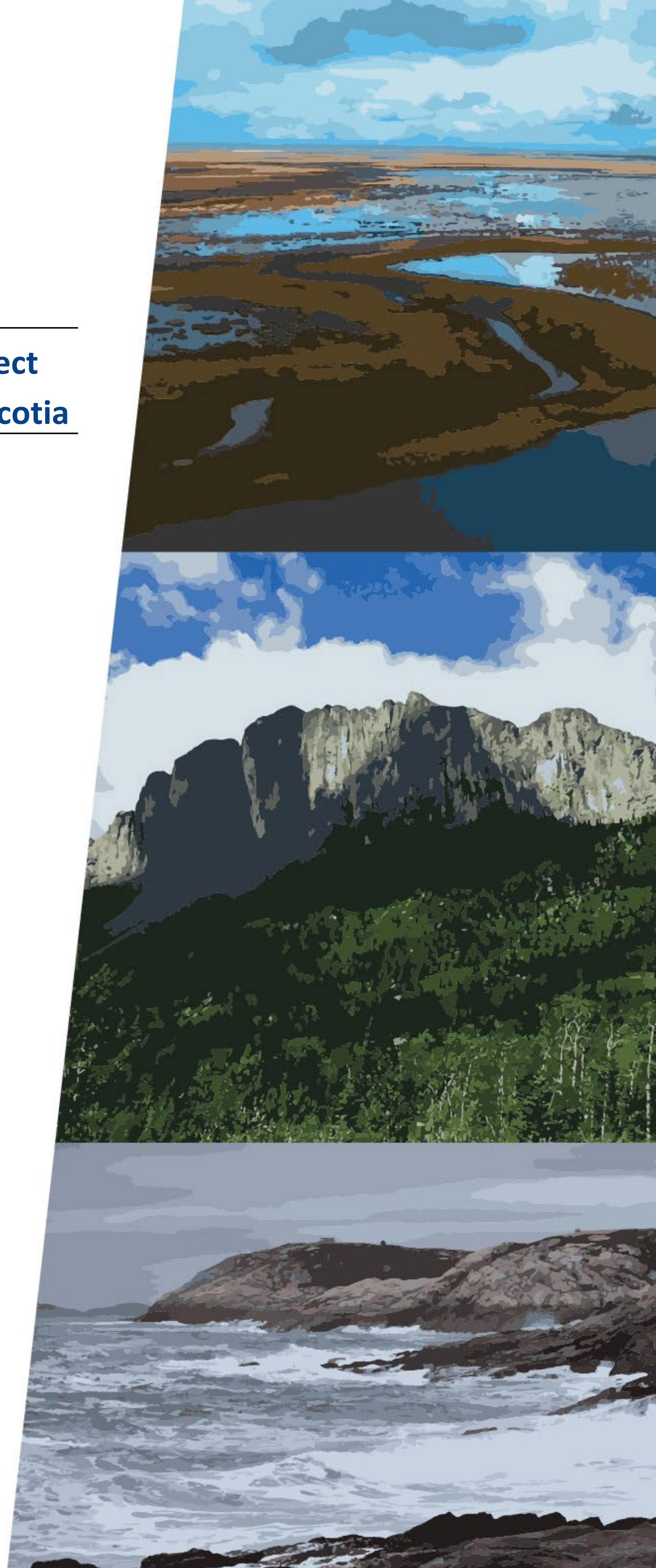
ENVIRONMENTAL ASSESSMENT
REGISTRATION DOCUMENT

Wedgeport Wind Farm Project
Little River Harbour, Nova Scotia



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EXECUTIVE SUMMARY

Wedgeport Wind Farm GP Inc., Elemental Energy Renewables Inc., Stevens Wind Ltd., and Sipekne'katik First Nation carrying on business as Wedgeport Wind Farm Limited Partnership (Wedgeport Wind), is proposing to construct and operate the Wedgeport Wind Farm Project (the Project) in Little River Harbour, Municipality of the District of Argyle, Yarmouth County, Nova Scotia. The Project includes up to 13 WTGs with individual generating capacities ranging between 5.9 to 7.0 MW per turbine, depending on final turbine selection. As the Project is an energy generating facility with a production rating of at least 2 MW derived from wind, the Project requires a provincial Environment Assessment (EA) registration (Class I undertaking) with Nova Scotia Environment and Climate Change (NSECC).

On June 26, 2012, Anaia Global Renewable Energies registered a previous version of the Project for EA (the "2012 Project"). On August 15, 2012, The Minister released a decision that the registration information provided in the original submission was insufficient to make a decision on the project, and additional information was required in accordance with clause 13(1)a of the Environmental Assessment Regulations, pursuant to Part IV of the *Environment Act*. Following that determination, Anaia Global Renewable Energies made the decision not to continue with the development of the Project and no further information was provided to NSECC. Wedgeport Wind has since acquired the Project, including all reports, documents, and information related to the 2012 Environmental Assessment Registration Document (EARD). Wedgeport Wind is completing the necessary steps for the successful permitting, construction, operation, and decommissioning/reclamation of the Project.

The government of Nova Scotia announced a Rate Base Procurement (RBP) aiming to supply the province with ~350 MW of renewable energy. The RBP is designed to assist the province in getting closer to the 80% target of renewable energy and support the province's goal of achieving a 53% reduction in greenhouse gas emissions by 2030 and net-zero by 2050. In August 2022, the Project was officially selected as 1 of 5 successful projects under the RBP process.

The Project Area is situated south of Goose Lake and is delineated by Comeaus Hill Road along its western boundary and the Tusket Islands Wilderness Area along its eastern boundary. Wedgeport Wind has obtained option agreements to lease the private land and Crown land agreements will be obtained for the Crown land proposed to support Project infrastructure.

The primary components associated with the Project include the following;

Wind turbine generators (WTG)

Wedgeport Wind is proposing the construction of up to 13 WTGs with an individual generating capacity of 5.9 to 7.0 MW per turbine, depending on final turbine selection. There are a variety of turbine makes and models being considered. For the purposes of the EA, Wedgeport Wind has selected the Siemens Gamesa SG 6.6-170 WTG model as this turbine represents the general range of turbine options that are being considered.

Access roads to WTGs

Access roads to support the construction, operation, and decommissioning phases of the Project total 8.72 km and include both existing (0.24 km; 2.8%) and new access (8.48 km; 97.2%).

Electrical collector lines to move electrical energy from WTGs to the substation

Approximately 11 km of new 34.5 kV electrical collection will be installed, using a mix of above (i.e., overhead) and below ground methods.

Substation

Electricity generated by the Project will be transmitted through the electrical collection system to a new substation located within the Project Area. The substation is required to step up the power generated by the WTGs from a voltage of 34.5 kV to 138 kV which is then supplied to Nova Scotia Power Inc. (NSPI).

Transmission line

NSPI has confirmed that connection to the electricity grid is feasible. NSPI is currently considering multiple routing options of the transmission line, but interconnection is proposed to occur on the 138 kV NSPI transmission line L-6024 approximately 1.5 km southeast of the Tusket substation. NSPI has confirmed that they will be responsible for supporting all environmental permitting associated with the Project's transmission line with the cost incurred to Wedgeport Wind and as per direction from the NSECC, the transmission line is not required to be assessed with this EA.

Temporary laydown yards

Two temporary laydown yards (100 m x 250 m) are proposed to be constructed within the Project Area. Laydown yards will be used to store construction equipment and materials during the construction and decommissioning phases of the Project.

Construction pads

The erection of a WTG requires a large level work area for storage of WTG components and safe operation. Three construction pads will be associated with each turbine (ranging in size from 30 m x 50 m to 30 m x 100 m).

Concrete batch plant

A mobile concrete batch plant allows consistent high output and quality concrete to be produced at the Project site and reduce trucking costs and local impacts to communities.

Meteorological tower

A permanent meteorological tower may be required for the Project. The tower would be at the hub height of the turbines and be either a self-supported structure or use guy wires. The met mast, if installed, will comply with all regulations.

The predicted timeline of the Project has been proposed over a 39-year time period which includes site preparation and construction (2 years), operation (35 years) and decommissioning and reclamation (1-2 years).

Site preparation and construction includes clearing and grubbing, access road construction, crane pad construction, turbine foundation installation, turbine assembly and erection, and collector line construction. During operations, routine maintenance activities will continue.

Wedgeport Wind commits to ensuring sufficient funds will be available to complete Project abandonment and reclamation at the end of the Project life cycle and expects that the costs or majority of the costs to reclaim the Project will be recovered from the salvage value associated with the Project components. The end land use objectives after reclamation are based on pre-development site conditions, to the extent possible. The reclaimed site will plan to support equivalent land capability and uses that are present at the time of abandonment and reclamation.

Mi'kmaq of Nova Scotia and Mi'kmaq Engagement

Sipekne'katik First Nation is a partner in the Project.

The Acadia First Nation is the most proximate First Nation community to the Project. Yarmouth 33 IR is located ~10 km northwest of the Project Area.

A Mi'kmaq Ecological Knowledge Study (MEKS) was completed for the 2012 Project and a second MEKS was completed in 2022 to update the results of the 2012 MEKS. The 2012 MEKS identified Mi'kmaq traditional use activities occurring within the 2012 Project site and concluded that there was potential the 2012 Project could affect Mi'kmaq traditional use of the area, specifically commercial fishing in the Tusket Falls area. The 2022 MEKS also notes historical use of the Project Area by the Mi'kmaq of Nova Scotia and no changes to the conclusions of the 2012 MEKS were identified.

Wedgeport Wind has initiated engagement with all 13 First Nations communities in the province as well as the Kwilmu'kw Maw-klusuaqn Office (KMKNO). This engagement resulted in constructive dialogue relating to the Project and its potential impact on the surrounding environment and the Mi'kmaq of Nova Scotia. Sipekne'katik First Nation was engaged in reviewing the Project, environmental studies, the scope of the EA, and potential mitigation measures that were included in the EA. Sipekne'katik also reviewed a draft of the Mi'kmaq Ecological Knowledge Study (MEKS) before it was finalized and submitted. Sipekne'katik First Nation has also expressed interest around training, employment, and contracting opportunities for their members.

Wedgeport Wind is committed to engaging with First Nation communities and organizations throughout the life of the Project and has proposed several mitigation measures to reduce impact on traditional practices.

Public Engagement

Public engagement activities have occurred to support the EA process for the Project and included distributing a Project description letter and invitation to a public information session. A public information session was held at the Wedgeport & District Fire Department on April 20, 2022, and was attended by 42 people. Members of the public inquired about Project generated noise, shadow flicker, potential impacts to birds and wildlife, property value impacts, setbacks from dwellings, and community benefits. Wedgeport Wind is committed to continuing to engage with the public throughout the life of the Project.

Spatial Boundaries

Spatial boundaries of the EA are defined by the Project Area, Study Area, Fish Study Area, and the Project footprint.

Project Area

The Project Area was designed to include the maximum extent of expected terrestrial impacts (and in consideration of property ownership) and is 919 ha.

Study Area
The Study Area is located within the Project Area and it includes the entirety of the Project footprint. The Study Area is further defined by the buildable area for turbines (e.g., setback 1,000 m from residential dwellings) and includes buffers of various sizes surrounding the Project footprint. This Study Area captures all direct impacts from the Project. The Study Area is 353 ha in size.

Fish Study Area
Evaluation of fish and fish habitat was completed within the Fish Study Area, which serves as an extension of the Study Area for the purposes of fish collection. The Fish Study Area (361 ha) includes the entirety of the Study Area and two additional aquatic features to the west. The Fish Study Area was defined to consider fish and fish habitat representation with the Project Area and the maximum extent of potential impacts to fish and fish habitat.

Project Footprint
The Project footprint includes the maximum extent of the cleared area to support Project infrastructure and totals 57 ha (or 6.2% of the Project Area).

Environmental Effects Assessment

The Environmental Assessment Registration Document (EARD) has been prepared to evaluate the effect of the Project on selected Valued Environmental Components (VEC), which includes a detailed assessment of baseline conditions and predicted impacts to each VEC. The VECs selected include:

- Climate Change
- Air Quality
- Noise
- Surficial and bedrock geology
- Groundwater
- Habitat, Flora, and Lichens
- Fauna
- Bats
- Avifauna
- Wetlands
- Surface Water, Fish, and Fish Habitat
- Visual Aesthetics
- Shadow Flicker
- Electromagnetic Interference
- Local Economy
- Land Use and Value

- Transportation
- Recreation and Tourism
- Human Health
- Cultural and Heritage Resources
- Other Undertakings in the Area

A summary of each VEC and Project interactions are outlined below.

Climate Change
GHGs will be emitted during all phases of the Project, which includes construction, turbine maintenance, and decommissioning and reclamation. During operations, WTGs produce emission free electricity.

The total amount of ROG, CO, NO_X, PM10, PM2.5 and CO_2 emissions generated by the Project are estimated to be 128 kg, 2,202 kg, 1,624 kg, 1,482 kg, 336 kg, and 796,386 kg, respectively. The primary source of GHG emissions per day from the Project is during the construction phase due to the use of heavy equipment for the installation and construction of site facilities.

In a single year during the operational phase, the Project will reduce overall provincial GHG emissions as WTGs provide emission free electricity. Available information (turbine size, wind generating potential, project lifespan, etc.) estimates that emissions reductions from the renewable energy provided by the Project will be the equivalent of offsetting approximately 63,608 tonnes of CO_2 per year. The amount of power generation would have an estimated 2,226,262 tonnes of CO_2 offset potential over a 35-year lifespan.

Based on the available GHG emissions calculations, including the production of roughly 796.4 metric tonnes of CO_2 during construction, operations and decommissioning, the offset potential for the Project is anticipated to be 2,225,466 metric tonnes of CO_2 over the Project's 35-year lifespan. During the first year of operations (2025), the Project is anticipated to offset of 112,750 tonnes of CO_2.

The Project is predicted to have a significant positive effect on climate change.

Air Quality
Air quality (dust) during construction has the potential to cause a nuisance to local residents and can affect the health of flora. Wind Farm operation has very limited potential to have an effect to air quality by changing particulate levels. After mitigation measures are implemented the predicted residual environmental effects for air quality are assessed to be not significant.

Noise

The Projects WTGs are setback by a minimum of 1,000 m from existing residential receptors. Construction generated noise is anticipated to attenuate to background conditions within 165 m of the source. Noise modelling was completed for the operational phase of the Project, and it predicts that turbine generated noise levels will not exceed 40 dBA at any existing residential receptor. After commitments and mitigation measures are implemented the predicted residual environmental effects for noise are assessed to be not significant.

Surficial and Bedrock Geology

Surficial geology within the Project Area is characterized by thin deposits of sandy glacial till, with exposed bedrock, and in local depressions a combination of organic and alluvial deposits. The bedrock geology of the Project Area, is comprised of Monzogranite, intruded into the surrounding Goldenville Formation.

The construction of access roads and turbine foundations has the potential to alter surficial and bedrock geology. The potential for ARD within the Project Area is considered low. These activities also have the potential for naturally occurring uranium to enter groundwater. Uranium potential in groundwater in the area is listed as medium-risk. The predicted residual effects are assessed to be not significant.

Groundwater

Hydrogeologic characterization of Nova Scotia's Groundwater Regions indicates that the Project Area is located on an area of igneous (monzogranite) rock. There is potential for the Project to affect groundwater quality and quantity during the construction and decommissioning phases of the Project. Changes to the natural surface conditions within the Project footprint has the potential to alter groundwater recharge. Localized groundwater flow paths within the Project footprint may be disrupted from initial construction operations. However, due to the nature of the Project, local groundwater quantity is not expected to be impacted. Groundwater quality could also be affected from blasting (if required) or rock-water interaction. Operational effects are considered to be negligible. However, after mitigation, residual environmental effects to groundwater are anticipated to be not significant.

Habitat, Flora, and Lichens

Habitat in the Project Area consist mainly of softwood stands (331 ha, 36% of the Project Area) followed by barrens (280 ha, 30 %). Alder (119 ha) and mixed wood (122 ha) stands are the third most dominant habitat types and both comprise 13% of the Project Area. The majority of the Project Area is intact forest (97%). Only 2% (14 ha) and 1 % (5 ha) of the Project Area is classified as disturbed (urban and cutover, respectively).

A total of 171 vascular plant species and 11 bryophyte species were identified within the Study Area. Three species of conservation interest (SOCI) vascular plant species were documented throughout the Project Area. No Species at Risk (SAR) vascular plants were identified.

Fourteen lichen species were observed within the Project Area. One was determined to be a SAR, blue felt lichen and five were determined to be a SOCI.

The proposed Project will have direct impacts to habitat structure and to flora and lichens. Clearing and grubbing for road and pad construction account for the most notable impact but will be limited to the construction phase of the Project. Six observations of one SOCI vascular plant is situated within the proposed Project footprint.

One observation of a SOCI lichen, is situated within the proposed Project footprint. The proposed Project footprint is situated 195 m from the blue felt lichen observation, therefore, complying with the 100 m setback.

The predicted residual environmental effects are assessed to be not significant. No SAR vascular plants or lichen will be lost as a result of Project development.

Fauna

Terrestrial fauna species, including mammal, herpetofauna and insect species, were observed incidentally within the Project Area during the biophysical surveys. One species, monarch is a SAR (note: no swamp milkweed was identified within the Study Area during vascular plant surveys or incidentally).

The Project Area is outside of mainland moose core habitat and concentration areas and no mainland moose sign was identified incidentally during field surveys.

No turtles were identified incidentally or during wetland and watercourse delineation and assessment. No nest beaches or suitable overwintering habitat were identified within the Study Area for snapping turtle. The known distribution for wood turtle and Blanding's turtle does not exist in proximity to the Project Area.

