X
Industrial Facilities Installation and Commissioning	X
Operations and Maintenance (30 years)	
Transmission Line Operation	-
Industrial Facilities Operation	X
Turbine Operation	-

Project Phase	Potential for Interaction
Water Withdrawal	-
Inspection and Maintenance	X
Decommissioning and Rehabilitation (5 years)	
Infrastructure Removal	X
Site Reclamation	X

The Project may have effects on economy, employment, and business during the construction, operations and maintenance, and decommissioning stages, and these effects may result in changes to local workforce, changes to business revenue and wages, and changes to local economy. A full assessment of the potential effects of the Project on economy, employment, and business will be completed during the EA process.

Changes to Local Workforce

Changes to the local workforce may arise from the different development phases of this Project. A project of this size may require a larger workforce than is present in local communities, requiring an increase in the number of temporary workers, particularly during the construction phase. Additionally, the increase in available jobs may change the availability of labour for other businesses operating within the region.

Changes to Business Revenue and Wages

Changes to contracts and business opportunities can arise during all phases of this Project. These changes may affect several sectors including, but not limited to supply chain, transportation, accommodation, manufacturing, etc. Additionally, changes to wage levels may result in changes for regional business either directly through business expenses or through changes to the disposable income of residents.

Changes to Local Economy

Changes to the local economy may occur through spending and revenue generation of the Project. Tax revenues through business tax, both directly through the Project and through local supplies, may result in changes to regional economies. Benefits agreements negotiated between TQK and local/regional governments may result in changes to regional economies in addition to those contemplated under traditional economic analysis.

TQK engaged with several regional organizations and associations to better understand local labour market conditions, workforce availability, and skills-related challenges. These discussions included input from, econext, Energy NL, Trades NL, Construction Labour Relations Association of NL, Skills Canada NL, local chambers of commerce, and many more. Key themes that emerged from these engagements included a shortage of skilled tradespeople, challenges with workforce attraction and retention in rural areas, and the need for expanded access to training and upskilling programs, particularly in fields relevant to renewable energy and large-scale infrastructure projects.

This feedback has been instrumental in shaping the Project's understanding of regional workforce readiness and is being considered in the development of hiring strategies, local economic benefit planning, and potential partnerships with training institutions and employment organizations.

5.14.6 Mitigations

- Work with local colleges and trade schools to develop training programs for skilled labour.
- Engage with local chambers of commerce to inform local businesses of potential opportunities.
- Establish a procurement policy providing local suppliers full and fair opportunity
- Conduct supplier information sessions through all stages of the Project.

6.0 ACCIDENTS AND MALFUNCTIONS

Accidents and malfunctions are unplanned events that are not anticipated during Project activities. Without proper mitigation, accidents and malfunctions have the potential to result in adverse effects. However, effective planning and preventative measures limit the probability of occurrence, and having appropriate response procedures in place reduces the magnitude of adverse residual effects.

Accidents, malfunctions and unplanned events that are considered as part of this EA include:

- Ammonia Release (Hazardous Release)
- Hydrogen Release (Fire or Explosion)
- Untreated Liquid Effluent Release
- General Hazardous Material Spills and Releases
- Fires
- Ice Throw
- Collapse of Wind Tower/Dislodging Turbine Blade
- Erosion and Sediment Control Failures

6.1 Ammonia Release (Hazardous Release)

TQK intends to design the Project to meet or exceed all applicable safety guidelines, with clear and well-established emergency response plans in place to manage potential incidents. Accidental ammonia release, although very unlikely, may occur at industrial facilities during Project operations. Ammonia release scenarios could be considered in the event of the following:

- Ammonia storage tank release
- Transfer pipeline release
- Process plant release (Liquid ammonia accumulator)

The consequences of a toxic ammonia release depend on the dilution rate and dispersion (of the ammonia cloud) to safe levels in the atmosphere. Liquid releases rely heavily on the pooled surface area within the release area, where the larger the pooled surface area, the greater the evaporation rate. The evaporation rate of the chemical pool determines the toxic gas cloud volume, hazard zone, and/or impact radius. A QRA will be completed to evaluate which processes pose the highest risk for the generation of an ammonia release and compare potential scenarios against applicable guidelines detailing appropriate concentration levels for exposure periods.

In addition, tailored spill response plans will be developed for each credible release scenario. These plans will be incorporated into the Project's Emergency Response Plan and regularly tested through training exercises involving the on-site Emergency Response Team (ERT) and regional Mutual Aid Partners, including local Volunteer Fire Departments. All response planning will align with the ECCC Environmental Emergency Regulations (E2) to ensure readiness and compliance.

6.2 Hydrogen Release (Fire or Explosion)

TQK intends to design the Project to meet or exceed all applicable safety guidelines, with clear and well-established emergency response plans in place to manage potential incidents. As with any process plant, accidental release, fires, and/or vapour cloud explosions are potential hazards. These accidents have very low probability of occurrence at the Project due to the engineered safeguards and industry best practices inherent to safety-in-design principles that will be implemented. An accidental hydrogen release could adversely impact air, soil, aquatic habitat, terrestrial habitat, wildlife, avifauna, human health and safety.

One such potential hazard could be accidental hydrogen release resulting in possible fire or explosion hazard at the Industrial Facilities. Potential confined vapour cloud explosion, (cVCE), as well as unconfined vapour cloud explosion, (uVCE), and fireball hazard events may occur (although they are very unlikely) during the Project's process operations.

Hydrogen release scenarios considered to be the most probable emergency event scenarios for potential loss of containment include the following:

- Explosion event due to a connection leak at an electrolyzer stack.
- Explosion event due to a connection leak within the hydrogen compressor enclosure (on the high-pressure discharge line).
- Fireball event due to a connection leak on a hydrogen main manifold.
- Fireball event/explosion due to a rupture in HP hydrogen storage.

Regarding explosion scenarios, projectiles are typically part of explosion events and may significantly impact infrastructure and/or the integrity of process buildings which may compromise the safety of Project personnel. Mitigations to protect personnel and respond to damage from projectiles during an emergency event will be included in the Project's emergency response plan and mitigations.

Detailed fire response pre-plans for each potential fire or explosion scenario will be developed, used in training, and exercised by the Emergency Response Team (ERT) and Mutual Aid Partner (local Volunteer Fire Departments) per the requirements of ECCC Environmental Emergency (E2) regulations and the Authority Having Jurisdiction (AHJ).

6.3 Untreated Liquid Effluent Release

Untreated liquid effluent releases from the Industrial Facilities have the potential to cause adverse environmental effects. Untreated effluent may be introduced into the environment by malfunction of the treatment system which would fail to effectively treat process wastewater and stormwater, which could lead to the discharge of contaminated effluent into the environment. The discharge of untreated and/or poorly treated effluent may result in the following impacts:

- Eutrophication of marine or freshwater sources
- Degradation of water quality
- Endangerment of aquatic species and habitat
- Contamination of soils
- Contamination of groundwater; impacts to residential potable groundwater

The quality and contaminant risk of the untreated effluent is dependent on the final PtX Plant components selected and will be determined during engineering design. Mitigation for the release of untreated effluent into the environment will be included in Project design and addressed within the Environmental Protection Plan.

6.4 General Hazardous Material Spills and Releases

Hazardous spills resulting from the use of fuel (i.e., storage, refuelling, operation of combustion vehicles) and other on-site chemicals may occur during the Project's construction and operations activities. Hazardous spills can adversely impact air, soil, surface water groundwater quality, human health, and safety. In addition, hazardous spills may risk the health of aquatic, avian, and terrestrial wildlife. The severity of the impacts will depend on the nature of the hazardous material and the quantity spilled. More details on spill response will be provided in the EPP.

6.5 Fires

Fires may occur during construction, operations, or maintenance due to sources such as overheated equipment, hot work, fuel storage facilities and buildings, dry conditions, and malfunctioning mechanical systems. Of these potential sources, fires originating from, or in proximity to, fuel sources are inherently dangerous as they can sustain fires, cause explosions, and release hazardous materials that may affect air quality, terrestrial and aquatic environments, and human safety.

While the Project is sited away from residential areas, TQK acknowledges that fire events, however unlikely, pose a serious risk to both personnel and the environment. To ensure readiness and reduce potential impacts, TQK is actively working with local fire departments to understand existing response capacity, constraints, and resource needs. This collaboration will continue as the Project's Emergency Response Plan is developed and refined, ensuring that plans are realistic, community-informed, and appropriately resourced. Note that this section does not address fires stemming from hydrogen or ammonia releases, which are discussed separately in Section 6.2.