Habitat will be lost as a result of the Project, but the habitat present in the Project footprint is common to the regional area and available in the surrounding landscape. The geographic extent of disturbance footprint is small (57 ha). The activities likely to create the greatest indirect impact to fauna are sensory disturbances during all Project phases. Project development has the potential to have an effect on fauna from the loss or alteration of habitat and habitat fragmentation, sensory disturbance, and mortality.

After mitigation measures are implemented, residual effects of the Project on fauna are anticipated to be not significant.

Bats

Acoustic monitoring surveys for bats identified 191 total bat passes, 86% of which were from migratory species. The most common species groups recorded during the monitoring period (May 10 to October 31, 2022) were the silver-haired bat (58%) followed by eastern red bat (13%), high frequency bats (12%), and little brown myotis (11%). Hoary bat, the myotis species group, and tricolored bat were also recorded comprising the remaining 6% of bat passes. The average total passes per detector night for the Project Area over the entire survey period for all species was 0.18. The average migratory passes per detector night for the Project Area over the entire survey period was observed to be 0.15.

Bats may be affected by loss of alteration of habitat, sensory disturbance, and direct (e.g., collision with turbine blade) or indirect mortality (barotrauma). The loss of habitat from clearing and grubbing may impact roosting habitat, however, no previously known hibernacula are within the Project Area nor were any potential bat hibernaculum identified during biophysical surveys.

Construction noise (e.g., heavy equipment, blasting, and pile-driving) could potentially affect bats, particularly those species that roost nearby. Sudden, loud noises can potentially disturb bats and cause abandonment of roosts.

Based on precautionary guidance from the Alberta Government (no guidance currently exists in Nova Scotia), the average of 0.15 migratory passes per detector night observed across the Project Area would be considered a potentially acceptable risk and is the lowest risk threshold for bats identified. Therefore, residual effects of the Project on bats are anticipated to be not significant.

Avifauna

Avifauna surveys included spring and fall migration surveys, breeding bird surveys, waterfowl surveys, nocturnal owl surveys, and nightjar surveys. Additionally, radar and acoustic monitoring was completed.

Field surveys resulted in the observation of 16,020 individuals, representing 100 bird species within and outside the Project Area. The most abundant bird group observed (by total number of individuals) was shorebirds accounting for 61% of total individuals, followed by passerines (29%), waterfowl (5.6%), other landbirds (2.1%), diurnal raptors (1.3%), other waterbirds (0.94%), and nocturnal raptors (0.07%).

Across all survey seasons, a total of 16 avian SOCI and one SAR were identified, barn swallow (*Hirundo rustica*). The barn swallow was observed outside of the Project Area on the coastline, close to a fish processing facility. Although there is foraging habitat for this species within the Project Area, such as swamps and open barrens/heathlands, there is no suitable breeding habitat for the barn swallow within the Project Area.

During the acoustic monitoring period a total of 821 detector-nights were monitored out of a possible 852 (i.e., 96%). A total of 28,853 nocturnal flight calls (NFCs) were recorded, averaging approximately 35 NFCs per detector-night. The majority of NFCs detected were warblers (83%), then sparrows (17%), followed by thrushes (<1%). The bulk of the detections (42%) were made across just seven nights: August 12, 25, 27, 28, and September 6, 28, and 29, 2022.

Nightly migration tracks throughout the radar recording period totaled 165,862, for all heights. During this time the tracks considered most at risk (<225 m) numbered 76,552.

Physical loss of bird habitat within the Project footprint will occur during the construction phase of the Project. Sensory disturbance from Project generated noise can impact birds in a number of ways. Avifauna may also be displaced from areas adjacent to the Project as a result of construction related noise.

There is potential for direct mortality during all Project phases and direct mortality resulting from the collision with WTGs is the most apparent Project interaction. McCallum Environmental Ltd. has conducted an analysis for estimated mortality using prescribed methods out of Scotland, and the results estimate that during operations, mortality is estimated between 1.7 to 2.8 birds/turbine/year.

After standard industry mitigation measures have been implemented, the predicted residual environmental effects are assessed to be not significant.

Wetlands

A total of 44 wetlands were delineated within the Study Area (16.5 ha in total or 4.7% of the Study Area), consisting of 43 freshwater wetlands and one tidal wetland. Swamp represents the most abundant wetland class in the Study Area, accounting for 91% of all wetlands and 98% of total wetland area. Two bogs, one fen, and one tidal salt marsh were also identified. Most individual wetlands are hydrological isolated in the sense that they do not have defined surface water connections (i.e., inlets, outlets, throughflow).

Thirteen wetlands are located within 30 m of Project infrastructure and were assessed to have potential for indirect impacts. Direct impacts are only anticipated at five wetlands, resulting in 0.314 ha in disturbance (1.9% of the total area of all wetlands identified).

No impacts (direct or indirect) are anticipated to any Wetlands of Special Significance (WSS).

Wetland alteration approvals will be obtained for wetlands proposed for alteration, wetlands altered will be appropriately compensated for, and a wetland monitoring program will be implemented for wetlands partially altered or with potential to be indirectly affected by the Project. As a result, the predicted residual environmental effects to wetlands are assessed to be not significant.

Surface Water, Fish and Fish Habitat

Fish habitat within the Fish Study Area is generally limited by dry conditions and extensive sections of subterranean flow. As first order streams, watercourses within the Study Area do not provide passage to any upgradient aquatic features. Watercourses are largely seasonal, low-gradient, soft-bottomed watercourses with little to no visible flow and moderate cover.

Eight field identified watercourses were delineated within the Fish Study Area. One watercourse, is a historically excavated channel, as determined from its straightened banks and machine tracks throughout this portion of the Fish Study Area. The remaining seven watercourses flow intermittently (i.e., seasonally). Another common characteristic of watercourses within the Study Area is a discontinuous channel. The channels of six watercourses were all noted to sporadically disappear, up to 50% of the length of the delineated flow line. When this occurred, surface flow water was observed to infiltrate underground or flow between vegetated boulders, with flow being more often heard than seen. Channels with surface flow would often reappear at a natural topographic low.

Electrofishing and trapping surveys in Black Brook and Black Brook Pond resulted in the capture of a single species, American eel (*Anguilla rostrat)*, in low abundance.

Surface water features within the Study Area provide poor quality habitat for other fish species identified through desktop review due to the inconsistent flow and subterranean sections acting as impediments to fish passage.

The Project is predicted to result in a direct impact to 17 m^2 of fish habitat in at a single watercourse resulting from the installation of a culvert to support construction of an access road. Watercourse alteration approvals will be obtained prior to construction. The Project is not predicted to result in indirect effects to surface water features or associated fish habitat. This is based primarily on proactive Project planning and implementation of a mitigation sequence which prioritizes avoidance of impacts, and implementation of 30-m buffers on watercourses wherever practicable.

The predicted residual environmental effects of the Project on surface water, fish, and fish habitat are assessed to be not significant.

Visual Aesthetics

The visual representation of the Project was completed to demonstrate to stakeholders and the public at large where the Project will be visible and to what extent it will be visible in the surrounding area. The visual representation includes a Zone of Visual Influence (ZVI) and visual simulations.

The predicted residual environmental effects of the Project on the visual aesthetics are assessed to be not significant.

Shadow Flicker

Shadow flicker modelling was completed for the Project. The model was based on developing theoretical (i.e., worst case) and actual (i.e., realistic) case scenarios. Theoretical case provides the maximum amount of shadow flicker expected to be experienced at the modeled receptors and was calculated for shadow hours per year and shadow minutes per day. Actual case was modeled by incorporating site specific wind conditions and monthly sunshine probabilities. Actual case was calculated for shadow hours per year.

The actual case scenario is believed to provide a more realistic result as the assumptions in the theoretical case are very conservative. The actual case scenario shows that all receptors are below the 30 hours per year threshold. The analysis of the theoretical case indicates that modelled shadow flicker exceeds the 30 hours per year threshold at 10 of 32 receptors and exceeds the 30 mins per day threshold at 4 of 32 receptors.

Wedgeport Wind is committed to operating the Project to be in compliance with the NSECC guidelines for shadow flicker (30 hours/year and/or 30 mins/day). A Complaints Resolution Plan and Community Liaison Committee (CLC) will be developed for the Project. Mitigation measures may include the installation of blinds, curtains or other screening devices, or the implementation of an operational curtailment plan, if necessary.

After mitigation measures are implemented, the predicted residual environmental effects of the Project on shadow flicker are assessed to be not significant.

Electromagnetic Interference

An Electromagnetic Interference (EMI) Study was completed for the Project. The results of the EMI Study show that the turbines are not expected to pose any serious interference with existing radio, telecommunication, or radar systems in the area. Wedgeport Wind has engaged with Municipality of the District of Argyle, Bell, and Bragg and no issues with the proposed Project layout were noted by these licensees. Wedgeport Wind reached out to the fourth licensee, Orion, but has not yet received a response.

Nav Canada and the DND have provided letters of non-objection indicating that there are no impacts on the air navigation system and specifically on civil and military air traffic control radars, navigation aids, and airports in the vicinity of the Project.

After mitigation measures are implemented, the predicted residual environmental effects of the Project on electromagnetic interference are assessed to be not significant.

Local Economy

The Project will provide a low-cost, fixed price clean electricity for the Province of Nova Scotia. Additionally, tax revenues of approximately $650,000 per year will go to the municipality in property tax.

Wedgeport Wind's intent is to fulfill construction and operations contracts/positions with local personnel wherever possible. However, due to the specialized nature of wind turbine delivery, erection, and energization, if local personnel cannot be found, personnel may be required from other municipal, provincial, national, or international firms.

A significant positive effect on the economy is anticipated from the Project.

Land Use and Value

The Project is located on both private and Crown land. Informal recreational activities include ATV trails, hunting, and possible berry harvesting. Access to private lands parcels will be gated to restrict public access to private land during construction and operational periods of the Project. For Crown land parcels, Wedgeport Wind will work with NSDNRR and Mi'kmaq Nations of Nova Scotia to determine future public access restrictions to portions of the Project Area on Crown land.

For private and Crown land parcels, land use change within the Project Area is anticipated to be positive as it is adding a renewable energy resource to the area.

Based on a literature review on the effects of property values in proximity to wind power projects, there is no anticipated decrease in property values.

The Project effects on land use and value is anticipated to be not significant.

Transportation
An increase in truck traffic will occur during the construction (2 years) and decommissioning phases (2 years) of the Project. No change to local transportation is anticipated during operations, the Project phase with the longest duration (35 years). The increase in transportation during decommissioning will also recover to baseline levels after the completion of the Project.

Transportation routes are subject to Nova Scotia Department of Public Works (NSDPW) approval.

Project effects on transportation are anticipated to be not significant.

Recreation and Tourism
The Project Area borders the Tusket Islands Wilderness Area. The construction and operation of the Project will result in modified use by ATVs, hunters, general users or landowners. Once the Project is developed, access to the private lands will be restricted for 35 years during operations (via gates), as per Wedgeport Winds agreements with landowners (with the exception of those people having permission from the landowners). For portions of the Crown land that are being used for the Project, Wedgeport Wind will work with the Province of Nova Scotia to determine appropriate access to Crown land as well as safety measures to protect the Mi'kmaq of Nova Scotia and members of the public.

The effects of the Project on local tourism and tourist perceptions cannot definitively be known until the Project is implemented, a literature review indicated that the dominant perceptions of wind farm projects are either positive or neutral. An increase in construction personnel (e.g., equipment operators) are required during the construction and decommissioning phases of the Project. The influx of workers (~ 100+ people) during these phases will require hotel rooms in Yarmouth for extended periods. This may reduce the availability of rooms for tourists to the area.

Project effects on recreation and tourism are anticipated to be not significant.

Human Health

The Project has the potential to interact with human health during all Project phases. During construction and decommissioning, there will be an increase in traffic and heavy equipment will be in operation. These activities may also affect air quality and noise.

Ice throw is another potential risk to human health and the maximum ice throw distance for the Siemens Gamesa SG 6.6-170 turbine was calculated to be 420.75 m. All commercial wind turbines include vibration monitors, which will automatically shut the turbine down when vibrations exceed a pre-set level. This vibration safety shutdown feature is also effective when excessive ice builds up on the turbine blades thus further limiting the risk of ice throw.

After mitigation measures are implemented, no adverse effects to human health are predicted.

Cultural and Heritage Resources

Construction of the Project has the potential to interact with cultural and heritage resources, however, both the 2022 and the 2012 ARIA concluded that the Study Area is of low archaeological resource potential and no significant archaeological features were identified within the Study Area during the field reconnaissance study. Due to a low potential for archaeological resources, of either First Nations or European-descended origin within the Study Area, no direct or indirect impacts to cultural and heritage Resources are expected as a result of the Project, therefore, no adverse effects to cultural and heritage resources are predicted.

Other Undertakings in the Area

Three COMFIT turbines exist in proximity to the Project, the Little River Harbour Community Wind Project, Black Pond Community Wind Project, and Wedgeport Wind Power Project. The potential for cumulative impacts between the projects is high.

The total linear length of access roads for the COMFIT turbines is approximately 2.4 km. The Project will require the construction of 8.48 km of new access roads which will increase local habitat fragmentation.

The Project has avoided direct impacts to lichen SAR, and no impacts to fish and fish habitat and wetlands that are cumulative with the existing projects will occur, therefore, cumulative impacts on these VECs are not anticipated.

It is assumed that the three COMFIT turbines in proximity to the Project have caused direct mortality to birds and bats from collisions with the WTG blades but the number of mortalities is unknown. This Project is predicted to cause bird and bat mortalities during operations and the cumulative impact on birds and bats is elevated due to the three existing turbines being present in proximity to the Project.

The cumulative impact of the operational noise generated by the Project and the existing COMFIT turbines was captured in the predictive noise model. The cumulative noise generated by the Project and COMFIT turbines maintains the 40 dBA threshold is met at all existing residential receptors. Therefore, no cumulative impacts are anticipated on the noise VEC.

There is anticipated to be a positive cumulative impact between the Project and the COMFIT turbines related to the climate change and local economy VECs.

Monitoring

Wedgeport Wind commits to developing the following monitoring plans:

- Wetland Monitoring Plan
- Post Construction Bird and Bat Monitoring

These plans will be developed to meet EA approval terms and conditions.

Additional Commitments

Wedgeport Wind has developed the following plan:

- Environmental Protection Plan

The Environmental Protection Plan includes details on erosion and sediment control, vegetation management, and spill response.

Wedgeport Wind commits to the following additional commitments:

- Ongoing engagement with First Nation communities and organizations and the public throughout the life of the Project.
- Support Mi'kmaq review of the EARD by making the Project team available to provide additional information about the Project, answer questions or facilitate discussion with interested Mi'kmaq Nations, organizations or individuals;
- Provide the Mi'kmaq of Nova Scotia an opportunity to walk the Project Area with Wedgeport Wind to identify and document sensitive sites prior to construction;
- Allow the Mi'kmaq of Nova Scotia to harvest traditional plants prior to clearing the Project footprint;
- Provide a tour of the Project to the Mi'kmaq of Nova Scotia, once in operation;
- Ensure there are various opportunities for Mi'kmaq participation in the Project (e.g., opportunities to participate in environmental monitoring);
- Development of a Mi'kmaq Communication Plan;
- Development of a Complaint Resolution Plan;

- Development of a Community Liaison Committee;
- Development of a Wildlife Management Plan; and,
- Development of a Contingency Plan.

The plans noted above will be developed to meet EA approval terms and conditions.

Conclusion

The findings of this EARD indicate that residual environmental effects after mitigation is implemented will be not significant for identified VECs.

Monitoring will be completed to confirm the predicted effects and determine if additional mitigation measures need to be implemented utilizing an adaptive management approach.

Therefore, it is the opinion of McCallum Environmental Ltd. that the Project should be approved by the Minister with conditions as the environmental effects are within standard industry expectations and expected regulatory thresholds and requirements. McCallum Environmental Ltd. also concludes that given the extensive amount of work completed at the Project, further environmental assessment work will not provide additional information which may be relevant for reducing Project related effects.