6.6 Ice Throw

Ice throw and ice shedding occur when ice builds up and releases from the turbine's rotor blades, tower, or nacelle. This phenomenon is possible under a variety of freezing conditions when air temperatures range from 0°C to -12°C because of accumulation of ice caused by fog, rain, or snow. If released, ice fragments can either be thrown from the rotor due to centrifugal and aerodynamic forces or fall to the ground (CREA, 2020).

Modern wind turbines are equipped with automated load detection systems that monitor blade conditions, load imbalances, and ambient weather. A typical cause of weight imbalance is ice loading. If design limitations are reached, the turbine will shut down automatically to prevent turbine malfunction. The potential risk of injury or damage due to ice throw/ice fall is present within the maximum throwing distance of ice from here:

d_t = Maximum throwing distance (m)
D = Rotor diameter (m)
H = Hub height (m)

Although the WTG model has not yet been finalized and may change depending on market developments, it is reasonable to assume that hub heights may be as high as 138 m and a rotor diameter as wide as 182 m. Assuming these values, the maximum throwing distance associated with the Project turbines is 480 m. In real-world conditions, actual throw distances are typically much shorter due to aerodynamic drag, the dampening effects of surrounding vegetation, and local topography.

TQK's turbine siting incorporates setbacks far exceeding this conservative range, including 600 m from primary roads, 500 m from transmission infrastructure or commercial buildings, and at least 1,000 m from residences. These buffer distances aim to eliminate any potential strike risk and are consistent with industry best practices.

Given these conservative setbacks and physical buffers, TQK does not consider a dedicated ice throw study necessary. Signage will be placed along access routes within potential throw zones to inform workers and visitors of the possibility of ice shedding during freeze-thaw conditions.

6.7 Collapse of Wind Tower/Dislodging Turbine Blade

The collapse of a wind tower or dislodgement of a turbine blade may occur during the operation of the Project. These incidents may happen during construction, as well as a result of adverse weather effects or mechanical failure during operations. The collapse of wind tower or dislodgement of a turbine blade may result in potential adverse effects to wildlife, avifauna, and biophysical environment as well as compromise public safety and result in damage to Project infrastructure and property.

To mitigate these risks, TQK is incorporating conservative setbacks from public infrastructure, transmission lines, roads, and residences into the Project design. These setbacks exceed typical industry standards and serve as a buffer to ensure that even in the event of a structural failure, the potential for offsite impact is minimized.

6.8 Erosion and Sediment Control Failures

Erosion and sediment control failures may occur during construction of all components of the Project. Failure of erosion and sedimentation controls implemented by the Project may result in potential adverse effects on the surrounding terrestrial and freshwater environment. Erosion and sedimentation controls are typically implemented to minimize impacts to watercourses (and to fish and fish habitat) from the migration of fine sediment from disturbed soils (i.e., grubbing, excavation), stockpiled material (i.e., removed fill), and former infill and sand during all phases of the Project.

Erosion and sedimentation controls may fail due to extreme weather conditions (e.g., flooding), improper installation, improper maintenance, and unforeseen accidents (e.g., on-site vehicle or equipment collisions with silt fences). Failure of these control measures may release sediment into the environment, impacting water quality and aquatic and terrestrial habitats. TQK is committed to the development of an Erosion and Sedimentation Control Plan to ensure that erosion and sedimentation control measures are correctly implemented through all necessary Project phases.

7.0 RESIDUAL EFFECTS

Residual effects refer to environmental effects which cannot be avoided or mitigated, or that remain after mitigations (i.e., control technologies and best management practices) are implemented (NLECC, 2023). While many effects can be avoided, some residual effects may be unavoidable. The information presented in this EA Registration includes a description of the Project, the existing environmental setting, and the proposed methodology for evaluating potential effects through project interactions with identified VCs.

Project planning has undergone several iterations to reduce potential impacts, and additional studies will be conducted to refine the assessment of environmental effects and to identify appropriate and feasible mitigation measures. Residual effects will be characterized using standard criteria such as magnitude, frequency, likelihood, duration, and reversibility to support future determinations of significance.

8.0 CUMULATIVE EFFECTS

Cumulative effects are changes to environmental, social, and economic VCs caused by the combined effect of past, present, and known future human activities and natural processes (Government of British Columbia, u.d). Concerns are often raised about long-term changes that may occur not only because of a single action but of the combined effects of each successive action on the environment (Hegman et al., 1999). While a single undertaking might not cause significant adverse effects, multiple undertakings may result in incremental impacts, referred to as cumulative effects. These cumulative effects may potentially result in an adverse effect to one or more VCs.

The goal of a cumulative effects assessment (CEA) is to assess changes to an environmental condition (i.e., VC) that could occur based on a combination of the proposed Project with other past, present, or reasonably foreseeable future projects. The CEA is completed using publicly available data, with uncertainties clearly identified, following guidance outlined in the Cumulative Effects Assessment Practitioners Guide (Hegmann et al., 1999).

As outlined by Hegmann et al. (1999), a CEA scoping exercise is completed using the following steps:

- Identification of the VCs that will enter the CEA process.
- Determination of spatial and temporal boundaries for the CEA.
- Identification and description of other projects or activities in the spatial boundary (or boundaries).
- Confirmation of which VCs will be carried through the CEA process.

For those VCs selected for the CEA process, an analysis will be conducted considering the residual effects of the Project on that VC, the effect of other activities or projects on that VC, and potential cumulative effect. Mitigation measures and proposed monitoring programs and follow up are described, if cumulative effects are predicted. The certainty in effects predictions must be considered. It is not uncommon for data on effects of other projects or activities to be limited, increasing the uncertainty of the CEA predictions.

The spatial boundaries selected for a CEA can vary depending on the VC being evaluated. In some VCs, such as climate change, a very large spatial boundary is appropriate, compared to other VCs such as fish and fish habitat, it should be defined as only the Project's watershed(s) as the spatial boundary.

The CEA will consider past projects as those approved and constructed and those projects that are visible via aerial imagery. Reasonably foreseeable future projects are those which have been registered with Newfoundland and Labrador but have not been approved or constructed. Projects registered through the EA process will be considered based on availability of effects assessment data.

9.0 SUMMARY AND CONCLUSION

TQK is proposing a Project comprising of a large-scale onshore wind development, and potentially PV systems, to generate green electricity, water electrolysis facilities to produce green hydrogen, and Haber-Bosch production facilities to produce green ammonia, located in the Isthmus of Avalon region of NL. Ammonia will be transported to ammonia storage sites via pipelines, with storage facilities located near potential marine terminal operators for transshipment to vessels. The Project is designed to facilitate the production and transportation of green ammonia for international markets, with an option to supply green hydrogen for local off-take. The Project is currently in the design stage and detailed engineering and siting of facilities will be refined as the Project progresses.

The centralized green hydrogen and green ammonia production will be powered by between 2,500 MW and 3,200 MW of onshore wind located within the Wind Reserve Lands. The electricity produced will be collected through MV lines into substations distributed along the wind farms. From there, it will be transported via HV transmission lines [230 to 345 kilovolt (kV)] to the central substation at the Industrial Facilities, where it will be used to produce green hydrogen and convert it to green ammonia.

At the Industrial Facilities, an installed electrolyzer capacity of between 2,000 and 2,500 MW will convert water and electricity to hydrogen which will be fed to a Haber-Bosch plant together with nitrogen (N_2), to produce ammonia. The installed production capacity of the ammonia plant will be within 4,400 and 5,550 tonnes per day.

In 2023 and 2024, TQK has conducted baseline field studies and community engagement in the TQK Central and portions of the TQK South region to support the EA Registration and future EA processes. These studies inform the potential interactions between the Project and VCs, both biophysical and socioeconomic. The future design and layout of the Project will be directly influenced by the information gathered in these studies, through the identification of constraints and application of a hierarchical approach to mitigation. This approach will first seek to avoid potential effects with the goal of eliminating potential impacts before they happen and subsequently minimize effects through mitigation when avoidance is not possible. The effectiveness of these mitigations will be evaluated through the application of monitoring programs through all stages of the Project lifecycle.