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LIST OF ACRONYMS

AA	Assessment Area
AC	Alternating Current
ACCDC	Atlantic Canadian Conservation Data Centre
ACPFG	Atlantic Coastal Plain Flora Group
AQHI	Air Quality Health Index
ARD	Acid Rock Drainage
ARIA	Archaeological Resource Impact Assessment
ATV	All-terrain vehicle
BFL	Boreal Felt Lichen
BOP	Balance of Plant
BSC	Bird Studies Canada
CAF	Canadian Armed Forces
CAO	Chief Administrative Officer
CCTH	(Special Places Program of) Community, Culture, Tourism, and Heritage
cm	Centimeters
CO	Coastal forest group
COMFIT	Community Feed-in Tariff
CONI	Common nighthawk
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPUE	Catch Per Unit Effort
CRM	Cultural Resource Management Group
CWS	Canadian Wildlife Services
dBA	A-Weighted Decibel
DC	Direct Current
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
DS	Downstream
E	Endangered
EA	Environmental Assessment
EARD	Environmental Assessment Registration Document

EC	Environment Canada
ECCC	Environment and Climate Change Canada
ELC	Ecological Land Classification
EPP	Environmental Protection Plan
ESC	Erosion and Sediment Control
FAC	Facultative
FACW	Facultative Wet
FAR	Finance, Audit, and Risk (Members of Glooscap's)
FBP	Functional Benefit Product
FEC	Forest Ecosystem Classification for Nova Scotia
FWAL	Protection of Aquatic Life for Freshwater Guidelines
g	Gram
GHG	Green House Gas
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectares
HP	Habitat Point
hr	Hour
HRP	Heritage Research Permit
IAA	Impact Assessment Act
IBA	Important Bird Area
IES	Indigenous Environmental Solutions
IH	Intolerant Hardwoods
IR	Indian Reserve
kg	Kilogram
km	Kilometer
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
KMKNO-ARD	Kwilmu'kw Maw-klusuaqn Negotiation Office - Archaeology Research devision
KMZ	Keyhole Markup Languge
KPA	Kilopascal

kV	Kilovolt
L	Litres
LiDAR	Light Detection and Ranging
Ltd	Limited
m	Meters
mASL	Meters Above Sea Level
MBBA	Maritime Breeding Bird Atlas
MBS	Migratory Bird Sanctuary
MD	Municipality of the District
MEKS	Mi'kmaq Ecological Knowledge Study
MEL	McCallum Environmental Ltd.
MET	Meteorological evaluation tower
MLA	Member of the Legislative Assembly
mm	Millimeter
MOU	Memorandum of Understanding
MTRI	Mersey Tobeatic Research Institute
MW	MegaWatts
MWh	Mega Watt Hours
NAD	North American Datum
NAPS	National Air Pollution Surveillance
NB	New Brunswick
NFC	Nocturnal Flight Calls
NLM	Natural Landscape of Maine
NS	Nova Scotia
NSCCH	Nova Scotia Communities, Culture and Heritage
NSDFA	Nova Scotia Department of Fisheries and Aquaculture
NSDNRR	Nova Scotia Department of Natural Resources and Renewables
NSDPW	Nova Scotia Department of Public Works
NSE	Nova Scotia Environment
NSECC	Nova Scotia Environment and Climate Change
NS-EHJV	Nova Scotia Eastern Habitat Joint Venture

NSESA	Nova Scotia Endangered Species Act
NSL &F	Nova Scotia Department of Lands and Forestry
NSPI	Nova Scotia Power Inc.
NSTDB	Nova Scotia Topographic Database
NTS	National Topographic System
OBL	Obligate
OLA	Nova Scotia Office of L'nu Affairs
PC	Point Counts
PG	Peatland Group
PH	Potential of Hydrogen
PID	Premises Identification Number
PM	Particulate Matter
PWA	Protected Water Area
QGIS	Quantum Geographic Information System
RBP	Rate Based Procurement
RFP	Request for Proposal
RSA	Rotor Swept Area
SAR	Species at Risk
SARA	Species at Risk Act
SC	Special Concern
SM4BAT	Wildlife Acoustic SM4BAT FS Bioacoustic data sensors
SMP	Special Management Plan/Practices
SOCI	Species of Conservation Interest
SOP	Standard Operating Procedure
SRank	Status rank
T	Threatened
TC	Transport Canada
tCO2	Tonnes of Carbon Dioxide
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
US	Upstream

UTM	Universal Transform Mercator
V	Vulnerable
VEC	Valued Environmental Component
VT	Vegetation Type
WAfLS	Western *Asio flammeus* Landscape Survey
WAM	Wet Areas Mapping
WC	Watercourse
WD	Wet Deciduous Forest Group
WESP-AC	Wetland Ecosystem Services Protocol – Atlantic Canada
WL	Wetland
WSS	Wetland of Special Significance
WTG	Wind Turbine Generator
YQI	Yarmouth Airport

AUTHORIZATION OF APPLICATION FOR APPROVAL

The following authorizes McCallum Environmental Ltd. to submit this registration document on our behalf

Wedgeport Wind Farm GP Inc
Name of Proponent

Daniel Eaton
Name of Proponent Applicant

Director of Project Development
Title

March 2, 2023

Date

Signature

1 PROJECT OVERVIEW

Wedgeport Wind Farm GP Inc., Elemental Energy Renewables Inc., Stevens Wind Ltd., and Sipekne'katik First Nation carrying on business as Wedgeport Wind Farm Limited Partnership (Wedgeport Wind), is proposing to construct and operate the Wedgeport Wind Farm Project (the Project) in Little River Harbour, Municipality of the District of Argyle, Yarmouth County, Nova Scotia. The proposed Project is an energy generating facility with a production rating of at least 2 MW derived from wind, therefore, the Project requires a provincial Environment Assessment (EA) registration (Class I undertaking) with Nova Scotia Environment and Climate Change (NSECC).

2 PROPONENT PROFILE

Wedgeport Wind is a Limited Partnership between Sipekne'katik First Nation, Elemental Energy Renewables Inc, and Stevens Wind Ltd. Wedgeport Wind combines Indigenous values, local knowledge and responsible resource stewardship with industry leading experience developing, constructing, and operating renewable energy projects in Atlantic Canada and across Canada.

2.1 Sipekne'katik First Nation

Sipekne'katik First Nation is the largest Mi'kmaq band in mainland Nova Scotia and includes the communities of Indian Brook IR #14, New Ross, Pennal, Dodd's Lot, Wallace Hills, and Grand Lake (Sipekne'katik First Nation, 2022).

2.2 Elemental Energy Renewables Inc.

Elemental Energy Renewables Inc. (Elemental), based in Vancouver, British Columbia, is a privately owned developer, owner, and operator of solar wind and hydro project across North America. Elemental has significant experience developing, project financing, constructing, and operating a portfolio of renewable energy projects across Canada and the United States.

2.3 Stevens Wind Ltd.

Stevens Wind Ltd., based in Dartmouth, Nova Scotia, has over 22 years of renewable energy experience in Nova Scotia. The principals of Stevens Wind Ltd. have been involved in the development, construction, and operations of over 1 GW of renewable energy projects across North America.

3 PROJECT SUMMARY

The Project summary is provided in Table 3-1.

Table 3-1. Project Summary

Project name	Wedgeport Wind Farm Project (the "Project")
Proponent name	Wedgeport Wind Farm GP Inc ("Wedgeport Wind")
Proponent information	The Project is jointly owned by Sipekne'katik First Nation, Elemental Energy Renewables Inc., and Stevens Wind Ltd.
Proponent contact information	Suite 600, 1741 Lower Water Street Halifax, Nova Scotia B3J 0J2 Email: deaton@elementalenergy.ca
Project type	Wind Energy
Number of turbines	13
Capacity per turbine	5.9 to 7.0 Megawatts (MW)
Project location	The Project is located in Little River Harbour, Yarmouth County, Nova Scotia. The approximate centre of the Project is located at: 19T 740697 m E 4845376 m N
Landowner(s)	The Study Area is located on private land and Crown land.
Provincial authorities issuing approvals under this application	Nova Scotia Environment and Climate Change (NSECC)
Municipal authorities	Municipality of the District of Argyle
Required municipal permits & authorizations	Development Agreement from the Municipality of the District of Argyle

Environmental Assessment Registration Document Completed By:	McCallum Environmental Ltd Suite 115, 2 Bluewater Road Bedford, Nova Scotia B4B 1G7 902-446-8252 qa@mccallumenvironmental.com

3.1 Anticipated Project Schedule

The anticipated Project schedule is provided in Table 3-2.

Table 3-2. Project Schedule

Project Task	Estimated Start Date	Estimated Completion Date
Environmental Assessments registration	Q1 2023	TBD
Regulatory permitting for wetland and watercourse crossings	Q2 2023	Q3 2023
Geotechnical investigations and site survey	Q2 2023	Q3 2023
Construction	Q4 2023	Q3 2025
Pre-commissioning, commissioning, and acceptance tests	Q3 2025	Q3 2025
Commercial operation date	December 2025	December 2060
Interim site reclamation	December 2060	December 2061/2062

4 REGULATORY CONTEXT

Wind energy projects that can produce at least 2 MW of energy require a Class I Environment Assessment, as per *Schedule A - Designated Class I and Class II Undertakings* of the Nova Scotia *Environmental Assessment Regulations,* made under Section 49 of the *Environment Act, S.N.S. 1994-95, c.1, O.I.C. 2018-329, N.S. Reg. 221/2018.*

No federal Environmental Assessment is required under the *Impact Assessment Act (IAA), 2019, c.28* as a Project of this size and location is not listed in the *Physical Activities Regulations: SOR/2019-285*.

5 PROJECT INFORMATION

The following sections outline the Project overview and the environmental assessment team.

5.1 Project History

On June 26, 2012, Anaia Global Renewable Energies registered a previous version of the Wedgeport Wind Farm Project for EA, in accordance with Part IV of the Environment Act. At that time, the purpose of the proposed undertaking was to construct and operate a wind energy facility providing up to 50 MW of renewable energy to the provincial grid.

On August 15, 2012, The Minister released a decision that the registration information provided in the original submission was insufficient to make a decision on the project, and additional information was required in accordance with clause 13(1)a of the Environmental Assessment Regulations, pursuant to Part IV of the *Environment Act*.

Following that determination, Anaia Global Renewable Energies made the decision not to continue with the development of the Project. No further information was provided to NSECC (formerly NSE).

Wedgeport Wind has since acquired the Project, including all reports, documents, and information related to the 2012 Environmental Assessment Registration Document (EARD). Wedgeport Wind is completing the necessary steps for the successful permitting, construction, and operation of the Project.

The 2012 Project layout generally overlaps the currently proposed Project layout (Figure 2; Appendix A).

5.2 Need for the Project

The government of Nova Scotia announced a Rate Base Procurement (RBP) aiming to supply the province with ~350 MW of renewable energy. The RBP is designed to assist the province in getting closer to the 80% target of renewable energy and support the province’s goal of achieving a 53% reduction in greenhouse gas emissions by 2030 and net-zero by 2050.

“The Rate Base Procurement (RBP) portfolio was chosen through an independent, objective and open procurement process. The portfolio is comprised of 5 projects, totaling 372 megawatts or 1,373 gigawatt hours per year of renewable low-impact electricity production. This represents approximately 12% of Nova Scotia’s total electricity consumption.” (NSRBP 2022)

In August 2022, the Project was officially selected as 1 of 5 successful projects under the RBP process.

5.3 Consideration of Alternatives

5.3.1 Alternatives to Wind Energy

The RBP was restrictive in the requirements for renewable energy, and only wind power projects were able to submit under the RBP process. Therefore, there were no other project types (i.e., solar) that could be considered for submission under the RBP process.

5.3.2 Alternative Project Locations

The Wedgeport Wind team has collectively and individually investigated project opportunities at several alternative Project locations throughout Nova Scotia. Due to the possibility of future use of other alternate project locations and the need to keep those confidential they are not provided here.

5.4 Determination of Project Location

Wedgeport Wind has selected this Project location due to the following factors that make this a favorable location for the Project:

- The Project location has a wind resource with sufficient energy and consistency suitable for a wind energy project.
  - An 80 m MET mast has been installed at the Project since 2012 which confirms the viability of the wind resource.
  - Elemental Energy also owns a single wind turbine located within the Project Area, which was approved under the Nova Scotia Community Feed-in Tariff (COMFIT) program, which further confirms the strong wind resource.
- The Municipal District of Argyle is supportive of wind energy projects and a project in the proposed area.

Residents of Wedgeport appear generally supportive of wind energy projects. Through the construction and operations of the existing COMFIT turbine, no complaints have been received to date.

The following describes the high-level decision-making process to determine a Project Area.

5.4.1 Site Optimization and Constraints

A key aspect of planning the Project was the determination of suitable lands for development. This section details how the Project lands and buildable area was rationalized:

- Site Optimization: determination of the most appropriate location for the Project to maximize power yields and to minimize overall impact on the landscape.
- Constraints Analysis: Analysis used to determine appropriate lands for the Project.

5.4.2 Site Optimization

This section describes how multiple factors were considered to determine the footprint for the Project. These factors include technical (i.e., wind resource), financial, construction, socio-economic, landowner, biophysical, as well as community and stakeholder feedback.

The determination of the most appropriate location for the Project turbines helps to minimize the overall impact on the landscape. Detailed planning and analysis was completed to determine available lands and to ensure that the turbines can be located within a buildable area. Minimization of the Project footprint allows Wedgeport Wind to reduce the impact on the environment and reduce construction and development costs.

The Project lands were chosen for the following reasons:

- Appropriate wind regime to make the Project financially viable;
- Presence of adequate land base for placement of turbines and Balance of Plant (BOP);
- Ability to locate turbines to meet regulatory setbacks to and from receptors;
- Proximity to the transmission system to connect the Project to the Nova Scotia electrical grid; and,
- Suitable available land area to allow for adequate setbacks between turbines. Turbines can only be located a certain distance from each other to limit the wind turbulence they create which can interfere with adjacent turbines. This interference makes each turbine less productive. Furthermore, turbine manufacturers will not allow turbines to be erected if the threshold for turbulence intensity is exceeded.

5.4.3 **Constraints Analysis**

Once the more general process of site optimization was completed and a Project Area confirmed, more detailed and a site-specific process of constraints analysis was completed.

Detailed planning and analysis were completed to ensure that turbines can be located within the smallest footprint. Minimization of the footprint was and will continue to be (during placement of temporary construction areas), a very important factor while planning the Project.

Site specific constraints that were used for the Project are as follows:

- Wind Regime: Once specific turbine site determinations were modeled, considerations of the loss of output due to mutual interference between turbines is factored in. Wind regime mapping was used to identify optimal wind resource areas within the land base. This allows for effective placement of the turbines to maximize power generation from the wind resource for the Project based upon expected energy outputs within the modeled wind regimes.
- Species at Risk (SAR): Species at risk locations were taken from known datasets, government databases/sources, or other relevant studies specific to the Project Area and setbacks imposed.
- Existing Infrastructure: Existing roads, transmission lines, or other infrastructure that is available was used to reduce impacts and construction costs.
- Setbacks for proximity to receptors (i.e., residences), which include constraints for noise at a receptor and a 1,000 m setback from residences as outlined in the Municipality of the District of Argyle's Municipal Planning Strategy.
- Topographical Constraints: Known data from Topography datasets were used to determine optimal locations for turbine placement. Slopes in excess of 15% were eliminated from the available land base due to construction restrictions.
- Setbacks between turbines: To minimize wake loss and turbulence from blades while they are in operation, setbacks were applied between the Project's turbines of approximately five (5) times rotor diameter in the prevailing wind direction two and a half (2.5) times rotor diameter perpendicular to the prevailing wind direction.
- Geographic Information System (GIS) mapping of the Project lands was completed using data collected (above), public datasets and the Nova Scotia Provincial Landscape Viewer (NSDNR, 2022) including:

- Topography
- Land Use;
- Existing infrastructure;
- Meteorological (MET) Towers;
- Residences;
- Existing roads;
- Existing transmission lines;
- Atlantic Canadian Conservation Data Center (ACCDC) observations;
- Critical and core habitat;
- Wood Turtle Special Management Plan (SMP) Buffers;
- Nova Scotia Old Forestry Policy polygons;
- Atlantic Coastal Plain Flora (ACPF) buffers;
- Boreal felt lichen predictive habitat polygons;
- Parks and Protected Areas;
- Known heritage sites;
- Mapped watercourses and waterbodies;
- Mapped wetlands and Wetlands of Special Significance (WSS), and
- Property boundaries.

5.4.4 Project Setbacks and Separation Distances

The Project is proposed to be constructed within the Project Area (Figure 3, Appendix A). Wedgeport Wind has consulted with the Municipality of the District of Argyle's Project Planner Reid Shepherd from WSP and municipality staff on September 28, 2021, and March 16, 2022, to understand land use by-laws and setback regulations (Table 9-1). Wedgeport Wind has also consulted with Nova Scotia Power Inc. (NSPI) to confirm that connection to the electricity grid is feasible (Section 6.3.5).

The following items were considered when determining the extent and location of Project infrastructure:

Table 5-1. Project Infrastructure and Setbacks

Project Infrastructure	Setback	Setback Driver
Wind Turbine Generator	1,000 m from known dwelling	Municipal
Wind Turbine Generator	Noise and Shadow flicker	Provincial
Wind Turbine Generator	100 m from Tusket Island Wilderness Area	NSECC Protected Areas
Project infrastructure	20 m from Tusket Island Wilderness Area	NSECC Protected Areas
Wind Turbine Generator	1,200 m from Little River Harbour Community Wind Project	Engineering
Wind Turbine Generator	490 m of the Black Pond Community Wind Project	Engineering
Wind Turbine Generator	590 m of the existing Wedgeport Wind Power Project	Engineering
Project infrastructure	30 m from a watercourse (unless approval is provided)	NSECC
Project infrastructure	Not encroaching within a wetland (unless approval is provided)	NSECC
Project Infrastructure	100 m from blue felt lichen observation	NSDNRR

5.5 Benefits of the Project

The Project will benefit all Nova Scotians by providing a clean, renewable and affordable source of energy that reduces provincial Greenhouse Gas Emissions (GHG) while bringing significant economic and social benefits for the province. A summary of benefits anticipated from the Project includes the following:

GHG Reductions: The Project is expected to offset approximately 2,225,466 tCO_2 of coal fired generation in Nova Scotia over the Project's 35-year operational life. In the first year of operations (2025), the Project is anticipated to offset 112,750 tCO_2.

Employment: The Project is expected to create up to 100 jobs during peak construction, and approximately 10 Full-Time-Equivalent jobs are anticipated during operations.

Tax revenues: The Project's substantial tax revenue of approximately $650,000 / year for their first year of operations, with annual escalation, which will support municipal services and infrastructure over the term of life of the Project[1].

[1] *Wind Turbine Facilities Municipal Taxation Act*, 2006

Contracting opportunities: Construction and operations will rely on local supply chain services, with job opportunities such as surveying civil, electrical, and mechanical construction and equipment transportation.

Local stimulus: Local businesses will benefit from increased spending on goods and services during construction and operations phases. Wedgeport Wind is committed to supporting various local community organizations and initiatives that bring positive impacts to nearby communities, as well as providing capital contributions and/or ongoing financial support.

First Nations partnership benefits: As a project partner the Sipekne'katik First Nation will also benefit from this Project in terms of revenue from operations, employment opportunities and capacity building.

Community Benefits Fund: Wedgeport Wind has committed to establishing Community Benefits Fund of $80,000 per year to support local initiatives. Elemental Energy already provides funding in the region from its COMFIT wind farm projects and has had various discussions on potential local funding initiatives for this Project.

Please refer to Section 13.6 for more information on the economic and social impacts and benefits for the Project.

5.6 Environmental Assessment Project Team

The Environmental Assessment Project Team and responsibilities are detailed in **Table 5-2**.

Table 5-2. Environmental Assessment Project Team

Company	Name	Responsibility
McCallum Environmental Ltd.	Robert McCallum, B.Sc., P.Biol.	Senior review, project management, reporting, regulatory consultation
	Meghan Milloy, MES	Senior review
	Jeff Bonazza, M. Env. Sci.	Project management, reporting, regulatory consultation
	Lee Pominville, MREM, P. Biol.	Wetland and watercourse delineation and assessment, Project coordination, reporting
	Mark MacDonald, M.Sc.F	Biophysical reporting
	Melanie MacDonald, MREM	Fish and fish habitat reporting

Company	Name	Responsibility
	Sarah Scarlett, M.Sc.	Wetland reporting
	Amber Stoffer, MREM	Fish and fish habitat reporting
	Ryan Gardiner, B.Sc.	Bat data analysis and reporting
	John Gallop, B.Sc., P.Biol	Lichen assessment
	Jason More, B.Sc.	Atmospheric and geophysical reporting
	Melissa Dube, B.Sc.	Socioeconomic reporting and GIS
	Katrina Ferrari, B.Sc.	Fish and fish habitat reporting
	Jessica Lohnes, B.Sc.	Bird surveys and reporting
	Nick Doane, B.Sc.	Bird surveys and reporting on technical studies
	Brayden Thomas, B.Sc.	Wetland and watercourse delineation and assessment
	Lucas Bonner, B.Sc.	Wetland and watercourse delineation and assessment
	Emma Halupka, M.Sc.	Wetland and watercourse delineation and assessment
	Hannah Machat, MREM	Wetland and watercourse delineation and assessment and terrestrial reporting
	Destin Gardner, MREM	Wetland and watercourse delineation and assessment and wetland reporting
	Sadie Jacobs-Peters, B.Sc.	Wetland and watercourse delineation and assessment
	Sasha Chillibeck	Wetland and watercourse delineation and assessment
McCallum Environmental Ltd. Subcontractor	Melvin Pothier	Bird surveys
Nortek Resource Solutions Inc	Kirk Schmidt, B.Sc, MScF	Noise Impact Assessment; Electormagnetic Interference study; shadowflicker, visual assessment
Cultural Resource Management Group Ltd.	Kyle Cigolotti, BA	Archaeological Resource Impact Assessment (ARIA)
	Robert Shears, MA, RPA	
	Logan Robertson, BA	
	Peter Oram, P.Geo	

Company	Name	Responsibility
Indigenous Environmental Services	Michael Cox, B.Sc	Mi'kmaq Ecological Knowledge Study (MEKS).
Cognitive Radar Corporation	Peter Scarlett, B.A.Sc., M.A.Sc	Radar data analysis and reporting for avifauna.
Ausenco	Mike Peckford, M.Sc., P.Biol	Acoustic bird data analysis, interpretation, and reporting.
	Jillian Leonard, B.Sc, MMS	

CVs are provided in Appendix B.

6 DESCRIPTION OF THE UNDERTAKING

6.1 Project Area

The Project Area is located in the Little River Harbour, Yarmouth County, Nova Scotia. The Project Area is bounded by the communities of Little River Harbour to the west (0 m), Comeaus Hill to the south (865 m), and Wedgeport to the east (2,000 m; Figure 1, Appendix A). The Project Area is situated south of Goose Lake and is delineated by Comeaus Hill Road along its western boundary and the Tusket Islands Wilderness Area along its eastern boundary (Figure 3; Appendix A). The Project Area is 919 ha in size and has an approximate center located at 19T 740697 m E 4845376 m N.

The Project Area was designed to include the maximum extent of expected terrestrial impacts (and in consideration of property ownership) and is defined by the boundaries of PIDs: 90222274, 90092578, 90092644, 90092701, 90298829, 9093055, 90295379, 90321506, 90321472, 90270018, 90321480, 90222266, 90093105, 90093287, 90093345, 90093360, 90024373, 90024498, 90093642, 90024480, 90024647, 90024613, 90024621, 90024639, 90024696, 90024795, 90024894, 90007071, 90007089, and 90007105.
(Figure 4; Appendix A).

The proposed entrance to the Project will be north and south from Black Pond Road, approximately 750 m and 2,200 m west of Highway 334, respectively.

6.1.1 Land Ownership

All of the aforementioned Project Area PIDs are private land, with the exception of three Crown land PIDs; 90007071, 90007089, and 90007105 (Figure 4; Appendix A).

Wedgeport Wind has obtained option agreements to lease the private land, which includes the development, construction, operational, and decommissioning phases of the Project. The lease includes the potential for wind turbines and BOP.

Crown land agreements will be obtained by Wedgeport Wind for the Crown land proposed to support Project infrastructure. Wedgeport Wind has initiated consultation with the Land Services Branch of Nova Scotia Department of Natural Resources and Renewables (NSDNRR) on the Crown land lease process.

6.2 Project Proximity to Other Areas

The Projects location in relation to towns or cities, Mi'kmaq communities, other developments, parks and protected areas, water supplies, and Important Bird Areas (IBA) are outlined as follows.

6.2.1 Towns or Cities

The Study Area is situated approximately 12 km southeast of Yarmouth (Figure 1; Appendix A) and 213 km southwest of Halifax.

6.2.2 Mi'kmaq Communities

The nearest Mi'kmaq community to the Project is Acadia First Nations Yarmouth Reserve No. 33 which is situated 9.9 km Northwest of the Study Area (Figure 5; Appendix A). Refer to Section 7 for additional details on the Mi'kmaq of Nova Scotia.

6.2.3 Other Known Developments

Other developments in proximity to the Study Area include three existing COMFIT wind projects (Figure 3; Appendix A):

- Little River Harbour Community Wind Project (single 1.99 MW WTG; 675 m north of the Study Area);
- Black Pond Community Wind Project (single 1.99 MW WTG; 190 m north of the Study Area); and,
- Wedgeport Wind Power Project (single 1.8 MW WTG; within the Study Area).

6.2.4 Water Supplies

The Lake George Watershed Protected Water Area (PWA) is the nearest PWA to the Project. It is located 21 km north of the Project Area.

6.2.5 Parks and Protected Areas

The Tusket Islands Wilderness Area is situated immediately adjacent to the eastern Study Area boundary (Figure 3, Appendix A). This wilderness area totals 715 ha (includes several separate parcels of land) and contains provincially significant saltmarshes that are known to support rare vascular plants, and provide waterflow and shorebird habitat (NSECC, 2022). Refer to Table 5-1 for specific setback distances of the Projects proposed WTG locations to the Tusket Islands Wilderness Area.

Kejimkujik National Park and National Historic Site, the nearest federal park to the Project Area, is located 78 km to the northeast.

6.2.6 Important Bird Areas (IBA)

The nearest IBA, The Brothers (NS003), is located 16 km southwest of the Study Area in Lower West Pubnico. Refer to Appendix C-1 for more details.

6.3 Physical Components

The primary components associated with the Project include the following;

- Wind turbine generators (WTG);
- Access roads to WTGs;
- Electrical collector lines to move electrical energy from WTGs to the substation;
- Substation;
- Transmission line;
- Temporary laydown yards;
- Construction pads;
- Concrete batch plant;
- Meteorological tower; and,

- Operations and maintenance building.

These components are described in greater detail within the following subsections. Refer to Figure 6 (Appendix A) for the Project layout.

6.3.1 Wind Turbine Generators

Wedgeport Wind is proposing the construction of up to 13 WTG's. Each WTG will have an individual generating capacity of 5.9 to 7.0 MW, depending on final turbine selection. There are a variety of turbine makes and models being considered. For the purposes of the EA, Wedgeport Wind has selected the Siemens Gamesa WTG (SG 6.6-170) as this turbine represents the general range of turbine options that are being considered. Refer to the following table (Table 6-1) for both the range of WTG characteristic that are being considered as well as the specific characteristics of the Siemens Gamesa WTG (SG 6.6-170). Additional information and specifications of the SG 6.6-170 turbine are provided in Appendix D.

Table 6-1. WTG Characteristics

Turbine Characteristics	Range of WTGs Being Considered	SG 6.6-170
Turbine output (MW)	5.9 – 7.0	6.6
Hub height (m)	110 – 118	110.5
Blade length (m)	79.3 – 83.3	83.3
Rotor diameter (m)	162 – 175	170
Rotor Swept Area (RSA; m^2)	20,612 – 24,053	22,698
Total height (m)	190 – 200	195.5

The wind turbines and supporting structures consist of nine key components:

1. tower foundations
2. five tower sections, stacked (sections range from 13.2 to 29.9 m in length)
3. nacelle
4. three rotor blades
5. hub

6. generator
7. transformer
8. electrical and grounding wires, and
9. locking doorway to access the interior of the tower at the base with staircase.

Tower foundations may range 5 to 7 m in depth and 30 m wide depending upon site-specific soil conditions. Refer to Section 6.4.3 for additional details on turbine foundation construction.

The nacelle includes the gearbox and electric generator, as well as blade and turbine control equipment, sensors, and cooling/heating equipment. These components are located at the top of the tower and are connected to the blades via a main shaft through the hub.

All transformers and switchgear are expected to be located inside of the turbine tower and are required for each turbine to step-up the generator voltage to the 34.5kV medium voltage of the collection system.

Lighting on WTGs will meet the design requirements and quality assurance for lights required under Canadian Aviation Regulations 2019-1, Part VI - General Operating and Flight Rules, Standard 621, Chapter 12 – Marking and Lighting of Wind turbines and Wind Farms. Turbines with an overall height greater than 150 m must use CL-864 medium intensity, flashing red beacon lights to delineate the perimeter of a wind farm. The highest turbine (based on topographic elevation) must also be lighted (along with any other turbines deemed to need lighting). Once turbines reach a height of 60 m or greater during construction, they must be lit with temporary lighting (Transport Canada, 2019).

6.3.1.1 *Wind Turbine Generator Locations*

Thirteen WTGs are proposed for the Project (Figure 6; Appendix A). Refer to Table 6-2 for WTG locations and property information at these locations.

Table 6-2. Wind Turbine Generator Locations

Wind Turbine Generator ID	Location (UTM NAD83 Zone 19)		PID	Private or Crown land
	Easting	Northing		
WTG1	740990	4849216	90092701	Private
WTG2	741154	4848212	90093642	Private
WTG3	740077	4848113	90024498	Private
WTG4	740154	4847650	90024480	Private

Wind Turbine Generator ID	Location (UTM NAD83 Zone 19)		PID	Private or Crown land
	Easting	Northing		
WTG5	740303	4847203	90024613	Private
WTG6	740364	4846680	90024639	Private
WTG7	740944	4846583	90024639	Private
WTG8	740537	4846215	90024696	Private
WTG9	740641	4845746	90024795	Private
WTG10	741282	4845482	90024894	Private
WTG11	740642	4845272	90024894	Private
WTG12	740754	4844295	90007071	Crown
WTG13	740618	4843845	90007089	Crown

6.3.2 Access Roads

Access roads to support the construction, operation, and decommissioning phases of the Project total 8.72 km and include both existing and new access, as outlined in the following subsections. Access roads will be constructed north (to WTG1) and south (to WTG2, 3, 4, 5, 6, 7, 8, 9, 10, and 11) from Black Pond Road and east (to WTG12 and 13) from Comeaus Hill Road (Figure 6; Appendix A).

6.3.2.1 *New Access Roads*

The majority of the Projects access roads will be new access (8.48 km; 97.2%). The cleared corridor required to support access roads varies from 20 m to 30 m in width. Twenty-meter-wide corridors are required for access roads that do not parallel collector lines (e.g., from Black Pond Road to WTG1 and from) and 30 m wide corridors are required for access roads that do parallel collector lines (e.g., between WTG2 to WTG11 and from Comeaus Hill Road to WTG13). The width of clearing is important to create a safe work area, allow for enough material to be gathered within the cleared areas to use for road and pad construction, to maintain setbacks (in the case of collector lines), and to allow sunlight to penetrate and promote drying of travelling surfaces. The roads are designed to be as short as possible in order to reduce material demand, costs, and environmental impacts.

Access roads will have a 6 to 12 m wide road surface and including ditching and grading will be 17 to 20 m wide. Wider roads (12 m road surface) are required from the crane to crawl from turbine to turbine and narrower roads (6 m road surface) will be utilized if the crane is mobilized via a float truck. Six-meter-wide roads are proposed to be constructed north from Black Pond Road to

WTG1, from Black Pond Road south to WTG3, and from Comeaus Hill Road east to WTG13. All other access roads will have a 12 m wide roads surface.

Access roads will be constructed as all-weather all-season roads. Access roads will be built to accommodate the oversize loads and large weights of the WTG components. Following construction, access roads will be gated to limit public access.

Refer to Section 6.4.2 for specifications related to access road construction.

6.3.2.2 *Existing Access Roads*

The remaining 2.8% (0.24 km) of access roads are existing roads. Existing roads include an unnamed gravel road that branches south from Black Pond Road, immediately south of Goose Lake Road.

6.3.3 **Electrical Collector Lines**

Approximately 11 km of new 34.5 kV electrical collection will be installed, using a mix of above (i.e., overhead) and below ground methods (Figure 6; Appendix A).

From the foundation of each WTG, 70 m to 150 m of underground cable will be run to a riser pole adjacent to the access road and crane pads. The underground cables can be direct buried or contained in conduits that are buried in sand trenches and marked with warning tape according to specification.

The remainder of the collector system (i.e., from the riser poles to the substation) will remain above ground. The above ground section will consist of standard wood utility poles spaced approximately 50 to 70 m apart, with appropriate guying as required. Pole mounted disconnect switches and additional safety and regulating equipment will be installed as required. A fibre-optic communication system will be underbuilt on the overhead collector system and also installed underground from each WTG to the riser pole and will be used to monitor and control the Project remotely.

The overhead collector lines will be installed adjacent to the access roads, except from WTG1 and from Comeaus Hill Road to WTG11. The collector line is independent from the access roads from WTG1 in order to reduce the total length of collector line and tie more directly into the substation. The collector line is independent from the access roads from Comeaus Hill Road to WTG11 to avoid private property that is not part of the Project footprint. Collector lines independent of access roads will be cleared to a width of 12 m.

6.3.4 **Substation**

Electricity generated by the Project will be transmitted through the electrical collection system to a substation located within PID 90321480 and PID 90024373, south of Black Pond Road (19T 257161 m E 44848509 m N). The substation is required to step up the power generated by the WTGs from a voltage of 34.5 kV to 138 kV which is then supplied to NSPI. The footprint of the substation is expected to be no larger than 100 m x 100 m with a fenced security perimeter.
The substation components will include the following:

- a small, prefabricated control building which typically contains the protection and control panels, AC and DC power systems, UPS system, and telecommunication panel;
- main 34.5kV/138kV step-up transformer and containment system;
- station service transformer;
- 138kV and 34.5kV circuit breakers;
- 138kV and 34.5kV disconnect switches;
- grounding transformers;
- lightning arrestors;
- potential transformers and current transformers;
- underground ground grid;
- cable trays, electrical conduits and ducts;
- associated equipment concrete foundations; and,
- associated steel structures.

6.3.5 **Transmission Line**

NSPI has confirmed that connection to the electricity grid is feasible. NSPI is currently considering multiple routing options of the transmission line, but interconnection is proposed to occur on the 138 kV NSPI transmission line L-6024 approximately 1.5 km southeast of the Tusket substation.

NSPI has confirmed that they will be responsible for supporting all environmental permitting associated with the Project's transmission line with the cost incurred to Wedgeport Wind (T. Omodayo, NSPI, Personal Email Communications to Wedgeport Wind, April 8, 2022). This information was relayed to the NSECC EA Branch, and it was confirmed that the transmission line component of the Project is not required within the EARD. NSECC did state that "if the proponent is or becomes responsible for any aspect of the transmission line (e.g., construction), this information will need to be provided either in the EA registration for review, or for an already approved project, to the EA branch in writing and may constitute a modification to the project which could require EA" (H. MacPhail, NSECC, Personal Communications to Wedgeport Wind, October 27, 2022).

6.3.6 Temporary Laydown Yards

Two temporary laydown yards (100 m x 250 m) are proposed to be constructed within the Project Area. One is situated east of WTG03 and at the intersection of the access road to WTG02. The second laydown yard is located along the access road, east of WTG08. Laydown yards will be used to store construction equipment and materials during the construction and decommissioning phases of the Project.

6.3.7 Construction Pads

The erection of a WTG requires a large level work area for storage of WTG components and safe operation. Three construction pads will be associated with each turbine. Refer to Table 6-3 for details and dimensions of each construction pads.

Table 6-3. Infrastructure Dimensions and Workspace

Infrastructure	Dimensions of Workspace Required	Permanent or Temporary
Turbine base with underground power cables	15 m diameter	Permanent
Blades laydown pad	30 m x 100 m	Temporary
Crane pad	30 m x 50 m	Permanent
Remaining WTG equipment laydown pad	25 m x 60 m	Temporary

6.3.8 Mobile Concrete Batch Plant

On average, a WTG base requires approximately 400 m^3 of concrete. The volume of a concrete truck is approximately 10 m^3. Therefore, 40 trucks may be required for pouring a single WTG foundation.

A mobile concrete batch plant allows consistent high output and quality concrete to be produced at the Project site and reduce trucking costs and local impacts to communities. The batch plant is fully mobile making it ideal for projects in remote areas. Short mixing times allows for increased production, up to 120 m^3 of concrete per hour. These typically have a compact modular arrangement that can be fully erected in one day.

6.3.9 Meteorological Tower

A permanent meteorological tower may be required for the Project. The tower would be at the hub height of the turbines and be either a self-supported structure or use guy wires. The met mast, if installed, will comply with all regulations.