TQK is committed to transparent, meaningful, and ongoing Indigenous, community, and stakeholder engagement. TQK has had ongoing discussions with local community stakeholders in the Project's area of interest and will continue to build upon these relationships and expand our stakeholder reach to ensure authentic collaboration and cooperation from all relevant groups and individuals. Through this engagement and EA process the Project is being developed to produce competitive green hydrogen and ammonia powered by the province's exceptional wind resources for potential domestic use and export to the global market.

10.0 ENVIRONMENTAL PROTECTION PLAN

An EPP will be developed following EA release. The EPP is the primary mechanism for ensuring that mitigation is implemented, as determined through the EA process, to avoid or mitigate potential adverse environmental effects that might otherwise occur from construction activities, and as required by applicable agencies through the permitting processes.

The EPP is developed for all Project personnel, including contractors, and describes the responsibilities, expectations, and methods for environmental protection associated with Project activities. The EPP will incorporate:

- Major construction and operational activities
- Means to comply with requirements of relevant legislation
- Environmental protection measures identified as part of the EA
- Environmental commitments made as part of the EA
- Permit requirements
- Contingency planning

A suggested Table of Contents for the EPP is provided in Appendix E. The EPP will be provided to NLECC prior to the start of construction for review.

11.0 PERSONNEL

This EA Registration Document was completed by Strum Consulting, an independent, multi-disciplinary team of consultants with extensive experience with submission of EA Registration Documents for undertakings within Atlantic Canada. Curriculum vitae for EA Report contributors and Project Team members are available. A list of the Project Team and their associated roles is provided below.

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Public and Indigenous Engagement work, open houses, and authorship of Section 4.0 was completed by ABO Energy. A list of the ABO Energy Project Team and their associated roles is provided below.

- Lori Tobin, BComm, Communications & Engagement Coordinator
- Heidi Kirby, MPR, Communications & Engagement Lead, Atlantic Canada
- David Berrade, MADev.,Social Impact and Engagement Lead, Canada

12.0 REFERENCES

ACCDC. (2022a). *GIS scan of rare and provincially/federally listed species for point of interest outside Chance Cove, Newfoundland and Labrador* (No. RQ1020). Atlantic Canada Conservation Data Centre.

ACCDC. (2022b). *GIS scan of rare and provincially/federally listed species for point of interest outside Clarenville, Newfoundland and Labrador* (No. RQ1018). Atlantic Canada Conservation Data Centre.

ACCDC. (2022c). *GIS scan of rare and provincially/federally listed species for point of interest outside Come By Chance, Newfoundland and Labrador* (No. RQ1019). Atlantic Canada Conservation Data Centre.

ACCDC. (2025). *Species ranks* [Dataset]. http://accdc.com/en/ranks.html

AEP. (2020). *Bird migration survey protocol*. Alberta Environment and Parks. https://open.alberta.ca/publications/bird-migration-survey-protocol

AMEC. (2015). *Wetlands inventory and classification study: Proposed Bay d'Espoir to Western Avalon transmission line (TL 267)*. Amec Foster Wheeler Environment & Infrastructure. https://www.gov.nl.ca/ecc/files/env-assessment-projects-y2015-1803-1803-appendix-g-wetlands.pdf

AMEC Environment & Infrastructure, a Division of AMEC Americas Limited. (2013). *Hydrogeology of Eastern Newfoundland. Prepared for the Newfoundland and Labrador Department of Environment and Conservation, Water Resources Management Division (NLDEC),*.

Angold, P. G. (1997). The impact of a road upon adjacent heathland vegetation: Effects on plant species composition. *Journal of Applied Ecology*, *34*(2), 409–417. https://doi.org/10.2307/2404886

Atherton, I., Bosanquet, S., & Lawley, M. (Eds.). (2010). *Mosses and liverworts of Britain and Ireland—A field guide*. Latimer Trend & Co. Ltd. https://www.britishbryologicalsociety.org.uk/member-dashboard/field-guide-online/

Band, W., Madders, M., & Whitfield, D. P. (2007). *Developing field and analytical methods to assess avian collision risk at wind farms*. https://www.naturalresearch.org/application/files/4114/9182/2839/Band_et_al_2007.pdf

Bastille-Rousseau, G., Murray, D. L., Schaefer, J. A., Lewis, M. A., Mahoney, S. P., & Potts, J. R. (2018). Spatial scales of habitat selection decisions: Implications for telemetry-based movement modelling. *Ecography*, *41*(3), 437–443. https://doi.org/10.1111/ecog.02655

Batáry, P., Fronczek, S., Normann, C., Scherber, C., & Tscharntke, T. (2014). How do edge effect and tree species diversity change bird diversity and avian nest survival in Germany's largest deciduous forest? *Forest Ecology and Management*, *319*, 44–50. https://doi.org/10.1016/j.foreco.2014.02.004

Birds Canada. (2024). *Christmas bird count result*. Welcome to Audubon's Christmas Bird Count Results. https://netapp.audubon.org/CBCObservation/

Birds Canada. (2025a). *Atlantic Nocturnal Owl Survey*. Birds Canada | Oiseaux Canada. https://www.birdscanada.org/atlantic_owls

Birds Canada. (2025b). *Newfoundland breeding bird atlas*. https://naturecounts.ca/nc/nfatlas/findsquare.jsp

Blakeslee, C. J., Galbraith, H. S., & Deems, R. M. (2018). The effects of rearing temperature on American glass eels. *Agricultural Sciences*, *09*(08), 1070–1084. https://doi.org/10.4236/as.2018.98074

Blickley, J. L., & Patricelli, G. L. (2010). Impacts of Anthropogenic Noise on Wildlife: Research Priorities for the Development of Standards and Mitigation. *Journal of International Wildlife Law & Policy*, *13*(4), 274–292. https://doi.org/10.1080/13880292.2010.524564

Bliss-Ketchum, L. L., de Rivera, C. E., Turner, B. C., & Weisbaum, D. M. (2016a). The effect of artificial light on wildlife use of a passage structure. *Biological Conservation*, *199*, 25–28. https://doi.org/10.1016/j.biocon.2016.04.025

Bliss-Ketchum, L. L., de Rivera, C. E., Turner, B. C., & Weisbaum, D. M. (2016b). The effect of artificial light on wildlife use of a passage structure. *Biological Conservation*, *199*, 25–28. https://doi.org/10.1016/j.biocon.2016.04.025

Braya Renewable Fuels. (2024). *Global leaders in the energy transition and renewable fuel production*. Braya Renewable Fuels. https://brayafuels.com/

British Bryological Society. (n.d.). Fissidens bryoides. *British Bryological Society*. Retrieved April 17, 2025, from https://www.britishbryologicalsociety.org.uk/learning/species-finder/fissidens-bryoides/

Broders, H. G., & Forbes, G. J. (2004). Interspecific and Intersexual Variation in Roost-site Selection of Northern Long-eared and Little Brown Bats in the Greater Fundy National Park Ecosystem. *The Journal of Wildlife Management*, *68*(3), 602–610. https://doi.org/10.2193/0022-541X(2004)068[0602:IAIVIR]2.0.CO;2

Buskirk, S. W., & Zielinski, W. J. (1997). American marten (Martes americana) ecology and conservation. *Mesocarnivores of Norther California: Biology, Management, & Survey Techniques*, 17–22.

California Department of Transportation. (2016). *Technical guidance for assessment and mitigation of the effects of traffic noise and road construction noise on bats* (No. CTHWANP-RT-15-306.04.1). California Department of Transportation Division of Environmental Analysis. https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/noise-effects-on-bats-jul2016-a11y.pdf

Canada. (1994). *Migratory Birds Convention Act, 1994, S.C. 1994, c. 22*. https://laws-lois.justice.gc.ca/PDF/M-7.01.pdf

Canada. (1999). *Canadian Environmental Protection Act, S.C. 1999, c. 33*. https://laws-lois.justice.gc.ca/eng/acts/c-15.31/page-1.html

Canada. (2002). *Species at Risk Act, S.C. 2002, c. 29*. https://laws.justice.gc.ca/eng/acts/s-15.3/page-1.html#h-434501

Canada. (2006). *Aboriginal Communal Fishing Licences Regulations SOR/93-332*. https://laws-lois.justice.gc.ca/eng/regulations/sor-93-332/PITIndex.html

CCEA. (n.d.-a). *Ecoregions of Canada: Central Newfoundland*. Ecozones.ca: Canadian Council on Ecological Areas. Retrieved May 2, 2025, from http://www.ecozones.ca/english/region/112.html

CCEA. (n.d.-b). *Ecoregions of Canada: Maritime Barrens*. Ecozones.ca: Canadian Council on Ecological Areas. Retrieved May 2, 2025, from http://www.ecozones.ca/english/region/114.html

CCME. (n.d.). *Canadia Environmental Quality Guidelines Summary Table*. Canadian Council of Ministers of the Environment. Retrieved February 24, 2025, from https://ccme.ca/en/current-activities/canadian-environmental-quality-guidelines

CCME. (1987). *pH*. Canadian Council of Ministers of the Environment. https://ccme.ca/en/chemical/162

CDT. (2016). *Technical guidance for assessment and mitigation of the effects of traffic noise and road construction noise on birds*. California Department of Transporation Division of Environmental Analysis.