6.3.10 Operations and Maintenance Building

One operations and maintenance building may be required during operations. This building will be situated at a laydown area.

6.4 Site Preparation and Construction[2]

The following sections outline the activities associated with the Construction and Operational phases of the Project. Table 6-4 outlines the general order of activities associated with the development of a wind power project.

[2] Please note that at this time these methods are expected but cannot be confirmed until the Project is approved and an Engineering Procurement and Construction (EPC) contractor has been selected. The EPC will create final detailed requirements for all construction activities, which will generally align with those provided here.

Table 6-4. Construction Phases

Phase	Details	Approximate Timing
Preconstruction	• Notification of residents/landowners of construction commencement • Geotechnical testing for turbine site locations in field • Survey access roads and turbine locations • Delivery and set up of temporary facilities – construction offices, workers trailers, temporary washroom facilities, etc. • Construction equipment delivery	Fall 2023 or early 2024
Construction – General	• Clearing of soils • Construction of laydown yards	Fall 2023 or early 2024
Construction – Civil	• Stripping, storage, and stabilization of surface soils along access roads, at turbine locations, at substation, at other required work areas • Construction of access roads, ditches, water crossings, including water management. • Construction of temporary workspace(s) • Construction of turbine locations and crane pads • Installation of erosion and sediment control structures • Site grading • Compaction testing of roads • Creation of crane pads using crushed rock • Excavation of foundations • Pouring of concrete ‘mud mat’ working surface • Installation of re-bar and form work for turbine foundations • Pouring of concrete for foundations • Testing of concrete foundations • Installation of site drainage (aka - weeping tile) at base of turbine foundations • Backfilling of foundations with previously excavated soils	2024

Phase	Details	Approximate Timing
	• Reclamation of surplus soils • Grading of site	
Construction – Turbines	• Turbine component delivery • Crane delivery • Tower/turbine erection • Install turbine electrical systems & (if necessary) pad mount transformers	2025
Construction – Collection System	• Soil stripping and excavation of trenches for underground electrical system • Installation of utility poles • Hanging wires and associated infrastructure • Install and connect underground collector system • Terminations in turbine and/or at pad mount transformer • Testing & commissioning	2024-2025
Construction – Collector Substation	• Delivery of equipment • Installation of equipment foundations and station ground grid • Installation of equipment support structures • Installation of transformer, switch gear, protection and control systems, control building, conduits, wiring, and terminations • System testing	2025
Operations & Maintenance	• Reclamation of subsoils and disturbed surface soils • Weed control • Re-seeding of disturbed soils • Grading of roads • Road maintenance • Culvert maintenance • Turbine maintenance • Sub-station maintenance • Equipment testing	2025-2060

Phase	Details	Approximate Timing
Decommissioning & Reclamation	• De-energize facility • Removal of above ground infrastructure which includes turbine blades, nacelles, tower components, and other support structures • Removal of crane pads and gravel from access roads • Recontouring of crane pads and access road grades • Reclamation of surface soils • Re-seeding or re-planting • Reclamation monitoring	2060-2061/2062 (i.e., 1 to 2 years)

Site preparation and construction includes clearing and grubbing, access road construction, crane pad construction, turbine foundation installation, turbine assembly and erection, and collector line construction. Refer to the following subsections for more details related to each component.

The construction phase of the Project is proposed to commence in November 2023 and be completed by July 2025. The construction period is expected to employ approximately 100 people.

Equipment proposed to be used for construction of the Project infrastructure includes:

- Feller buncher (1);
- Tree Skidder (1);
- Log truck (1);
- Main crane and assist crane;
- Cable trencher (1);
- Cable reel tractor (1);
- Fuel truck (1);
- Concrete trucks (10-12);
- Borehole drilling machine (1);
- Back hoes (2);

- Bulldozers (4);
- Dump trucks (2-4);
- Compaction Rollers (2);
- Excavators (4);
- Grader (1);
- Forklift or telehandlers (4);
- Welding trucks (1)
- Delivery vehicles;
- Pickup trucks (~10);
- Erection and support cranes (up to 4);
- Generators (10);
- Site/Office Trailers; and,
- Storage Containers.

Access to the Project site during the construction period will be via Black Pond Road (WTG1 to 11) and Comeaus Hill Road (WTG12 and 13; Figure 6; Appendix A). All construction equipment and vehicles can access Black Pond Road and Comeaus Hill Road via Highway 334. Turbine component delivery will be via Highway 103 & Highway 334. During turbine component delivery, signage and traffic control will be implemented as required.

6.4.1 Clearing and Grubbing

Clearing of vegetation and grubbing of overburden will take place in advance of scheduled work at the site and will include harvesting trees and grubbing of overburden from areas proposed to support Project infrastructure. When possible, overburden will be strategically stockpiled onsite to reduce double handling of material and all for future use in reclamation. Clearing and grubbing will occur outside of the breeding bird window (April 15 to August 31).

6.4.2 Access Road Construction

The following construction activities will take place for new roads:

- Road areas will be clear cut and grubbed. Salvageable lumber will be stockpiled for the landowners at their request. If landowners do not want salvageable timber it will be sold or provided for use by local commercial saw mills;
- Excess organic material will be stockpiled temporarily and used for reclamation / revegetation as needed;
- A cut and fill technique will be used where suitable road building materials exist. The road surface will be graded and levelled to the engineering specification;
- It is unknown at this time whether blasting will be required;
- A suitable compacted subgrade will be verified by a geotechnical engineer;
- Geotextile fabrics may be used as specified by the civil engineer;
- Culverts will be installed to maintain natural drainage according to the erosion and drainage controls specified by the civil engineering drawings;
- Borrow pit areas may also be proposed in areas where there is insufficient material to construct an access road capable of hauling equipment to and from the sites;
- All final access road construction and design will be completed in accordance with both landowner and WTG manufacturer requirements; and,
- One watercourse crossing is associated with the Projects access roads.

6.4.3 Turbine Pads and Foundations

The following describes the proposed methods for turbine pads and foundation installation:

- Remove all timber and grubbing's;
- Strip surface and subsoils in areas to be constructed. Separate and stockpile organic soils for later use with reclamation and revegetation;
- Contour and level working areas;
- Turbine bases will be excavated to appropriate dimensions (determined by engineering requirements);
- Excavated subsoil will be piled on location for use in padding of the tower base or for eventual removal;

- It is assumed that each turbine base will require installation of a support structure using over 500 cubic metres (m^3) of concrete and re-bar. As a result, 1000+ m^3 of subsoil will require excavation and relocation;
- A portion of this soil will be used to backfill and level the crane pad area. During construction operations, landowners and municipalities will be approached to discuss how best to remove excess subsoil from turbines on their land(s);
- It is unknown at this time whether blasting will be required;
- Pouring of concrete slab;
- Installation of internal formwork;
- Installation of rebar followed by external formwork and other required infrastructure;
- Transport of concrete (the supplier location is to be determined);
- Pouring of concrete;
- Curing and testing (tests taken throughout pouring process);
- Backfilling;
- Recontouring; and,
- Interim reclamation of surface soils and revegetation of disturbance areas not needed to support operations and maintenance activities.

6.4.4 **Temporary Components**

During the construction phases of the project, the following temporary Project components will be required:

1. Storage yard (or multiple storage areas) will be required to store construction equipment, turbines, cranes, shacks, offices, parking and other necessary components. During the construction period trailers or other temporary structures will be brought in for construction support and management.
2. Temporary work space may be required along access roads and at crane pad sites. These temporary work spaces will be used as required (for example as truck turn around areas) and will be reclaimed/restored following turbine erection.

3. Borrow pits may be required to provide necessary fill for access road or crane pad site creation. All borrow pits will be permitted as required.

6.4.5 Turbine Assembly and Erection

WTG components will be delivered to site and the erection of turbines is based upon specific site conditions found at each turbine pad. Tower sections will be positioned on turbine pads and lifted via crane. The base section will be positioned onto the foundation and the remaining tower sections will be stacked on top. The hub which will be installed on the nacelle prior to being set in place on the tower. Lastly, the three blades will be attached individually to the hub.

Crane lifts required detailed engineering and safety protocols and those details are currently unknown but considered outside the scope of the EARD.

6.4.6 Electrical Collector Line Construction

Underground electrical system collector lines will be constructed by:

- Stripping surface soils along the route;
- Excavation of a trench to approximately 1.5 m to 2 m deep;
- Installation of a sand or gravel bed along the base of the trench;
- Laying and interconnection of below ground cables and conduits;
- Backfilling of trench with excavated material (parent materials). Excess soils that will result in a ridge along the trench will be removed and disposed of at an approved location;
- Replacement of subsoils;
- Replacement of topsoil; and,
- Re-seeding as per and erosion control requirements.

Overhead electrical system collector lines will be constructed by:

- Surveying of pole locations;
- Drilling to a specified depth;
- Installing wood poles;

- Installing cross-arm supports and pole mounted infrastructure;
- Unspooling and stringing of power lines and fiber optic cable;
- Guying;
- Interconnection with substation and underground sections; and,
- Testing & commissioning.

6.5 Operations and Maintenance

Routine maintenance activities will continue through the operating period of the Project and will include maintenance visits by technicians. Maintenance visits can be expected on a daily, weekly, or monthly basis for a Project of this size.

Grading of access roads will be required to maintain travel and for snow removal.
In the unlikely event that a nacelle or blade(s) require removal, a crane will be required.

6.5.1 Waste Management

There are limited waste by-products created from the wind energy generation process. Some waste will be produced from ongoing maintenance for the turbine facilities (e.g., lubrication and hydraulic fluids) and these waste materials will not be generated in large quantities and will be disposed of through disposal methods as regulated in the Province of Nova Scotia.
A spill kit with appropriate spill response gear (e.g., spill pads, absorbent, booms etc.) will remain within each Turbine base during operations.

Non-hazardous waste (i.e., domestic waste) will be disposed of through conventional, local waste handling facilities operated by local municipalities.

Materials suitable for recycling will be reused and/or recycled.

6.5.2 Utilities

Maintenance may periodically require bucket trucks to service the collector lines.

6.6 Decommissioning and Reclamation

The Project is expected to be in operation under current turbine warranties for approximately 35 years. The exact timeframe for decommissioning cannot be determined but for the purpose of this report, it has been assumed to occur at year 35 and will take approximately 1 to 2 years to complete.

Wedgeport Wind acknowledges its statutory obligation to decommission and reclaim the project in accordance with any provincial regulatory requirements and any development permit issued. Wedgeport Wind commits to ensuring sufficient funds will be available to do so and expects that the costs or majority of the costs to reclaim the Project will be recovered from the salvage value associated with the Project components. Salvage values for steel, copper and other metals in a wind turbine can be significant and since wind turbine installations are mainly above ground, practically all the valuable components are salvageable. Wedgeport Wind's internal analysis shows that the salvage value is more than sufficient to cover the cost to reclaim the Project in some scenarios. In addition, publicly available studies indicate that salvage value contribute greatly towards the decommissioning of a facility (Anderson et al. 2014; McCarthy 2015).

Furthermore, the Project leases with landowners have a commitment that Wedgeport Wind must decommission/reclaim the premises in accordance with applicable laws and regulations in substantially the same condition as that at the signing of the lease. This obligation is still a requirement in the event that the Project is assigned to another party including in the event of a bankruptcy.

The end land use objectives are based on pre-development site conditions, to the extent possible, and the reclaimed site will plan to support the land uses that were present prior to Project development occurring (i.e., undeveloped, forested land). Ultimate site restoration will be based upon regulatory requirements in place at the time.

7 MI'KMAQ OF NOVA SCOTIA

The Mi'kmaq are the founding people of Nova Scotia and currently live throughout the province in 13 Mi'kmaq communities (OLA 2015). The Project Area is located within the Mi'kmaq territory called Kespukwitk, which means 'end of flow' (CMM 2015).

The Mi'kmaq in the provinces of Nova Scotia, New Brunswick, Prince Edward Island, and the Gaspé Peninsula in Quebec are founded on land historically occupied by the ancestors of the Mi'kmaq. The earliest evidence of the Mi'kmaq of Nova Scotia in the Maritimes Region indicates that the ancestors of the Mi'kmaq have existed on the land for more than 11,000 years (NSOAA 2017).

The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights, including the right to fish for a "moderate livelihood" which flows from the Peace and Friendship Treaties, and Aboriginal rights to hunt, fish and gather for food, social and ceremonial purposes – more broadly referred to as “traditional” purposes. Mi’kmaq rights are communal rights and therefore shared amongst all members of the Mi’kmaq Nation in Nova Scotia.

The Crown has a duty to consult with the Mi’kmaq of Nova Scotia, which is achieved in accordance with the Mi’kmaq-Canada-Nova Scotia Consultation Terms of Reference. As per Supreme Court of Canada instruction and subsequent guidance from governments, such as the Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (Government of Canada 2011) and the Proponents' Guide: Engagement with the Mi'kmaq of Nova Scotia (Province of Nova Scotia 2012), the Crown may delegate procedural aspects of consultation to proponents. However, the duty to consult, and ultimate decision-making authority remains with the Crown. The results of the Proponent’s Mi’kmaq of Nova Scotia engagement program and EA development is expected to be considered by the federal and provincial governments in the EA decision-making process.

For the purposes of consultation, 10 of the 13 Mi’kmaq communities are represented in consultation by the KMKNO, which reports to the Assembly of Nova Scotia Mi’kmaq Chiefs (ANSMC). Millbrook, Sipekne'katik, and Membertou First Nations represent their own communities in consultation through their elected Chiefs and Councils.

Acadia First Nation is the most proximate First Nation community to the Project Area. The Acadia First Nation includes the communities of Gold River, Medway, Ponhook, Wildcat, Yarmouth, Hammonds Plains, and Gardener’s Mill (Acadia First Nation, 2022) and has a registered population of 1,885 individuals (Government of Canada 2012). Current First Nations communities located near the Project Area include Yarmouth 33 IR, located ~10 km northwest of the Project Area (Figure 5; Appendix A). The Yarmouth 33 IR was established on June 8, 1887 and is the central community for Acadia First Nation and their most populated reserve (Acadia First Nation, 2022). The Yarmouth 33 IR had a population of 157 individuals in both the 2011 and the 2016 National Census (Government of Canada 2016).

The nearest known Mi’kmaw placename to the Project Area is Kepe’k which means “obstruction, (narrowing as in a river)”, and is the name for Wedgeport (Ta’n Weji-sqalia’tiek 2022). The Tusket River is located ~2 km east of the Project Area. Kjipanuk, meaning “at the big opening” is the Mi’kmaw name for the mouth of the Tusket River (Ta’n Weji-sqalia’tiek 2022).

7.1 Mi’kmaq Engagement

Wedgeport Wind is also developing the Higgins Mountain Wind Farm Project. Mi’kmaq engagement on the Higgins Mountain Wind Farm Project commenced in 2017. While these meetings and discussions were not specific to this Project, they have informed the approach to project development and informed Wedgeport Wind with the typical areas of interest of the Mi'kmaq of Nova Scotia.

Early engagement with First Nation communities and organizations was completed by Wedgeport Wind, prior to initiating environmental field work and during early project concept development. Early engagement was initiated through provision of the Project information and an invitation to discuss the Project. Between January and March 2022, emails containing the Project overview, location map, anticipated EA timeline, and an offer to meet to discuss the Project were distributed to the following First Nation communities/organizations:

- Sipekne'katik First Nation;
- Acadia First Nation;
- Glooscap First Nation;
- Pictou Landing First Nation; and,
- Kwilmu'kw Maw-klusuaqn Office (KMKNO).

An invitation to meet to discuss the Project and an invitation to the public information session (scheduled to be held on April 20, 2022), was sent via email in March to Acadia First Nation. To the Project team's knowledge, no First Nation community members or representatives attended the information session.

On December 16, 2022, Wedgeport Wind provided a company description, environmental overview, and Project description to all 13 First Nation communities in Nova Scotia and the KMKNO. Wedgeport Wind also notified these communities, organizations, and native councils that this Project was awarded the power purchase agreement with NSPI as part of the RBP and informed the communities/organizations that the EA is proposed to be registered in January/February 2023.

Please refer to Table 7-1 for a complete First Nations engagement log of communications and Table 7-2 for a summary of issues raised during First Nations engagement.

7.2 Office of L'nu Affairs and NSDNRR Aboriginal Consultation and Engagement

On May 9, 2022, Wedgeport Wind provided the Office of L'nu Affairs (OLA) an email with an introduction to the Project, public information session posters, Project information handouts (detailing location, capacity, schedule, Project activities etc.) and extended an invitation to meet with their office to review the Project. The OLA forwarded this email to Janel Hayward (NSDNRR Aboriginal Consultation and Engagement) and Ms. Hayward requested a call to discuss the Project. On May 10, 2022, Wedgeport Wind met with Ms. Hayward and introduced the Project and discussed engagement methods undertaken by Wedgeport Wind, including following the 6-step Proponent's Guide to Mi'kmaq engagement (OAA 2012). Wedgeport Wind's role in crown consultation with the Mi'kmaq was discussed. The 2012 MEKS was discussed as was the need for a new MEKS. Ms. Hayward followed up with a sample Mi'kmaq engagement report table of contents to use as a guide to support how engagement efforts are tracked.

On October 17, 2022, after the Project was awarded the RBP, Wedgeport Wind introduced the Project to Kendra Gorveatt (OLA) during a One Window meeting.

7.3 Engagement Log

Refer to Table 7-1 for a log of Mi'kmaq communications. Please refer to Table 9-1 for all communications with the Office of L'nu Affairs and NSDNRR Aboriginal Consultation and Engagement Office.