CER. (2024). *Provincial and territorial energy profiles; Newfoundland and Labrador*. https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-newfoundland-labrador.html#s3

CFIA. (2008, January). *Canadian invasive plant framework*. Canadian Food Inspection Agency. Exotic and invasive alien species workshop, Corner Brook, NL. https://www.gov.nl.ca/ffa/files/wildlife-biodiversity-invasive-alien-species-cfia.pdf

Clarenville. (2022). *Attractions Clarenville*. Town of Clarenville. https://clarenville.ca/wp-content/uploads/2022/09/Clarenville-Attractions.pdf

Consortium of Lichen Herbaria. (n.d.). *Cladonia merochlorophaea*. Consortium of Lichen Herbaria. Retrieved April 17, 2025, from https://lichenportal.org/portal/taxa/index.php?taxon=53435&clid=1009

COSEWIC. (2011, October). *Atlantic salmon (Salmo salar): COSEWIC assessment and status report*. Committee on the Status of Endangered Wildlife in Canada. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/atlantic-salmon.html

COSEWIC. (2012). *COSEWIC assessment and status report on the American eel Anguilla rostrata in Canada*. Committee on the Status of Endangered Wildlife in Canada. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_anguille_amer_eel_1012_e.pdf

COSEWIC. (2013). *COSEWIC assessment and status report on the Little Brown Myotis Myotis lucifugus, Northern Myotis Myotis septentrionalis and Tri-colored Bat Perimyotis subflavus in Canada*. Committee on the Status of Endangered Wildlife in Canada. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/little-brown-myotis-tri-coloured-bat-2013.html

COSEWIC. (2014a). *COSEWIC assessment and status report on the boreal felt lichen, Erioderma pedicellatum: Boreal population, Atlantic population, in Canada*. COSEWIC, Committee on the Status of Endangered Wildlife in Canada = COSEPAC, Comité sur la situation des espèces en péril au Canada.

COSEWIC. (2014b). *COSEWIC assessment and status report on the caribou Rangifer tarandus Newfoundland population, Atlantic-Gaspésie population and boreal population, in Canada*. Committee on the Status of Endangered Wildlife in Canada. https://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Caribou_NF_Boreal_Atlantic_2014_e.pdf

COSEWIC. (2014c). *COSEWIC status report on the banded killifish Fundulus diaphanus Newfoundland populations in Canada*. Committee on the Status of Endangered Wildlife in Canada. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Banded%20Killifish_2014_e.pdf

COSEWIC. (2022). *COSEWIC assessment and status report on the American marten (Newfoundland population) Martes americana atrata in Canada*. Committee on the Status of Endangered Wildlife in Canada. https://ecprccsarstacct.z9.web.core.windows.net/files/SARAFiles/legacy/cosewic/sr%20American%20Marten%202022_e.pdf

COSEWIC. (2024, January 23). *COSEWIC assessment and status report on the hoary bat Lasiurus cinereus, eastern red bat Lasiurus borealis and silver-haired bat, Lasionycteris noctivagans, in Canada*. Government of Canada.

Crampton, L. H., & Barclay, R. M. R. (1998). Selection of Roosting and Foraging Habitat by Bats in Different-Aged Aspen Mixedwood Stands. *Conservation Biology*, *12*(6), 1347–1358. https://doi.org/10.1111/j.1523-1739.1998.97209.x

CWHC. (2022, July 7). *WNS reports & maps*. Canadian Wildlife Heath Cooperative. https://www.cwhc-rcsf.ca/white_nose_syndrome_reports_and_maps.php

De Lucas, M., Janss, G. F. E., Whitfield, D. P., & Ferrer, M. (2008). Collision fatality of raptors in wind farms does not depend on raptor abundance. *Journal of Applied Ecology*, *45*(6), 1695–1703. https://doi.org/10.1111/j.1365-2664.2008.01549.x

DFO. (n.d.). *NAFO subareas, divisions, and subdivisions—Open government portal*. Department of Fisheries and Oceans Canada. Retrieved April 2, 2025, from https://open.canada.ca/data/en/dataset/59af1c96-fc8f-4fa0-b398-d65e953eadaa

DFO. (2008). *Integrated management planning, Placentia Bay, Newfoundland*. Fisheries and Oceans Canada. https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/335024eng.pdf

DFO. (2009). Does eelgrass (Zostera marina) meet the criteria as an ecologically signifciant species? *DFO Can. Sci. Advis. Sec. Sci. Advis. Rep.*, *2009/018*.

DFO. (2012). *Temperature threshold to define management strategies for Atlantic salmon (Salmo salar) fisheries under environmentally stressful conditions* (Canadian Science Advisory Secretariat Science Advisory Report No. 2012/019; pp. 1–17). Department of Fisheries and Oceans Canada. https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/346488.pdf

DFO. (2013). *Report on the progress of implementation of the recovery strategy for northern wolffish (Anarhichas denticulatus) and spotted wolffish (Anarhichas minor), and management plan for Atlantic wolffish (Anarhichas lupus) in Canada for the period 2008- 2013.* vi + 16 pp.

DFO. (2018, February 13). *Banded killifish: Newfoundland population*. Government of Canada.

https://www.dfo-mpo.gc.ca/species-especes/publications/sara-lep/bandedkillfish-fondulebarre/index-eng.html

DFO. (2019). *Scallop—Newfoundland and Labrador Region*. Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/scallop-petoncle/2019/index-eng.html#toc1

DFO. (2020a, February 6). *Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater*. Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html

DFO. (2020b, November 3). *Atlantic Salmon—Newfoundland and Labrador Region*. Government of Canada. https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/salmon-saumon/2020/index-eng.html

DFO. (2021). *Assessment of American Lobster in Newfoundland* (Canadian Science Advisory Secretariat No. 2021/008; Science Advisory Report). https://publications.gc.ca/collections/collection_2021/mpo-dfo/fs70-6/Fs70-6-2021-008-eng.pdf

DFO. (2022a). *Newfoundland and Labrador Region—Aquatic species at risk*. https://www.dfo-mpo.gc.ca/species-especes/sara-lep/regions/nl-tnl-eng.html#speciesTable

DFO. (2022b). *Stock Assessment of Newfoundland and Labrador Atlantic Salmon in 2020* (Science Advisory Report No. 2022/031; Canadian Science Advisory Secretariat). https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/41073629.pdf

DFO. (2023, January 4). *European Green Crab*. Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/species-especes/profiles-profils/europeangreencrab-crabevert-eng.html

DFO. (2024a). *Update on the Status of American Eel and Elver Fisheries in Maritimes Region and Science Advice on Available Regional Indices* (Science Advisory Report No. 2024/013; Canadian Science Advisory Secretariat). https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/41234996.pdf

DFO. (2024b, May 8). *Habitat highlight: Restoring fish habitat in Newfoundland and Labrador, with a Placentia Bay case study*. Government of Canada. https://www.dfo-mpo.gc.ca/ecosystems-ecosystemes/habitat/highlights-faitssaillants/nfl-tnl/restoring-fish-habitat-restauration-poisson-eng.html

DFO. (2024c, October 4). *Pathways of effects* [Guide]. Fisheries and Oceans Canada, Public Affairs, Digital and Creative Services. https://www.dfo-mpo.gc.ca/pnw-ppe/pathways-sequences/index-eng.html

DFO. (2024d, December 5). *Rebuilding plan: Atlantic cod, Gadus morhua - NAFO subdivision 3Pn and divisions 4RS*. Government of Canada. https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/cod-morue/2024/cod-3Pn4RS-morue-eng.html

DFO. (2025a). *Newfoundland and Labrador anglers' guide 2025—2026*. Fisheries and Oceans Canada Newfoundland and Labrador Region. https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/41279050.pdf

DFO. (2025b, February 3). *Aquatic species at risk map*. Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html

Dodds, D. (1983). Terrestrial mammals. In *Biogeogography and Ecology of the Island of Newfoundland* (pp. 509–551). Dr W. Junk Publishers.

Duiker, S. W. (2004). *Effects of soil compaction*. Pennsylvania State University College of Agricultural Sciences. https://extension.psu.edu/effects-of-soil-compaction

ECCC. (2007). *Recommended protocols for monitoring impacts of wind turbines on birds*. https://publications.gc.ca/collections/collection_2013/ec/CW66-364-2007-eng.pdf

ECCC. (2013). *Federal Halocarbon Regulations, 2003* (p. 7) [Fact Sheet]. Environment and Climate Change Canada. https://publications.gc.ca/collections/collection_2014/ec/En14-108-1-2013-eng.pdf

ECCC. (2017). *Atlantic Canada shorebird survey*. Environment and Climate Change Canada - Canadian Wildlife Service. https://www.canada.ca/en/environment-climate-change/services/bird-surveys/shorebird/atlantic.html

ECCC. (2019). *Canada's changing climate report* (E. Bush & D. Lemmen, Eds.). Environment and Climate Change Canada. https://natural-resources.canada.ca/sites/www.nrcan.gc.ca/files/energy/Climate-change/pdf/CCCR_FULLREPORT-EN-FINAL.pdf

ECCC. (2020). *Action plan for the boreal felt lichen (Erioderma pedicellatum) (Atlantic population) and vole ears lichen (Erioderma molissimum), in Canada*. Environment and Climate Change Canada.

ECCC. (2022a). *Environment and Climate Change Canada's Canadian Wildlife Service (Atlantic Region)—Wind Energy & Birds Environmental Assessment Guidance Update*.

ECCC. (2022b, March 15). *Species at Risk Act: COSEWIC assessments and status reports*. Environment and Climate Change Canada. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports.html

ECCC. (2025a). *Atlantic Colonies—Density Analysis*. Environment and Climate Change. https://open.canada.ca/data/en/dataset/87bf8597-4be4-4ec2-9ee3-797f5eafbd97

ECCC. (2025b). *Historical data*. Environment and Climate Change Canada. https://climate.weather.gc.ca/historical_data/search_historic_data_e.html

E-Flora BC. (n.d.). *Suaeda calceoliformis (Hook.) Moq.* E-Flora BC: Electronic Atlas of the Flora of British Columbia. Retrieved April 17, 2025, from https://linnet.geog.ubc.ca/eflora_SMaps/indexStatic.html?sciname=Suaeda%20calceoliformis&synonyms=%27Dondia%20depressa%27,%27Schoberia%20occidentalis%27&mapservice=Vascular

Esseen, P.-A., & Renhorn, K.-E. (1998). Edge effects on an epiphytic lichen in fragmented forests. *Conservation Biology*, *12*(6), 1307–1317. https://doi.org/10.1111/j.1523-1739.1998.97346.x

European Commission. (2021). *Update of benchmark values for the years 2021 – 2025 of phase 4 of the EU ETS*.

Fensome, A. G., & Mathews, F. (2016). Roads and bats: A meta-analysis and review of the evidence on vehicle collisions and barrier effects. *Mammal Review*, *46*(4), 311–323. https://doi.org/10.1111/mam.12072

Ferrer, M., de Lucas, M., Janss, G. F. E., Casado, E., Muñoz, A. R., Bechard, M. J., & Calabuig, C. P. (2011). Weak relationship between risk assessment studies and recorded mortality in wind farms. *Journal of Applied Ecology*, *49*(1), 38–46. https://doi.org/10.1111/j.1365-2664.2011.02054.x

Finch, D., Schofield, H., & Mathews, F. (2020). Traffic noise playback reduces the activity and feeding behaviour of free-living bats. *Environmental Pollution*, *263*(B).

Francis, C. D., Ortega, C. P., & Cruz, A. (2009). Noise pollution changes avian communities and species interactions. *Current Biology*, *19*(16), 1415–1419. https://doi.org/10.1016/j.cub.2009.06.052

Garroway, C. J., & Broders, H. G. (2008). Day roost characteristics of northern long-eared bats (Myotis septentrionalis) in relation to female reproductive status. *Écoscience*, *15*(1), 89–93. https://doi.org/10.2980/1195-6860(2008)15[89:DRCONL]2.0.CO;2

GEMTEC. (2024a). *ABO electrofishing data and locations* [Excel].

GEMTEC. (2024b). *ABO NL stream habitat assessment data* [Excel].

GEMTEC. (2025a). *Surface water hydrology – discharge and water quality sampling*.

GEMTEC. (2025b, January 17). *Aquatics program (fish and fish habitat assessment)*.

Gotceitas, V., Fraser, S., & Brown, J. A. (1997). Use of eelgrass beds (Zostera marina) by juvenile Atlantic cod (Gadus morhua). *Canadian Journal of Fisheries and Aquatic Sciences*, *54*(6), 1306–1319. https://doi.org/10.1139/f97-033

Gov of NL - FFA. (2023). *Aquaculture Licenses* [Dataset]. https://geohub-gnl.hub.arcgis.com/datasets/GNL::aquaculture-licenses-1/explore?location=47.030248%2C-53.147512%2C8.49

Government of Canada. (2018). *Recovery strategy for the little brown myotis (myotis lucifugus), the northern myotis (myotis septentrionalis), and the tri-colored bat (perimyotis subflavus) in Canada*. https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/plans/Rs-TroisChauveSourisThreeBats-v01-2019Nov-Eng.pdf

Government of Canada. (2022). *Species at Risk Act: COSEWIC assessments and status reports*. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports.html

Grubb, T. G., Pater, L. L., & Delaney, D. K. (1998). *Logging truck noise near nesting northern goshawks* (No. RMRS-RN-3; p. RMRS-RN-3). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. https://doi.org/10.2737/RMRS-RN-3

Health Canada (2023). *Guidance for Evaluating Human Health Effects in Impact Assessment: Noise.* Health Canada. https://publications.gc.ca/collections/collection_2024/sc-hc/H129-54-3-2023-eng.pdf

Helldin, J. O., Jung, J., Neumann, W., Olsson, M., Skarin, A., & Widemo, F. (2012). *The impacts of wind power on terrestrial mammals: A synthesis*. Naturvårdsverket, The Swedish Environmental Protection Agency. https://www.naturvardsverket.se/globalassets/media/publikationer-pdf/ovriga-pub/vindval/978-91-620-6510-2.pdf

Heritage NL. (2025). *Introduction of moose to the island of Newfoundland*. Heritage Foundation of Newfoundland & Labrador. https://heritagenl.ca/discover/provincial-historic-commemorations-program-designations/introduction-of-moose-to-the-island-of-newfoundland/

Horton, K. G., Van Doren, B. M., Stepanian, P. M., Farnsworth, A., & Kelly, J. F. (2016). Where in the air? Aerial habitat use of nocturnally migrating birds. *Biology Letters*, *12*(11), 20160591. https://doi.org/10.1098/rsbl.2016.0591

Huff, M. H., Bettinger, K. A., Ferguson, H. L., Brown, M. J., & Altman, B. (2000). A habitat-based point-count protocol for terrestrial birds, emphasizing Washington and Oregon. *Gen. Tech. Rep. PNW-GTR-501. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 39 p*. https://doi.org/10.2737/PNW-GTR-501

IBA Canada. (2025). *Canadian important bird areas*. IBA Canada. https://www.ibacanada.com/mapviewer.jsp?lang=EN

ICS. (n.d.). *Environmental performance: Comparison of CO2 emissions by different modes of transport*. International Chamber of Shipping. Retrieved May 5, 2025, from https://www.ics-shipping.org/shipping-fact/environmental-performance-environmental-performance/

Jantzen, M. K., & Fenton, M. B. (2013). The depth of edge influence among insectivorous bats at forest–field interfaces. *Canadian Journal of Zoology*, *91*(5), 287–292. https://doi.org/10.1139/cjz-2012-0282