Table 7-1. Mi'kmaq Engagement Communication Log

Community or Organization	Individual	Method	Date	Details
KMKNO	Tracy Menge	Email	March 25, 2022	Project introduction sent to KMKNO. Email included information flyer, invitation to the public information session (April 20, 2022), and details about the partnership, location, capacity, engagement, and extended an offer to meet.
	Patrick Butler	Email	September 12, 2022	Introduced Mr. Butler to the Project and Wedgeport Wind and extended an offer to meet and discuss the Project.
	Patrick Butler	Email	September 19, 2022	Follow up email requesting availability to meet.
	Patrick Butler	Phone	October 6, 2022	Voicemail left with Mr. Butler requesting a meeting to discuss the Project.
	Patrick Butler	Phone	October 20, 2022	Voicemail left with Mr. Butler requesting a meeting to discuss the Project.
	Patrick Butler	Email	January 5, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
	Patrick Butler	Phone	January 9, 2023	Voicemail left with Mr. Butler to follow up on the notice to register the EA and Project information package and provide opportunity to discuss the Project.
	Patrick Butler	Phone	February 23, 2023	Voicemail left with Mr. Butler to follow up on notice to register the EA, Project information package shared in January, and invitation to meet.
Acadia First Nation	Rachel Stevenson Bruce Clark	Call	January 29, 2022	Introduced and discussed the proposed Wedgeport Wind Farm Project and potential partnership opportunities.
	Chief Deborah Robinson	Call	February 7, 2022	Follow up conversation about the Wedgeport Wind Farm Project and partnership opportunities.

Community or Organization	Individual	Method	Date	Details
	Rachel Falls Tim Pictou Natteal Battiste Amanda Lloyd Bruce Clark Heather Stevenson			
	Rachel Stevenson Bruce Clark	Call	February 10, 2022	Follow up conversation about the Project and partnership opportunities.
	Chief Deborah Robinson	Email	March 28, 2022	Sent Chief Robinson a project information summary outlining the partnership, location, capacity, timelines, opportunity, and project activities. This also included an invitation to the public information session scheduled on April 20, 2022.
	Chief Deborah Robinson	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
	Chief Deborah Robinson	Email	February 22, 2023	Email to follow up on Dec. 16, 2022, information package with Notice of intent to register an EA for the Project, Introduction letter to Wedgport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
	Julian O'Connell	Email	February 24, 2023	Introduction email to Julian and to follow up on previous correspondence with Chief Robinson

Community or Organization	Individual	Method	Date	Details
	Julian O'Connell Rachel Stevenson	Email	March 1, 2023	Julian acknowledged receipt of the February 24, 2022, email and shared the Project update with the Acadia First Nation development team. The documents provided by Wedgeport Wind will be entered into the record at the next Chief and Council meeting. Julian will connect with Wedgeport Wind if there are any specific questions about the Project.
Glooscap First Nation	Michael Peters	Call	February 9, 2022	Introduced and discussed the proposed Project and potential partnership opportunities.
	Michael Peters	Call	February 24, 2022	Follow up conversation about the Project and partnership opportunities.
	Michael Peters	Call	February 25, 2022	Follow up conversation about the Project and partnership opportunities.
	Chief Sidney Peters Michael Peters Karen Kluska Members of Glooscap's Finance, Audit, and Risk (FAR) Committee	Call	March 16, 2022	Discussion about the Project and potential partnership opportunity.
	Chief Sidney Peters	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.

Community or Organization	Individual	Method	Date	Details
Pictou Landing First Nation	Barry Francis	Call	February 11, 2022	Introduced and discussed the proposed Project and potential partnership opportunities.
	Barry Francis	Call	February 18, 2022	Follow up conversation about the Project and partnership opportunities.
	Chief Andrea Paul	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
Sipekne'katik First Nation	Sosep Hatfield	Call	February 11, 2022	Introduced and discussed the proposed Project and potential partnership opportunities.
	Sosep Hatfield Brian Dorey	Call	February 23, 2022	Follow up conversation about the Project and partnership opportunities.
	Sosep Hatfield Brian Dorey	Call	March 24, 2022	Follow up conversation about the Project and partnership opportunities.
	Sosep Hatfield	Call	March 28, 2022	Follow up conversation about the Project and proposed MOU between Wedgeport Wind and Sipekne'katik First Nation.
	Sosep Hatfield Brian Dorey Stuart Knockwood	In person	April 21, 2022	Discussed the project, Mi'kmaq related activities, and partnership opportunity. Toured the Sipekne'katik reserve lands.
	Cheryl Maloney Charlotte Connolly	Call	September 7, 2022	Introduced and discussed the Project. Wedgeport Wind gave a presentation about the project, benefits, and schedule. MEL gave a presentation on environmental conditions, design considerations/constraints, and EA schedule

Community or Organization	Individual	Method	Date	Details
	Samantha Watts Brian Dorey			and next steps. Sipekne'katik First Nation spoke on their interest areas around the MEKS and Mi'kmaq engagement.
	Brian Dorey Stewart Knockwood	In person	September 13, 2022	Introduce Elemental and NS wind projects to SFN chief and council. Council meeting cancelled due to death in the community, however elemental team met with Stuart Knockwood and Brian Dorey in lieu of council meeting. Project update meeting followed by a tour of the community.
	Charlotte Connolly Samantha Watts Brian Dorey	Call	September 29, 2022	Follow-up from in person meeting on Sept 13. Discuss community engagement process moving forward. Review of field studies completed and follow up from Sept 7th meeting.
	Brian Dorey	Call	October 6, 2022	Discuss Sipekne'katik Governance Initiative (SGI) process and SFN engagement approach with Brian Dorey. Discussed how to engage with other Mi'kmaq nations.
	Charlotte Connolly Samantha Watts Brian Dorey	Call	October 28, 2022	Provide project update, review scope of ENV Overview document for Wedgeport and discuss community engagement fprocess
	Charlotte Connolly Samantha Watts Brian Dorey	Email	November 2, 2022	Provided copy of ENV Overview document for the Wedgeport Wind Project for SFN review

Community or Organization	Individual	Method	Date	Details
	Charlotte Connolly Samantha Watts Brian Dorey	Call	November 18, 2022	Review SFN engagement plan -update on SFN election -solicit comments on ENV Overview documents
	Charlotte Connolly Samantha Watts Brian Dorey	Call	November 23, 2022	Project update -solicit comments on ENV Overview documents provided Solicit comments on SFN engagement plan -provided MEKS study for wedgeport
	SFN Chief and Council	In person	December 7, 2022	-Meeting with SFN council in Ottawa. -Focus was relationship building between project team and SFN -Provide introduction to projects and development approach. Discussions around partnership agreements and capacity building meeting
	Charlotte Connolly Samantha Watts Brian Dorey	Call	December 16, 2022	-Reporting out on meeting with SFN council -Discuss community engagement event for new year -Overview of MEKS for Wedgeport
	SFN Chief and Council	Call	January 10, 2023	-Discuss visit to SFN community and scope of community project update meeting. -Discussed partnership agreements implementation timing. -Discussed project concerns that SFN chief and council have and concerns that are being raised in the community.
	SFN Chief and Council	In person meeting	January 19, 2023	- Reviewed project materials that will be presented in the community meeting

Community or Organization	Individual	Method	Date	Details
				- Answered questions about the project and potential effects of the project - Answered questions about the EA review process - Discussed implementation of the community engagement plan with SFN support as a project partner
	SFN community open house	In person meeting	January 19, 2023	Poster boards were presented to the community with information on the Wedgeport Wind Project. Wedgeport wind had project representatives providing overview of project and answering questions about potential environmental effects -discussed potential employment and contracting opportunities Provided overview of project schedule and how / when we would be undertaking future engagements with the community
	SFN Community open house	In person meeting	February 16, 2023	Poster boards were presented to the community with information on the Project. Wedgeport Wind had project representatives providing overview of project and answering questions about potential environmental effects. Provided overview of project schedule and how / when we would be undertaking future engagements with the community. Discussion on potential employment and contracting opportunities followed.
	Charlotte Connelly Samantha Watts	Call	February 24, 2023	Update on Project EA Review and timing of registration. Feedback on Elemental participation in SFN community project info sessions (Jan. 19 and Feb. 16, 2023). Communications planning for community engagement of SFN members during EA review period.
Annapolis Valley First Nation	Chief Gerald Toney	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.

Community or Organization	Individual	Method	Date	Details
Eskasoni First Nation	Chief Leroy D.C. Denny	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
L'sitkuk (Bear River)	Chief Carol Dee Potter	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
Membertou First Nation	Chief Terrance J. Paul	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
Millbrook First Nation	Chief Robert Gloade	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
Paq'tnkek First Nation	Acting Chief Corey Julian	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
Potlotek First Nation	Chief Wilbert Marshall	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
Wagmatcook First Nation	Chief Norman Bernard	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.
Wekoqma'q First Nation	Chief Annie Bernard Daisley	Email	December 16, 2023	Notice of intent to register an EA for Wedgeport Wind, Introduction letter to Wedgeport Wind, Wedgeport Wind Environmental Overview and Description of the Project, and invitation to meet.

7.4 Summary of Issues

The following table provides a summary of all issues raised during First Nations engagement related to the Project. For each key issue identified, a summary of the Project team's response is provided along with references to sections within the EARD which more fully address the issue.

Table 7-2. Summary of Issues Raised During Mi'kmaq Engagement

Key Issue	Summary of Proponent Response	Primary EA Reference
Sipekne'katik First Nations consultation team would like to be involved in the review of the EA.	Wedgeport Wind will provide a comprehensive environmental overview document summarizing the assessment and methodology undertaken for the EA and offer an opportunity to meet to review and provide feedback on the document.	NA
Sipekne'katik First Nations consultation team expressed interest in being involved in the review of the MEKS.	Indigenous Environmental Solutions (IES) has shared the draft MEKS with Sipekne'katik's team for review and comment.	Section 7.6.2
Sipekne'katik First Nations consultation team expressed the importance of Wedgeport Wind following Sipekne'katik's Governance Initiative Protocol for engagement efforts.	Wedgeport Wind has worked closely with Sipekne'katik's consultation team to ensure that the Project is being properly and adequately engaged on. While there was a pause in formal engagement with Sipekne'katik First Nations Chief and Council during the election period (Mid Sept. to Mid Nov. 2022), Wedgeport Wind has provided Project updates and discussed Sipekne'katik First Nations involvement with the Project at meetings with the new Chief and Council in December 2022. This engagement is ongoing.	NA
Sipekne'katik First Nation expressed interest in potential environmental effects associated with the Project.	Wedgeport Wind provided an Environmental Overview document to Sipekne'katik First Nations consultation team on Nov. 2, 2022, that characterized potential effects and mitigation measures that could be applied.	Table 7-1

	Wedgeport Wind answered questions at community project information meeting and Chief and Council meetings regarding potential effects of the Project.	
Sipekne'katik First Nation Chief and Council expressed interest around training. employment and contracting opportunities for their members. Sipekne'katik members have also requested information at community project information session held on January 19, 2023.	Wedgeport Wind had made commitments to training, employment and contracting opportunities through Project partnership agreements. Wedgeport Wind is committed to working with the Sipekne'katik employment and training center related to specific opportunities	NA

7.5 Ongoing Engagement

Wedgeport Wind is committed to maintaining open lines of communication with interested Mi'kmaq communities through the life of the EA process and the construction, operational and decommissioning phases of the Project.

Wedgeport Wind will continue to support adjustments in proposed mitigation measures and monitoring plans relating to Project impacts based on on-going feedback and input received from communities.

The results of Mi'kmaq engagement have been considered and incorporated in the environmental effects assessment and are reflected in Wedgeport Winds commitments to involve the Mi'kmaq in the development and implementation of mitigation and monitoring measures and proposed compliance and effects monitoring programs.

7.6 Mi'kmaq Ecological Knowledge Study (MEKS)

As part of the 2012 EARD, a Mi'kmaq Ecological Knowledge Study (MEKS) was completed by Membertou Geomatics Solutions (Appendix E). In 2022, Indigenous Environmental Services (IES) completed a second MEKS for the Project (Appendix F). The 2022 MEKS was completed to update the results of the 2012 MEKS and to confirm if the conclusions presented in 2012 remain valid or if they have changed.

Refer to the following subsections for more details related to the 2012 MEKS and 2022 MEKS.

7.6.1 **2012 MEKS**

The 2012 MEKS, completed by Membertou Geomatics Solutions, was completed for the 2012 Project, which has a different layout than the current Project but was proposed to occur within the same general lands (Figure 2; Appendix A). The 2012 MEKS was completed to support the 2012 EARD. Its purpose was to assess the 2012 Project site and an area 5 km surrounding the 2012 Project for Mi'kmaq ecological knowledge (MEK).

The 2012 MEKS included a Mi'kmaq traditional land and resource use and a Mi'kmaq significance species analysis. These analyses were completed via interviews, literature and archival research, and field sampling.

In total, 15 interviews were completed and 31 individuals provided past and present traditional use activities. All the people interviewed resided in or were from the communities of Acadia, Bear River, Gold River, or Wildcat.

The 2012 MEKS documented that Mi'kmaq traditional use activities occurred within the 2012 Project site and within 5 km of the 2012 Project. Within the 2012 Project site, it was determined that the Mi'kmaq have historically undertaken some traditional use activities, which continues. Within the greater 5 km area, lobster was found to be the most fished species followed by trout. Rabbits were found to be the most hunted species followed by deer, partridge (i.e., grouse), and pheasant. Berry picking for blueberries, raspberries, and blackberries was also documented during interviews.

7.6.2 **2022 MEKS**

In 2022 an MEKS was completed by IES to support the Project and update the results of the 2012 MEKS. The 2022 MEKS included the following:

7.6.2.1 *Engagement*

Engagement with interested Mi'kmaq communities was completed to determine community participants. Engagement was also completed with supporting organizations.

Community engagement resulted in detailed discussions with Sipekne'katik First Nation.
No Assembly of Nova Scotia Mi'kmaq Chiefs Communities nor supporting organizations responded to the engagement requests from IES.

7.6.2.2 *Interviews*

No specific Sipekne'katik First Nation community participants were identified as having MEK data for the Study Area. IES remains hopeful and ready to respond if participants are identified through the Community Notice and after Community Elections.

7.6.2.3 *Review of Historical Information*

The Project location is in an area that has historically been used by the Mi'kmaq of Nova Scotia. Current land use is recreational (e.g., ATVing), hunting, berry picking, and limited firewood gathering.

7.6.2.4 *Site Visit*

A site visit was completed by IES in June 2022. Several flora and fauna species known to be traditionally used by the Mi'kmaq of Nova Scotia were identified on site. No concerns related to these species were identified through MEKS engagement.

7.6.2.5 *MEKS Review*

The draft MEKS was provided to Sipekne'katik First Nation for review and validation.
Refer to Appendix F for the 2022 MEKS.

7.7 Effects of the Undertaking on the Mi'kmaq of Nova Scotia

Engagement has occurred with Mi'kmaq communities and organizations in the lead up to registering the EA and will continue through the EA phase, construction planning, and the construction, operations, and decommissioning/reclamation phases of the Project. Engagement activities have included seeking a Mi'kmaq partner for the Project and sharing information about the Project, potential environmental effects as well as potential mitigations measures that could be employed to avoid/minimize potential effects. While this engagement has not resulted in extensive two-way dialogue outside of a Project partner, Sipekne'katik First Nation, Wedgeport Wind will continue to engage with the Mi'kmaq of Nova Scotia through the life of the Project.

The 2022 and 2012 ARIA both concluded that there is low potential for First Nations archaeological resources on site. The current Project layout generally overlaps the 2012 Project layout (Figure 2; Appendix A).

The 2012 MEKS (Appendix E) identified Mi'kmaq traditional use activities occurring within the 2012 Project site and concluded that there is potential the 2012 Project could affect Mi'kmaq traditional use of the area, specifically commercial fishing in the Tusket Falls area. Please note that unlike the 2012 EARD, the proposed Project does not include the transmission line to the

Tusket Falls area, but rather the current transmission line follows an electrical and communications right of way alignment and will share transmission poles with the existing distribution line.

The 2012 MEKS recommends that the Project consider the interest the Mi'kmaq have in the area. The 2022 MEKS (Appendix F) also notes historical use of the Project Area by the Mi'kmaq of Nova Scotia and no changes to the conclusions of the 2012 MEKS were identified.

The Project Area consists of predominately private land and some Crown land. Recreational use of the land (e.g., hunting, ATVing etc.) has been documented. Once the Project is developed, access to the private lands will be restricted for 35 years during operations (via gates), as per Wedgeport Winds agreements with landowners. For portions of the Crown land that are being used for the Project, Wedgeport Wind will work with the Province of Nova Scotia to determine appropriate access to Crown land as well as safety measures to protect the Mi'kmaq of Nova Scotia and members of the public. Following the operations period, the Project will be decommissioned, and the site will be reclaimed which will aim to revert land back to existing conditions.

Wedgeport Wind is committed to continued engagement with Mi'kmaq communities and organizations throughout the life of the Project and will ensure Mi'kmaq interests are considered during all phases of the Project.

Mitigation measures and monitoring associated with related Valued Environmental Components (VECs; Section 10.3) are key to avoiding effects on the Mi'kmaq of Nova Scotia, as detailed in each VEC section (Section 13). The Project has been planned to minimize footprint disturbance and impacts to the Mi'kmaq of Nova Scotia. While there are limited expected indirect effects on the Mi'kmaq of Nova Scotia based on the assessment of effects for related VECs, this evaluation is based on the implementation of the proposed mitigation and associated monitoring as a result of direct effects as outlined in the VEC sections (Section 13). These mitigation measures are not repeated in detail in this section but generally include: obtaining wetland/watercourse alteration approvals, implementing erosion and sedimentation control, controlling dust, maintaining regulatory setbacks, meeting regulatory guidelines (e.g., noise and shadow flicker), and completing post construction bird and bat mortality monitoring.

There are also direct proposed mitigation measures to reduce impact on traditional practices and Mi'kmaq archaeological features (if identified), as follows:

- Support Mi'kmaq review of the EARD by making the project team available to provide additional information about the Project, answer questions or facilitate discussion with interested Mi'kmaq Nations, organizations or individuals;
- Continued engagement with the Mi'kmaq to understand traditional use of the Project Area and receive feedback on EA conclusion and impacts;
- Provide the Mi'kmaq of Nova Scotia an opportunity to walk the Project Area with Wedgeport Wind to identify and document sensitive sites prior to construction;
- Allow the Mi'kmaq of Nova Scotia to harvest traditional plants prior to clearing the Project footprint;
- If archaeological deposits or human remains are encountered during construction activities associated with the Project, all work in the associated area(s) will be halted and immediate contact made with the Nova Scotia Special Places Program and with the KMKNO Archaeological Division;
- Develop a Mi'kmaq Communication Plan that outlines an ongoing two-way communication process throughout the life of the Project;
- Develop a Complaints Resolution Plan;
- Provide a tour of the Project to the Mi'kmaq of Nova Scotia, once in operations;
- Wedgeport Wind would like to ensure there are various opportunities for Mi'kmaq participation in the Project (e.g., opportunities to participate in environmental monitoring); and
- Wedgeport Wind will continue to engage with the Mi'kmaq for the life of the Project.

Mitigation measures and conclusions relating to impacts to traditional practices will continue to be evaluated directly with Mi'kmaq communities throughout the EA process, and throughout the life of the Project.

Lastly, Sipekne'katik First Nation is a Project partner; therefore, the Project is anticipated to have a positive effect on this community.

8 PUBLIC ENGAGEMENT

In person meetings between local landowners and Don Bartlett of B6 Consulting were conducted to discuss the Project and opportunities to get involved in the Project. Follow up phone calls to the landowners were completed in December 2021 to provide a Project update, discuss Project activities, provide information on the RBP, and upcoming activities in 2022.

A webpage was published for the Project on March 21, 2022, at http://elementalenergy.ca/portfolio/wedgeport-wind-farm/. The webpage identifies a lead contact with an email and phone number to ask questions or provide feedback.

8.1 Public Information Session

Public information sessions allow Wedgeport Wind to inform the general public about a proposed Project and allow interested members of the public the opportunity to view information and speak directly with Wedgeport Wind and the EA Project Team. This allows one-on-one discussions to answer questions and allow for deeper, more detailed questions to be answered.

A consultation notice and public information session invitation was mailed to landowners within 1 km of the Project in late March 2022 identifying a lead contact for questions and feedback. Within the consultation notice was a public information session invitation for the general public to learn more about Wedgeport Wind and the Project, ask questions, and provide feedback. Refer to Appendix G for the consultation notice and public information session invitation.

A public information session was held at the Wedgeport & District Fire Department on April 20, 2022. The public information session provided take-home handouts of project information and maps (Appendix H), and included a series of 16 poster boards (Appendix I) on the following topics:

- Welcome
- Project Overview
- Information Wedgeport Wind Farm GP Inc
- Information on Elemental Energy
- Community Benefits
- Information why this location was chosen and the Rate Base Procurement Process
- Timeline and schedule

- Information on the provincial Environmental Assessment process and the studies that are currently underway
- Information on Sound and Noise Shadow Flicker
- Community Engagement information and contact information
- Frequently asked questions
  - How will the proposed project impact property values?
  - Does low frequency found, infrasound, or noise from wind turbines negatively impact human health?
  - Will there be any shadow and flicker effects from the Project?
  - Will there be an impact on the environment?
  - What is the lifetime of the project and what are the decommissioning plans?
- Map of the Project Area

Forty-two people attended the public information session. Attendees included the Chief Administrative Officer (CAO) and Deputy CAO of the Municipality of the District of Argyle, along with the local District 2 Councilor, Ted Saulnier and Councilor Gordon Boudreau from neighboring District 3.

8.2 Summary of Issues

The main issues that arose from the public information session are outlined as follows.

Two feedback forms were received from the public information session (Appendix J). The following table provides a summary of all issues raised during public engagement related to the Project. For each key issue identified, a summary of the Project team's response is provided along with references to sections within the EARD which more fully address the issue.

Table 8-1. Summary of Issues Raised During Public Engagement

Key Issue	Summary of Proponent Response	Primary EARD Reference
Birds and wildlife impacts	Complete flora and fauna assessments to understand baseline conditions are being completed. Once results	Section 13.3.2, 0, and 13.3.4.

Key Issue	Summary of Proponent Response	Primary EARD Reference
	of baseline studies are complete, develop mitigation strategies, if required, based on the data acquired and share strategies with stakeholders.	
Noise impacts	Concerns expressed about “grinding” sounds from turbines. Explore maintenance strategies to mitigate mechanical noise. Comply with 1 km setback requirements to residential receptors. Complete noise assessment to ensure compliance with noise regulations.	Section 13.1.3
Shadow flicker	Complete shadow flicker assessment to ensure that the regulated shadow flicker amount is not exceeded. Comply with 1 km setback requirements to residential receptors.	Section 13.5.2
Property value impacts	Share information with concerned property owners, for example Hoen (2013) study concluding "no statistical evidence that operating wind farms have any measurable impact on home sale prices."	Section 13.6.2
Setbacks from dwellings	Meet the 1 km setback requirements of the Municipality of the District of Argyle.	Section 5.4.4
Community benefits	Established a $80,000/year community benefit fund distributed to Wedgeport and Comeau's Hill. Work with local community and government to identify best use for community benefit fund. Communicated property tax benefits to local community members.	Section 5.5.

8.3 Ongoing Engagement

Wedgeport Wind is committed to maintaining open lines of communication with interested members of the general public through the life of the EA process and the construction, operational and decommissioning phases of the Project.

Wedgeport Wind will develop a Complaints Resolution Plan and create a Community Liaison Committee (CLC).

9 REGULATORY CONSULTATION

To support the EARD, the Project team consulted with the following regulatory agencies:

1. NSECC
2. NSDNRR
3. Nova Scotia Office of L'nu Affairs (OLA)
4. Nova Scotia Department of Public Works (NSDPW)
5. Environment Canada Canadian Wildlife Service (ECCC-CWS)
6. Fisheries and Oceans Canada (DFO)
7. Transport Canada (TC)
8. Nav Canada
9. Department of National Defense (DND)
10. Municipality of the District of Argyle

A Project introduction meeting was held on May 4, 2022, to inform the regulators on the Project location, EA Study Area, scope of proposed Project, site sensitivities, selection of VECs, proposed biophysical survey program, proposed archaeology survey program, proposed MEKS (to be completed by IES), and a review of the approach to Mi'kmaq and Community Engagement. This presentation was attended by Candace Quinn (NSECC) and Mark McInnis (NSECC). Table 9-1 provides complete log of all regulatory communications.

Table 9-1. Regulatory Consultation Communication Log

Department	Individual	Method	Date	Details
NSECC	Helen MacPhail	Email	March 29, 2022	Informed the EA branch of the Project and requested a meeting to formally introduce the Project to NSECC and other regulators.
	Candace Quinn Mark McInnis	Video conference	May 4, 2022	Presentation provided on the Project. Presentation included Project location, EA Study Area, scope of proposed Project, site sensitivities, VECs, biophysical survey program, Archaeology, Mi'kmaq Ecological Knowledge Study (being completed by Indigenous Environmental Services (IES)), and Mi'kmaq and Community Engagement. Copy of presentation provided.
	Candace Quinn	Email	May 5, 2022	Due to the proximity of the Project to the Tusket Islands Wilderness Area, the EA Branch recommended consulting with the Protected Areas and Ecosystems Branch (Kermit deGooyer & Oliver Maass).
	Kermit deGooyer Oliver Maass	Email	May 30, 2022	Introduced the NSECC Protected Areas and Ecosystems Branch to the Project and its proximity to the Tusket Islands Wilderness Area
	Kermit deGooyer Oliver Maass	Email	May 31, 2022	NSECC requested Project spatial files.
	Kermit deGooyer Oliver Maass	Email	May 31, 2022	Spatial files of proposed Project layout provided to NSECC
	Candace Quinn	Email	June 14, 2022	Requested call with EA branch to discuss new CWS requirements.

Department	Individual	Method	Date	Details
	Candace Quinn	Video conference	June 16, 2022	Provided EA branch with an update on the new requirements from CWS related to avifauna surveys. 2007 and 2018 CWS guidance suggest completing radar OR acoustic monitoring, therefore, MEL proceeded with only radar during the spring migration period. On May 18, 2022, MEL received an updated guidance document (CWS 2022) from NSDNRR indicating that both radar and acoustic monitoring are required. CWS also provided the 2022 guidance document on June 3, 2022. Acoustic monitoring was not completed in the spring migration monitoring window (March 15 - June 7) because MEL was unaware of this guidance document. Acoustic monitoring will be implemented in the fall. The EA Branch was also informed that requirements for EA registration in December by Natural Resources Canada do not align with CWS guidance, which requires radar and acoustic during an extended fall migration window (July 15 to November 30). Additionally, the potential for malfunctions to radar are likely to increase in colder weather within the extended window which would lead to data gaps and can be costly and take time to repair.
	Candace Quinn	Email	June 20, 2022	Requested a Project contact with DFO from the EA Branch.
	Candace Quinn	Email	June 22, 2022	EA Branch provided contact details for DFO (Laura Watkinson).
	Candace Quinn	Email	July 27, 2022	Requested a Project contact with Transport Canada and Nav Canada from the EA Branch.
	Candace Quinn	Email	July 28, 2022	EA Branch provided contact details for Transport Canada.
	Candace Quinn	Email	September 1, 2022	MEL requested information from the EA Branch on submission timing to ensure EARD is registered by in December.
	Candace Quinn	Email	September 9, 2022	EA Branch provided details on registration requirements and timeline to have the EA officially registered by December 31, 2022.

Department	Individual	Method	Date	Details
	Helen MacPhail Lynda Weatherby Bridget Tutty Kevin Turner	Video conference	October 17, 2022	Introductory One Window meeting between Wedgeport Wind and regulators to introduce the Project after the RFP award.
	Helen MacPhail	Email	October 27, 2022	EA Branch indicated that if Wedgeport Wind is or becomes responsible for any aspect of the transmission line, this information will need to be provided within in the EARD or if approved, to the EA branch in writing and may constitute a modification to the project which could require EA.
	Candace Quinn	Email	November 1, 2022	Requested details from EA Branch on complains on existing wind projects related to safety and human health to understand what concerns have been raised so that they are appropriately addressed within the EARD. November 2, 2022 – EA Branch indicated that the public concerns are typically around noise and shadow flicker. Other concerns have included separation distance, visual impacts, and ice throw.
	Candace Quinn	Email	November 17, 2022	MEL informed the EA Branch of proposed registration timing and requested additional information on registration and how to present the MEKS within the EARD. November 18, 2022 – EA Branch provided list of important dates and information on registration. Details on how to present the MEKS within the EARD were also shared. The EA Branch (via OLA) indicated to summarize the MEKS within the EARD and include the MEKS as an appendix.
	Candace Quinn	Email	November 23, 2022	NSECC EA Branch and OLA requested First Nations engagement details and the MEKS for review to assist the screenings.

Department	Individual	Method	Date	Details
	Mark McInnis	Email	November 24, 2022	EA Branch indicated a change in EA Officer reviewing the proposed EARD and requested an update on registration timing. November 24, 2022 – MEL responded and informed the EA Branch of a proposed January registration.
	Kermit deGooyer	Email	February 1, 2023	NSECC requested meeting to discuss the Project and its proximity to the Tusket Islands Wilderness Area.
	Mark McInnis	Email	February 23, 2023	Notified EA Branch of updated registration timing.
	Kermit deGooyer Peter Labor	Call	February 28, 2023	Wedgeport Wind provided a Project overview and the setback distances proposed to be maintained between the Tusket Islands Wilderness Area and clearing activities (20 m) and WTGs (100 m). The WTG setback will ensure turbine blades do not cross property boundaries. The footprint of disturbance has been minimized to the extent practicable and the Project layout was designed to minimize impact to sensitive environmental features (e.g., wetlands) and the 1,000 m setback to residential receptors. Wedgeport Wind indicated that access will be restricted via gates and committed to working with the Protected Areas branch to install signage at the WTGs in proximity to the protected area. NSECC recommended that all efforts be taken to minimize footprint of disturbance and to assess impacts. NSECC suggested reviewing research from John Kearny regarding migratory birds and inquired about the need to use Crown land. Wedgeport Wind indicated that the Crown land is important to the Project.
Office of L'nu Affairs	NA	Email	May 9, 2022	Provided an introduction to the proposed Wedgeport Wind Farm Project with a consultation notice document, public information session posters, and project information handouts detailing the location, capacity, schedule, and project activities of the Wedgeport Wind Farm Project. Extended an invitation to meet.

Department	Individual	Method	Date	Details
	Kendra Gorveatt	Video conference	October 17, 2022	Introductory One Window meeting between Wedgeport Wind and regulators to introduce the Wedgeport Wind project after the RFP award.
	Kendra Gorveatt	Email	November 23, 2022	NSECC EA Branch and OLA requested First Nations engagement details and the MEKS for review to assist the screenings.
NSDNRR	Janel Hayward	Video conference	May 10, 2022	Office of L'nu Affairs forwarded Wedgeport Wind's introductory email from May 9, 2022, to Janel Hayward. Janel Hayward responded to Wedgeport Wind's request to meet. Introduced the Wedgeport Wind Farm Project and discussed engagement methods undertaken by Wedgeport Wind, including following the 6-step Proponent's Guide to Mi'kmaq consultation. Discussed Wedgeport Wind's role in crown consultation with Mi'kmaq. Discussed the previously completed MEKS for the project and the need for a new study. Janel followed up with a sample Mi'kmaq engagement report table of contents to use as a guide to support how engagement efforts are tracked.
	Dr. Donna Hurlburt	Email	May 11, 2022	Provided the ACCDC report and Project Study Area spatial file to NSDNRR. Requested additional details on location sensitive species (i.e., confirm observation details (species occurrence vs hibernacula) and distance/direction from Study Area).
	Sian Williams Mark McGarrigle	Email	May 13, 2022	Provided proposed bird survey methodology to NSDNRR, for review.

Department	Individual	Method	Date	Details
	Sian Williams Mark McGarrigle	Email	May 18, 2022	NSDNRR indicated that proposed survey methods and timing windows look good. NSDNRR flagged the lack of proposed acoustic monitoring for birds and suggested an extended fall migratory period. NSDNRR provided the Environment and Climate Change Canada's Canadian Wildlife Service (Atlantic Region) - Wind Energy & Birds Environmental Assessment Guidance Update (April 2022). NSDNRR also looked at the ACCDC bat record and confirmed that there are no hibernacula present, and that this is a single siting of a bat at a possible summer roost. NSDNRR recommend surveys in appropriate habitat to assess the potential for maternity roosts and noted that no information was provided on bat acoustic and radar monitoring, which the province strongly recommends as part of any wind energy development project.
	Sian Williams Mark McGarrigle	Email	May 31, 2022	MEL informed NSDNRR that the radar will remain on site for the duration of the extended fall window (July 15 to November 30). MEL noted that referenced guidance documents (CWS 2007a; CWS 2007b; and CWS 2018) suggest radar or acoustic monitoring and MEL was unaware of the CWS 2022 document. Regarding bats, incidental surveys for bat maternity roosts and hibernacula will occur during all field surveys. Six bat acoustic monitors have been deployed within the Study Area, one of which is located on a MET tower (~30 m above ground level). These acoustic monitors were deployed on May 10/11, 2022, and will remain on site until October 31, 2022.
	Sian Williams Mark McGarrigle	Email	May 31, 2022	NSDNRR reiterated that the most recent CWS guidance (April 2022) requires both radar and acoustic.

Department	Individual	Method	Date	Details
	Mark McGarrigle	Phone	June 6, 2022	MEL notified NSDNRR that MEL will implement acoustic monitoring during the fall migration period and noted that acoustic monitoring was not completed during the spring migration period. MEL informed NSDNRR of CWS's new recommendation for common nighthawk surveys.
	Dr. Donna Hurlburt	Email	August 8, 2022	Follow up on location sensitive species request and requested NSDNRR provide details on any core habitat within the Study Area.
	Dr. Donna Hurlburt Mark McGarrigle Sian Williams	Email	August 30, 2022	Follow up on requests.
	Sarah Spencer	Email	August 31, 2022	Sarah Spencer indicated that Sian Williams is on leave. NSDNRR noted that the bat occurrence is approximately 1.3 km to the NE of the Study Area. There is no Critical Habitat for bats within the Study Area or within 5 km of the site. However, this is an important area for migratory birds, including many shorebird species.
	Sarah Spencer	Email	September 16, 2022	MEL requested that NSDNRR confirm that the Study Area is not located within core habitat for mainland moose, black ash, wood turtle, or any other SAR.
	Sarah Spencer	Email	September 26, 2022	NSDNRR indicated that there is no wood turtle or black ash core habitat in or near the Study Area. There have been moose sightings in the area including one in the Study Area, however, the Study Area is not a moose concentration area.
	Janel Hayward	Video conference	October 17, 2022	Introductory One Window meeting between Wedgeport Wind and regulators to introduce the Wedgeport Wind project after the RFP award.

Department	Individual	Method	Date	Details
DFO	Laura Watkinson	Video conference	June 23, 2022	MEL provided Project overview to DFO and informed DFO of approach for fish surveys to support the EA. MEL proposed to complete detailed habitat assessments (100 m upstream and 100 m downstream) on any watercourses proposed to be crossed and to electrofish at downstream tributaries of watercourse crossed. DFO indicated that electrofishing is not necessary for the EA and more details may be required during the Request for Review process. In the EA, DFO will require enough information to understand the potential impacts to fish. DFO suggested a desktop review to understand potential fish use of the area. It was recommended to get information of fish from locals and to review the SAR and critical habitat mapping.
ECCC-CWS	Stephen Zwicker	Email	May 12, 2022	MEL provided proposed bird survey methodology to ECCC-CWS, for review.