Kalff, J. (2002). *Limnology inland water ecosystems*. https://livresbioapp.wordpress.com/wp-content/uploads/2016/03/limnology-kalff.pdf

Liu, X., Elgowainy, A., & Wang, M. (2020). Life cycle energy use and greenhouse gas emissions of ammonia production from renewable resources and industrial by-products. *Green Chemistry*, *22*(17), 5751–5761. https://doi.org/10.1039/D0GC02301A

Longcore, T., & Rich, C. (2004a). Ecological light pollution. *Frontiers in Ecology and the Environment*, *2*(4), 191–198. https://doi.org/10.1890/1540-9295(2004)002[0191:ELP]2.0.CO;2

Longcore, T., & Rich, C. (2004b). Ecological light pollution. *Frontiers in Ecology and the Environment*, *2*(4), 191–198. https://doi.org/10.1890/1540-9295(2004)002[0191:ELP]2.0.CO;2

Marler, P., Konishi, M., Lutjen, A., & Waser, M. S. (1973). Effects of continuous noise on avian hearing and vocal development. *Proceedings of the National Academy of Sciences*, *70*(5), 1393–1396. https://doi.org/10.1073/pnas.70.5.1393

Matheson, K., Mckenzie, C. H., Gregory, R. S., Robichaud, D. A., Bradbury, I. R., Snelgrove, P. V. R., & Rose, G. A. (2016). Linking eelgrass decline and impacts on associated fish communities to European green crab Carcinus maenas invasion. *Marine Ecology Progress Series*, *548*, 31–45. https://doi.org/10.3354/meps11674

MDEP. (2022, April). *Reducing acidification in endangered Atlantic salmon habitat*. Maine Department of Environmental Protection. https://www.maine.gov/dep/water/monitoring/rivers_and_streams/salmon/Third%20yea r%20of%20clam%20shells%20(003).pdf

MDNR. (2012). *Brook trout*. Maryland Department of Natural Resources. https://dnr.maryland.gov/education/Documents/BrookTrout.pdf

MDNR. (2025). *Viola lanceolata: Lance-leaf violet*. Minnesota Department of Natural Resources: Rare Species Guide. https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=PDVIO040Y4

MTO. (2009). *Environmental guide for fish and fish habitat* (p. 581). Ontario Ministry of Transportation. https://longpointbiosphere.com/download/fish__water/MTO-Fish-Guide-June-2009-Final.pdf

Murphy, G. E. P., Dunic, J. C., Adamczyk, E. M., Bittick, S. J., Côté, I. M., Cristiani, J., Geissinger, E. A., Gregory, R. S., Lotze, H. K., O'Connor, M. I., Araújo, C. A. S., Rubidge, E. M., Templeman, N. D., & Wong, M. C. (2021). From coast to coast to coast: Ecology and management of seagrass ecosystems across Canada. *FACETS*, *6*(1), 139–179. https://doi.org/10.1139/facets-2020-0020

NAFO. (2025). *STATLANT 21A*. Northwest Atlantic Fisheries Organization. https://www.nafo.int/Data/STATLANT-21A

NASA. (2022, February 8). *Steamy Relationships: How Atmospheric Water Vapor Amplifies Earth's Greenhouse Effect - NASA Science*. https://science.nasa.gov/earth/climate-change/steamy-relationships-how-atmospheric-water-vapor-amplifies-earths-greenhouse-effect/

Native Plant Trust. (2025). *Viola lanceolata (lance-leaved violet)*. Go Botany. https://gobotany.nativeplanttrust.org/species/viola/lanceolata/

NatureServe. (2025a). *Cladonia merochlorophaea*. NatureServe Explorer. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.1040541/Cladonia_merochlorophaea

NatureServe. (2025b). *Fissidens bryoides*. NatureServe Explorer. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.817231/Fissidens_bryoides

Newfoundland. (1995). *Environment Act S.N.L. 1995, c. E-13.1*. Government of Newfoundland. https://www.assembly.nl.ca/legislation/sr/annualstatutes/1995/E13-1.c95.htm

Newfoundland and Labrador. (n.d.-a). *Brown Trout*. Fisheries, Forestry and Agriculture. Retrieved April 7, 2025, from https://www.gov.nl.ca/ffa/wildlife/all-species/animals/inland-fish/brown-trout/

Newfoundland and Labrador. (n.d.-b). *Geoscience Atlas*.

Newfoundland and Labrador. (n.d.-c). *Land use atlas*. Land Use Details. Retrieved April 1, 2025, from https://www.gov.nl.ca/landuseatlas/details/

Newfoundland and Labrador. (n.d.-d). *Water quality station profile: Rattling Brook below plant discharge*. Environment and Conservation. Retrieved April 8, 2025, from https://www.canal.gov.nl.ca/root/main/station_details_e.asp?envirodat=NF02ZK0025

Newfoundland and Labrador. (n.d.-e). *Water quality station profile—Pipers Hole River at Mothers Brook*. Environment and Conservation. Retrieved April 2, 2025, from https://www.canal.gov.nl.ca/root/main/station_details_e.asp?envirodat=NF02ZH0001

Newfoundland and Labrador. (2001). *Endangered Species Act, S.N.L. 2001, c. E-10*. https://www.assembly.nl.ca/Legislation/sr/statutes/e10-1.htm

Newfoundland and Labrador. (2002). *Water Resources Act, S.N.L. 2002, c. W-4.01*. https://www.assembly.nl.ca/legislation/sr/statutes/w04-01.htm

Newfoundland and Labrador. (2010). *Recovery plan for American marten in Newfoundland*. Department of Environment and Conservation, Government of Newfoundland and Labrador. https://www.gov.nl.ca/ffa/files/wildlife-endangeredspecies-marten-recovery-plan.pdf

Newfoundland and Labrador. (2012). *Occupational health and safety regulations*. https://www.assembly.nl.ca/Legislation/sr/regulations/rc120005.htm

Newfoundland and Labrador. (2018a, May 30). *Newfoundland and Labrador Fishery Regulations*. Government of Newfoundland and Labrador. https://laws-lois.justice.gc.ca/eng/regulations/SOR-78-443/page-5.html

Newfoundland and Labrador. (2018b, November 29). *Guidelines for applying to alter a body of water*. Government of Newfoundland and Labrador. https://www.gov.nl.ca/ecc/files/waterres-regulations-appforms-guide-applyingalterbodywater.pdf

Newfoundland and Labrador. (2024a). *Black bear—Hunting seasons and zones*. 2024-25 Hunting and Trapping Guide. https://www.gov.nl.ca/hunting-trapping-guide/2024-25/hunting-seasons-and-zones/island/black-bear/

Newfoundland and Labrador. (2024b). *General information for trappers*. 2024-25 Hunting and Trapping Guide. https://www.gov.nl.ca/hunting-trapping-guide/2024-25/general-information-for-trappers/

Newfoundland and Labrador. (2024c). *Moose—Hunting seasons and zones*. 2024-25 Hunting and Trapping Guide. https://www.gov.nl.ca/hunting-trapping-guide/2024-25/hunting-seasons-and-zones/island/moose/

Newfoundland and Labrador. (2024d). *Small game—Hunting seasons and zones*. 2024-25 Hunting and Trapping Guide. https://www.gov.nl.ca/hunting-trapping-guide/2024-25/hunting-seasons-and-zones/island/small-game/

Newfoundland and Labrador. (2025a). *Newfoundland & Labrador Heritage*. https://www.heritage.nf.ca/

Newfoundland and Labrador. (2025b). *Provincial land use atlas* [Dataset]. https://www.gov.nl.ca/crownlands/land-use-atlas/

NL ECC. (2001). *Policy for Development in Wetlands*. https://www.gov.nl.ca/ecc/waterres/regulations/policies/wetlands/

NLECC. (2006). *Guide to our wilderness and ecological reserves*. Newfoundland and Labrador Environment and Climate Change. https://www.gov.nl.ca/ecc/files/natural-areas-pdf-reserves-web.pdf

NLECC. (2008a). *Exotic and invasive alien species in Newfoundland and Labrador*. Newfoundland and Labrador Environment and Climate Change. https://www.gov.nl.ca/ffa/files/wildlife-biodiversity-invasive-alien-species-exotic-species-brochure.pdf

NLECC. (2008b). *Groundwater Data*. https://www.gov.nl.ca/ecc/waterres/groundwater/data/

NLECC. (2022). *Water Resources Portal*. Water Resources Management Division. https://gnl.maps.arcgis.com/apps/webappviewer/index.html?id=8f9cddf172014b8d89eaa118bdfdfb40

NLECC. (2024a). *Air quality annual reports*. Newfoundland and Labrador Environment and Climate Change. https://www.gov.nl.ca/ecc/publications/env-protection/

NLECC. (2024b). *Air quality data*. Newfoundland and Labrador Environment and Climate Change. https://www.gov.nl.ca/ecc/env-protection/science/airmon/

NLECC. (2024c). *Climate data*. Newfoundland and Labrador Environment and Climate Change. https://www.gov.nl.ca/ecc/occ/climate-data/

NLECC. (2024d). *Climate monitoring program*. Newfoundland and Labrador Environment and

Climate Change. https://www.gov.nl.ca/ecc/waterres/watermonitoring/climate/

NLECC. (2024e). *Public water supplies*. Newfoundland and Labrador Environment and Climate Change. https://www.gov.nl.ca/ecc/waterres/gis/gis/

NLFFA. (n.d.-a). *Mammals*. Government of Newfoundland and Labrador, Fisheries, Forestry and Agriculture. https://www.gov.nl.ca/ffa/wildlife/snp/programs/education/animal-facts/mammals/

NLFFA. (n.d.-b). *Newfoundland fur zones*. Newfoundland and Labrador Fisheries, Forestry and Agriculture. Retrieved April 2, 2025, from https://www.gov.nl.ca/ffa/public-education/wildlife/trapping/maps/

NLFFA. (n.d.-c). *Species at risk: Mammals*. Newfoundland and Labrador Fisheries, Forestry and Agriculture. Retrieved April 9, 2025, from https://www.gov.nl.ca/ffa/wildlife/endangeredspecies/mammals/

NLFFA. (2018). *Construction Standards for Resource Access Roads in Newfoundland and Labrador*. Newfoundland and Labrador Fisheries, Forestry, and Agriculture. https://www.gov.nl.ca/ffa/files/forestry-permits-pdf-construction-standards-for-resource-access-roads.pdf

NLFFA. (2021a, June). *Crown Zone 2 five-year forestry operating plan (2022-2026)*. Newfoundland and Labrador Fisheries, Forestry, and Agrifoods. https://www.gov.nl.ca/ecc/projects/project-2161/

NLFFA. (2021b, July). *Crown Zone 1 five-year forestry operating plan (2022-2026)*. Newfoundland and Labrador Fisheries, Forestry, and Agrifoods. https://www.gov.nl.ca/ecc/projects/project-2164/

NLFFA. (2022). *2022-2026 moose management plan*. Newfoundland and Labrador Fisheries, Forestry, and Agriculture. https://www.gov.nl.ca/ffa/files/22282-Moose-Management-Report-July-12.pdf

NLFFA. (2023). *FFA - AD - licensed fish processors and aquaculture sites*. Newfoundland and Labrador Fisheries, Forestry and Agriculture. https://geohub-gnl.hub.arcgis.com/maps/15586c5ed02f465fb6c141cf72fdb175

NLFFA. (2024a, December). *Forestry management districts and zones*. Newfoundland and Labrador Fisheries, Forestry and Agriculture GeoHub. https://geohub-gnl.hub.arcgis.com/maps/25888b0ae37641e2bb0e5875a798a8f5

NLFFA. (2024b, December 3). *Aquaculture Licenses*. Department of Fisheries, Forestry, and Agriculture GeoHub. https://geohub-gnl.hub.arcgis.com/datasets/GNL::aquaculture-licenses-1/explore?location=47.030248,-53.147512,8.49

NLFFA. (2025a). *2025-26 Hunting and trapping guide*. Newfoundland and Labrador Fisheries, Forestry and Agriculture. https://www.gov.nl.ca/hunting-trapping-guide/2025-26/print/

NLFFA. (2025b). *EcoRegions of Newfoundland* [Shapefile]. Newfoundland and Labrador Fisheries, Forestry and Agriculture GeoHub. https://geohub-gnl.hub.arcgis.com/maps/12239edf583e46feb52f83bc6ae48c64

NLFFA. (2025c). *Species at risk—Birds (information sheets)*. Newfoundland and Labrador Fisheries, Forestry and Agriculture. https://www.gov.nl.ca/ffa/wildlife/endangeredspecies/birds/

NLFFA. (2025d, February 14). *Land Cover*. Newfoundland and Labrador Fisheries, Forestry, and Agriculture GeoHub. https://geohub-gnl.hub.arcgis.com/datasets/ffa-land-cover-newfoundland

NLSA. (n.d.). *Community Infrastructure Mapping System*. Newfoundland and Labrador Statistics Agency. Retrieved April 2, 2025, from https://nlcims.ca/OpenData/

NLTCAR. (2024). *Visitor profile—Highlights from the 2023 visitor exit survey*. Newfoundland and Labrador Tourism, Culture, Arts and Recreation. https://www.gov.nl.ca/tcar/files/2023-Exit-Survey-Highlights-Report_FINAL.pdf

NLTCAR. (2025). *Vacation visitor profile*. Newfoundland and Labrador Tourism, Culture, Arts and Recreation. https://www.gov.nl.ca/tcar/files/Vacation-Visitor-Profile_Snapshot_UPDATED_FINAL.pdf

NRCan. (2023). *Lakes, Rivers and Glaciers in Canada—CanVec Series—Hydrographic Features*. https://open.canada.ca/data/en/dataset/9d96e8c9-22fe-4ad2-b5e8-94a6991b744b/resource/a28675d7-eb8e-4d3a-aa69-ea427277c866

NRCan. (2024). *Canadian Digital Elevation Data*. https://www.mcgill.ca/library/find/maps/cded

NTL. (2025). *About NTL*. Newfoundland Transshipment Limited. https://ntl.net/about/

NWWG. (1997). *The Canadian wetland classification system* (B. G. Warner & C. D. A. Rubec, Eds.; Second edition). National Wetlands Working Group. Wetlands Research Centre, University of Waterloo. https://nawcc.wetlandnetwork.ca/Wetland%20Classification%201997.pdf

PAANL. (2008a). *Central Newfoundland forest: North-central subregion.* Protected Areas Association of Newfoundland. https://www.gov.nl.ca/ecc/files/natural-areas-pdf-island-2a-north-central.pdf

PAANL. (2008b). *Maritime Barrens: Central Barrens subregion*. Protected Areas Association of Newfoundland. https://www.gov.nl.ca/ecc/files/natural-areas-pdf-island-6d-central-barrens.pdf

PAANL. (2008c). *Maritime Barrens: Southeastern Barrens subregion*. Protected Areas Association of Newfoundland. https://www.gov.nl.ca/ecc/files/natural-areas-pdf-island-6b-southeast-barrens.pdf

ParksNL. (n.d.). *Provincial park reserves*. Newfoundland and Labrador Parks Division. Retrieved April 1, 2025, from https://www.parksnl.ca/reserves/

Pauwels, J. (2018). *Light pollution & biodiversity: What are the levers of action to limit the impact of artificial lighting on nocturnal fauna?*

Pino-Bodas, R., Sanderson, N., Cannon, P., Aptroot, A., & Coppins, B. (2021). Lecanorales: Cladoniaceae, including the genera Cladonia, Pilophorus and Pycnothelia. *Revisions of British and Irish Lichens*, *19*, 1–45.

Prystay, T. S., Sipler, R. E., Foroutani, M. B., & LeBris, A. L. (2023). *The role of boreal seagrass meadows in the coastal filter*. *128*(12), e2023JG007537. https://doi.org/10.1029/2023JG007537

Qalipu First Nation. (n.d.). *Background*. Qalipu First Nation. Retrieved April 10, 2025, from https://qalipu.ca/about/background/

QENR. (2024). *Traditional Eel Harvest*. https://qalipu.ca/traditional-eel-harvest/#:~:text=American%20Eel%20in%20Newfoundland&text=Currently%20the%20recreational%20eel%20spearing,of%20eel%20in%20the%20area.

Qualipu First Nation. (n.d.). Traditional eel harvest – Qalipu. *Traditional Eel Harvest*. Retrieved April 7, 2025, from https://qalipu.ca/traditional-eel-harvest/

Raleigh, R. F. (1982). *Habitat suitability index models: Brook trout* (No. FWS/OBS-82/10.24; p. 42). US Fish and Wildlife Service.

Rao, A. S., Gregory, R. S., Murray, G., Ings, D. W., Coughlan, E. J., & Newton, B. H. (2014). *Eelgrass (Zostera marina) locations in Newfoundland and Labrador*. vi + 19 p.

Reynolds, C. (2011). *The effect of acidification on the survival of American eel*. https://dalspaceb.library.dal.ca/server/api/core/bitstreams/93f2d635-04dc-40c8-b6ef-b9b491eeeec9/content

Rigby, M. D., & Threlfall, W. (1982). A morphological comparison of muskrats (Ondatra zibethicus) from Newfoundland and New Brunswick. *Canadian Journal of Zoology*, *60*(9), 2235–2238. https://doi.org/10.1139/z82-287

Robertson, M., & Eddy, T. (2024, July 3). *The federal government has lifted the moratorium on Northern cod fishing after 32 years*. The Conversation. http://theconversation.com/the-federal-government-has-lifted-the-moratorium-on-northern-cod-fishing-after-32-years-233522

Robichaud, D., & Rose, G. A. (2006). Density-dependent distribution of demersal juvenile Atlantic cod (Gadus morhua) in Placentia Bay, Newfoundland. *ICES Journal of Marine Science*, *63*(4), 766–774. https://doi.org/10.1016/j.icesjms.2005.12.002

Saskatchewan Ministry of Environment. (2015). *Species detection survey protocols: Short-eared owl surveys*. Fish and Wildlife Branch. https://publications.saskatchewan.ca/#/products/79506

Schaefer, J. A., Mahoney, S. P., Weir, J. N., Luther, J. G., & Soulliere, C. E. (2016). Decades of habitat use reveal food limitation of Newfoundland caribou. *Journal of Mammalogy*, *97*(2), 386–393. https://doi.org/10.1093/jmammal/gyv184

Schirmer, A. E., Gallemore, C., Liu, T., Magle, S., DiNello, E., Ahmed, H., & Gilday, T. (2019). Mapping behaviorally relevant light pollution levels to improve urban habitat planning. *Scientific Reports*, *9*(1), 11925. https://doi.org/10.1038/s41598-019-48118-z

Schmelzer, I. (2005). *A management plan for the short-eared owl (Asio flammeus flammeus) in Newfoundland and Labrador*. Wildlife Division, Department of Environment and Conservation.

Schroer, S., & Hölker, F. (2017). Impact of Lighting on Flora and Fauna. In R. Karlicek, C.-C. Sun, G. Zissis, & R. Ma (Eds.), *Handbook of Advanced Lighting Technology* (pp. 957–989). Springer International Publishing. https://doi.org/10.1007/978-3-319-00176-0_42

Scott, W. B., & Scott, M. G. (1989). Review of Atlantic fishes of Canada. *American Society of Ichthyologists and Herpetologists (ASIH)*, *1989*(3), 812–814. https://doi.org/10.2307/1445533

Seewagen, C. L., Nadeau-Gneckow, J., & Adams, A. M. (2023a). Far-reaching displacement effects of artificial light at night in a North American bat community. *Global Ecology and Conservation*, *48*, e02729. https://doi.org/10.1016/j.gecco.2023.e02729

Seewagen, C. L., Nadeau-Gneckow, J., & Adams, A. M. (2023b). Far-reaching displacement effects of artifiical light at night in a North American bat community. *Global Ecology and Conservation*, *48*.

Shannon, G., Crooks, K. R., Wittemyer, G., Fristrup, K. M., & Angeloni, L. M. (2016). Road noise causes earlier predator detection and flight response in a free-ranging mammal. *Behavioral Ecology*, *27*(5), 1370–1375. https://doi.org/10.1093/beheco/arw058

Smith, C., K. Hill, A., & Torrente-Murciano, L. (2020). Current and future role of Haber–Bosch ammonia in a carbon-free energy landscape. *Energy & Environmental Science*, *13*(2), 331–344. https://doi.org/10.1039/C9EE02873K

Sooley, D. R., Luiker, E. A., & Barnes, M. A. (1998, March). *Standard methods guide for freshwater fish and fish habitat surveys in newfoundland and labrador: Rivers and streams*. Department of Fisheries and Oceans Science Branch. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/242052.pdf

Soper, L. R., & Payne, N. F. (1997). Relationship of introduced mink, an island race of muskrat, and marginal habitat. *Annales Zoologici Fennici*, *34*(4), 251–258.

Statistics Canada. (2023, November). *Census profile, 2021 census of population*. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E

Terraube, J., Archaux, F., Deconchat, M., van Halder, I., Jactel, H., & Barbaro, L. (2016). Forest edges have high conservation value for bird communities in mosaic landscapes. *Ecology and Evolution*, *6*(15), 5178–5189. https://doi.org/10.1002/ece3.2273

Tessa McBurney. (2018). *Got bats? How to manage bats in buildings in Newfoundland and Labrador*. Canadian Wildlife Health Cooperative. https://www.cwhc-rcsf.ca/docs/bat_health/bats_in_buildings/Bats%20in%20Buildings%20BMP-%20NL%20Version%20FINAL%20(October%2016%202018).pdf

Tilman, D., Knops, J., Wedin, D., Reich, P., Ritchie, M., & Siemann, E. (1997). The influence of functional diversity and composition on ecosystem processes. *Science*, *277*(5330), 1300–1302. https://doi.org/10.1126/science.277.5330.1300

Timmerberg, S., Kaltschmitt, M., & Finkbeiner, M. (2020). Hydrogen and hydrogen-derived fuels through methane decomposition of natural gas – GHG emissions and costs. *Energy Conversion and Management: X*, *7*, 100043. https://doi.org/10.1016/j.ecmx.2020.100043

US EPA. (2024). *Aluminum Industry*. Aluminum Industry. https://www.epa.gov/eps-partnership/aluminum-industry

Volkoff, H., & Rønnestad, I. (2020). Effects of temperature on feeding and digestive processes in fish. *Temperature*, *7*(4), 307–320. https://doi.org/10.1080/23328940.2020.1765950

Washinger, D. P., Reid, R., & Fraser, E. E. (2020). Acoustic evidence of hoary bats (Lasiurus cinereus) on Newfoundland, Canada. *Northeastern Naturalist*, *27*(3), 567–575.

Water Resource Act. (2002). *Water Resources Act*. https://www.assembly.nl.ca/legislation/sr/statutes/w04-01.htm

Westley, P. A. H., Fleming, I., & Ings, D. W. (2011). A review and annotated bibliography of the impacts of invasive brown trout (Salmo trutta) on native salmonids, with an emphasis on Newfoundland waters. In *Canadian Technical Report of Fisheries and Aquatic Sciences* (Vol. 2924, pp. 1–81). https://www.researchgate.net/publication/234839037_A_review_and_annotated_bibliography_of_the_impacts_of_invasive_brown_trout_Salmo_trutta_on_native_salmonids_with_an_emphasis_on_Newfoundland_waters

Wight, T. (2025, January 10). *Question re wind farm water assessments* [Personal communication].

Wight, T. (2025, March 25). *RE: DFO-Strum meeting to discuss FAFH methodology—* [Personal communication].

Wildlife Acoustics. (2024). *Kaleidoscope Pro* (Version 5.6.8) [Computer software]. Wildlife Acoustics. https://www.wildlifeacoustics.com/products/kaleidoscope-pro

Woollard, T. F., Harrison, D. J., Simons-Legaard, E. M., & Fagan, K. E. (2024). Functional responses in American marten habitat selection indicate cumulative effects of progressive habitat change. *Ecosphere*, *15*(1), e4715. https://doi.org/10.1002/ecs2.4715

Zhang, Z., Zimmermann, N. E., Stenke, A., Li, X., Hodson, E. L., Zhu, G., Huang, C., & Poulter, B. (2017). Emerging role of wetland methane emissions in driving 21st century climate change. *Proceedings of the National Academy of Sciences*, *114*(36), 9647–9652. https://doi.org/10.1073/pnas.1618765114

Zimmerling, J., & Francis, C. (2016). Bat mortality due to wind turbines in Canada: Bats and Wind Turbines. *The Journal of Wildlife Management*, *80*. https://doi.org/10.1002/jwmg.21128

Zimmerling, R. J., & Francis, C. M. (2016). Bat mortality due to wind turbines in Canada. *The Journal of Wildlife Management*.