	Stephen Zwicker	Email	June 3, 2022	ECCC-CWS provided feedback on the proposed bird survey methodology. ECCC-CWS shared a number of survey protocols and guidelines including: • Environment and Climate Change Canada's Canadian Wildlife Service (Atlantic Region) -Wind Energy & Birds Environmental Assessment Guidance Update (April 2022) • Birds Canada Canadian Nightjar Survey: Quick – Reference Protocol Summary 2022 • Western *Asio flammeus* Landscape Survey (WAfLS) Protocol • Program for Regional and International Shorebird Monitoring ECCC-CWS indicated that the Study Area is important for waterfowl, seaduck, and shorebirds during the breeding, resting, and refueling during migration and overwintering periods. ECCC-CWS identified important staging sites in proximity to the Study Area and made the following recommendations: • Contact NSDNRR • Complete bat monitoring from April to October for two years prior to construction • Recommends that the spring migration monitoring window commence in March 15 to June 7 • Common nighthawk surveys should follow the Canadian Nightjar Survey Protocol (2022) and include eastern whip-poor-will. • Breeding bird surveys also include monitoring of shorebird potentially breeding in the salt marsh and bog habitats within the site • Recommends winter surveys be completed to see if the site supports birds during this season.

Department	Individual	Method	Date	Details
Transport Canada	NA	Email	August 16, 2022	Wedgeport Wind submitted application form, KMZ, and coordinates of a meteorological test tower for review by Transport Canada. Re-sent email on August 17, 2022, as there was an error in Transport Canada's system to receive the original email.
	NA	Email	August 22, 2022	Wedgeport Wind submitted application form, KMZ, and coordinates of corners of Project Area for review by Transport Canada.
Nav Canada	NA	Email	August 17, 2022	MEL requested meeting to discuss the Project with Nav Canada and noted that the proposed Project is located 10 km southeast of the Yarmouth Airport (YQI) and Wedgeport Wind has some questions related to the protected air space to ensure we are in compliance with all Nav Canada regulations.
	Scott English	Email	August 17, 2022	Nav Canada responded and requested a land use submission. Meeting set for August 19, 2022.
	Scott English	Video call	August 19, 2022	Nav Canada requested an application for official review.
	NA	Email	August 22, 2022	Wedgeport Wind submitted application form, KMZ, and coordinates of corners of Project Area for review by Nav Canada.
	Scott English	Email	September 12, 2022	Wedgeport Wind followed up on status of review. September 12, 2022 - Nav Canada responded and indicated that they cannot see the application. September 14, 2022 –Wedgeport Wind resent application September 15, 2022 – Nav Canada indicated that a file was created and sent for review.

Department	Individual	Method	Date	Details
	Scott English	Email	September 29, 2022	Nav Canada provided an update on the file and indicated that the majority of the site is restricted to 700’ ASL and a portion to the southeast would be further restricted to 500’ ASL. Call organized for October 5, 2022.
	Scott English	Video call	October 5, 2022	Nav Canada indicated there are two areas of concern and a number of procedures impacted. Nav Canada to work internally to understand if the procedures can be amended. Nav Canada requested specific turbine heights and locations.
	Scott English	Email	October 5, 2022	Wedgeport Wind provided Nav Canada with turbine locations and ground elevations. October 6, 2022 – Nav Canada confirmed receipt of information and informed the Wedgeport Wind that the information was sent for review.
	Scott English	Video call	October 27, 2022	Nav Canada informed the Wedgeport Wind that there are no concerns with the proposed layout/turbine heights. Nav Canada to follow up with a letter of non-objection.
	Scott English	Email	November 4, 2022	Nav Canada provided the Wedgeport Wind with a letter of non-objection.
Department of National Defense (DND)	Jeff Bateman	Email	October 7, 2022	DND asked Wedgeport Wind to confirm Nav Canada file number for review. October 11, 2022 – Wedgeport Wind and Nav Canada confirmed.
	Jeff Bateman	Email	November 3, 2022	Follow up with DND on status of Review. November 3, 2022 – DND indicated that the analysis is not yet completed but in the final phase.
	Jeff Bateman	Email	November 4, 2022	DND provided the Wedgeport Wind with a letter of non-objection.

Department	Individual	Method	Date	Details
Municipality of the District of Argyle	Eilidh Canning Reid Shephard Jared Dalziel	Video call	September 21, 2021	Discussed the Project, potential procurement opportunity with the province, and next steps with MD Argyle for regulatory approvals and permits. Discussed the opportunity of meeting with Council.
	Alain Muise	In person	October 8, 2021	Discussed the Project, potential procurement opportunity with the province, benefits to MD Argyle, engagement best practices for the local area, and general feedback received from a previously proposed project in the same area in 2012.
	Alain Muise Scott Surette Reid Shephard John Sullivan	In person and video call	March 16, 2022	Discussed project updates, milestones, and developments since the last meeting with Alain Muise (CAO) in fall through a project overview presentation, and the upcoming Nova Scotia Rate Base Procurement. Discussed the upcoming public information session in April 2022 and an opportunity to meet with Council. MD Argyle arranged a date for the Wedgeport Wind to present the Project to Council.

Department	Individual	Method	Date	Details
	Alain Muise Scott Surette Danny Muise Ted Saulnier Gordon Boudreau Guy Surette Nicole Albright Richard Donaldson Kathy Bourque Glenn Diggdon Calvin d'Entremont	Video call	April 14, 2022	Provided a project overview presentation describing the Project, Wedgeport Wind, location, community benefits, environmental studies, Rate Base Procurement opportunity, community engagement, and upcoming public information session event. Answered questions about the turbine size, noise impacts, environmental studies, and the Wedgeport Wind's public engagement strategies. MD Argyle committed to providing a letter of support for the project to support the Rate Base Procurement RFP submission.
	Alain Muise Scott Surette Ted Saulnier	In person	April 20, 2022	Members of MD Argyle Council and staff attended the Wedgeport Wind Farm Project's public information session on April 20, 2022. Community benefits, sound impacts, and community perception of the project were discussed.
	Scott Surette	Phone call	May 4, 2022	Scott Surette called Wedgeport Wind to give an update of how the project was perceived by the community after the public information session. Generally, the perception from MD Argyle's perspective is positive.

Department	Individual	Method	Date	Details
	Alain Muise Scott Surette Danny Muise Ted Saulnier Gordon Boudreau Guy Surette Nicole Albright Kathy Bourque Glenn Diggdon Calvin d'Entremont	In person	September 14, 2022	Wedgeport Wind provided a project overview and partnership update presentation since the Rate Base Procurement RFP award. The presentation outlined the project location, partnership update, environmental studies, development milestones, schedule, community benefits. Wedgeport Wind answered questions from MD Argyle relating to Sipekne'katik First Nation as project partner, property value impacts, the EA process, transmission line, community benefit fund administration, and further municipal involvement. After the meeting, Wedgeport Wind followed up over an email on September 27, 2022, providing a summary of studies for property value impacts, wind turbine noise and health impacts, and wind energy fact sheets and information for Nova Scotian municipalities.
	Alain Muise Scott Surette	Phone call and email	December 13, 2022	Wedgeport Wind provided a project update and asked about a public hearing regarding potential amendments to the MD Argyle Land Use Bylaw regarding turbine setbacks. Wedgeport Wind attended the MD Argyle Land Use Bylaw public hearing and had further discussions with Alain Muise and Scott Surette regarding potential impacts to the Project, which are not anticipated to occur. Wedgeport Wind and MD Argyle will continue sharing information regarding municipal planning initiative and Project information to ensure we are both aware of each other's business.

Department	Individual	Method	Date	Details
Department of Public Works	Don Houston	In person	February 24, 2022	Discussed the Project, potential procurement from the province, and asked for input into their process required to construct a transmission line from the Wedgeport Wind Farm to the area of NSPI's Tusket Substation. NSDPW indicated that a pole permit application would need to be submitted and did not expect any significant issues in the project obtaining a permit as long as all of their requirements are met.
	Don Houston	Phone call	March 29, 2022	Discussed the pole permit application that Wedgeport Wind submitted. Don Houston indicated that they had no major issues and he will have their permit application contact, Trevor Hall, reach out to discuss further.
	Trevor Hall	Email	April 19, 2022	Email received from Trevor summarizing internal review of application has determined no major issues.
	Pamela Mehlman-Shand Trevor Hall Don Houston	In person	May 3, 2022	Discussed the Project, Wedgeport Wind, location, Rate Base Procurement. community benefits, and transmission line pole permit application along the Department of Public Works Road ROW. Department of Public Works agreed to issue a letter for the project to support the Rate Base Procurement RFP submission.
	NA	Email	May 9, 2022	Department of Public Works issued a letter outlining there being no issues with the pole permit application provided the requirements are met. Wedgeport Wind anticipates meeting the requirements.
	Pamela Mehlman-Shand Trevor Hall Don Houston	In person, video call	September 8, 2022	Discussed next steps and timelines with the pole permit application and requirements that Wedgeport Wind will provide to supplement the application.

10 ENVIRONMENTAL ASSESSMENT METHODS

The EA methods for the Project followed general guidance provided in the *Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia* (NSECC 2021) and Canada Wildlife Service (CWS) protocols (CWS 2007a; CWS 2007b; CWS 2018; CWS 2022). Assessments were also completed in accordance with acceptable practices in EA and specific methods by Project tasks are outlined below.

The EA focusses on specific environmental components called Valued Environmental Components (VECs). VECs are specific components of the atmospheric, geophysical, biophysical, and socioeconomic, environments. VECs are not only important to a local human population but can have a national or even international profile.

10.1 Scope

The scope of the assessment for this Project included: the selection and assessment of potential VECs; evaluation of the potential Project activities interactions with VECs (both positive and negative), identification of environmental effects from Project activities, if any, for each VEC; and identification of VEC thresholds to determine the significance of residual environmental effects, if any.

The EA process then allows for the prediction of environmental effects of the proposed Project. The proponent and technical experts then identify measures that can be used to mitigate, and subsequently minimize, potential adverse environmental effects. The EA then attempts to predict if significant residual adverse environmental effects will occur once mitigation measures are implemented.

The scope, methods, and baseline environmental conditions for the Project are described in detail in Sections 11 and Section 12 in this EARD. Each potential VEC, as identified in Section 10, has been described and an evaluation on the effects of the undertaking on each VEC is presented in Section 13.

10.2 Boundaries of the Assessment

Boundaries for the assessment of the Project include both spatial boundaries and temporal boundaries. Boundaries were designed to include potential Project interactions with VECs.

10.2.1 **Spatial Boundaries**

Spatial boundaries of the EA are defined by the Project Area, Study Area, Fish Study Area, and the Project footprint (Table 10-1; Figure 3, Appendix A).

10.2.1.1 *Project Area*

The Project Area is bounded by the communities of Little River Harbour to the west, Comeaus Hill to the south, and Wedgeport to the east (Figure 3, Appendix A). The Project Area is situated south of Goose Lake and is delineated by Comeaus Hill Road along its western boundary and the Tusket Islands Wilderness Area along its eastern boundary. The Project Area is 919 ha in size and has an approximate center located at 19T 740697 m E 4845376 m N.

The Project Area was designed to include the maximum extent of expected terrestrial impacts (and in consideration of property ownership) and is defined by the boundaries of private land PIDs: 90222274, 90092578, 90092644, 90092701, 90298829, 9093055, 90295379, 90321506, 90321472, 90270018, 90321480, 90222266, 90093105, 90093287, 90093345, 90093360, 90024373, 90024498, 90093642, 90024480, 90024647, 90024613, 90024621, 90024639, 90024696, 90024795, and 90024894 as well as Crown land PIDs 90007071, 90007089, and 90007105.

10.2.1.2 *Study Area*

The Study Area is located within the Project Area and it includes the entirety of the Project footprint. The Study Area (Figure 3; Appendix A) is further defined by the buildable area for turbines (e.g., setback 1,000 m from residential dwellings) and includes buffers of various sizes surrounding the Project footprint. This Study Area captures all direct impacts from the Project. The Study Area is 353 ha in size.

10.2.1.1 *Fish Study Area*

Evaluation of fish and fish habitat was completed within the Fish Study Area, which serves as an extension of the Study Area for the purposes of fish collection. The Fish Study Area (361 ha) includes the entirety of the Study Area and two additional aquatic features to the west – Black Pond and Black Pond Brook (Figure 3, Appendix A). The Fish Study Area was defined to consider fish and fish habitat representation with the Project Area and the maximum extent of potential impacts to fish and fish habitat.

10.2.1.2 *Project Footprint*

The Project footprint includes the maximum extent of the cleared area to support Project infrastructure (Figure 3; Appendix A). The Project footprint totals 57 ha and is situated within the following private land PIDs: 90092644, 90092701, 90298829, 90093055, 90222266, 90321480, 90270018, 90024373, 90024498, 90093642, 90024480, 90024647, 90024613, 90024621, 90024639, 90024696, 90024795, and 90024894 as well as the following Crown land PIDs: 90007071, and 90007089.

10.2.1.3 *Additional Spatial Boundaries*

Expanded spatial boundaries were considered for discrete aspects of the EA. Yarmouth County and Nova Scotia were used for the purpose of data collection relating to existing conditions and evaluation of certain conditions that naturally extend beyond the Project Area (Figure 1; Appendix A).

10.2.1.4 *Assessments Per Spatial Boundary*

All assessments used the Project Area, Study Area, Fish Study Area, or Additional Spatial Boundaries for assessment, as outlined in Table 10-1.

Table 10-1. Assessments Completed per Spatial Boundary

<table>
<tr><th colspan="2">Spatial Boundary</th><th>Assessment</th></tr>
<tr><td colspan="2" rowspan="8">Project Area</td><td>Noise</td></tr>
<tr><td>Geology</td></tr>
<tr><td>Groundwater</td></tr>
<tr><td>Habitat classification</td></tr>
<tr><td>Lichens</td></tr>
<tr><td>Fauna</td></tr>
<tr><td>Avifauna[1]</td></tr>
<tr><td>Bats</td></tr>
<tr><td colspan="2" rowspan="3">Study Area</td><td>Wetlands</td></tr>
<tr><td>Surface water</td></tr>
<tr><td>Vascular plants</td></tr>
<tr><td colspan="2">Fish Study Area</td><td>Fish and fish habitat</td></tr>
<tr><td rowspan="4">Additional Spatial Boundaries</td><td rowspan="3">Yarmouth County</td><td>Socioeconomic</td></tr>
<tr><td>Visual aesthetics</td></tr>
<tr><td>Shadow flicker</td></tr>
<tr><td>Nova Scotia</td><td>Climate change</td></tr>
</table>

Spatial Boundary		Assessment
		Air quality
		Electromagnetic interference
[1]**Note**: Several avian surveys (Owl, common nighthawk, waterfowl, and spring migration surveys) occurred within and beyond the Project Area but are not carried into the Additional Spatial Boundaries.		

10.2.2 Temporal Boundaries

The temporal boundaries of the EA include the following Project phases: construction (2 years), operations and maintenance (35 years), decommissioning and reclamation (2 years).

10.3 Valued Environmental Component (VEC) Selection

The selection of VECs were based on the following:

- Technical aspects of the Project and known interactions based upon similar projects
- Regulatory policies and guidelines[3], including regulatory consultation recommendations
- Information received during engagement with First Nations and/or the public
- Scientific knowledge of the area from existing public data sources
- Professional judgement based upon expertise in EA completion across Canada

Refer to Table 10-2 for the VECs selected for evaluation.

Table 10-2. VECs Selected for Evaluation

Group	VEC	Rationale for Inclusion
Atmospheric	Climate change	The Project may have an impact on climate change.
	Air quality	Dust will be emitted during the construction and decommissioning phases of the Project.
	Noise	The Project will generate noise during all phases which may adversely affect fauna or avifauna. Assessment of noise from turbines to ensure regulatory requirements for maximum allowances are not exceeded at residences.

[3] As part of VEC selection, MEL also reviewed the NSECC Guide to Preparing an Environmental Assessment Registration Document for Wind Power Projects in Nova Scotia, revised October 2021.

Group	VEC	Rationale for Inclusion
Geophysical	Surficial and bedrock geology	Surficial and bedrock geology will be altered by the construction of the Project. Soil erosion from Project construction may increase the potential for sedimentation in adjacent water features.
	Groundwater	Project construction may alter local groundwater flow patterns.
Terrestrial	Habitat, flora, and lichens	The Project will directly impact habitat, flora, and lichens, via clearing and grubbing associated with areas cleared during Project construction.
	Fauna	Fauna may be directly or indirectly impacted by Project activities.
	Bats	Bats may be directly impacted from loss of maternity roosting habitat and from potential Project related mortality.
	Avifauna	Avifauna will be directly impacted from loss of habitat and from potential Project related mortality.
Aquatic	Wetlands	Wetlands may be directly and indirectly impacted from the Project infrastructure.
	Surface water, fish and fish habitat	Water quality, fish and fish habitat may be directly or indirectly impacted from the Project infrastructure.
Technical	Visual aesthetics	The visual aesthetics of the area will be altered by Project development.
	Shadow flicker	Assessment of shadow flicker from turbines to ensure regulatory requirements for maximum allowances are not exceeded.
	Electromagnetic interference	To ensure the Project does not create electromagnetic interference with other electrical infrastructure.
Socioeconomic	Local Economy	The local economy may be affected by Project development.
	Land use and value	Land use will be altered from Project development. Land value may be altered from Project development.
	Transportation	The Project may alter traffic on roads in proximity to the Project, creating a safety concern or other transportation issues.
	Recreation and tourism	Recreation and tourism may be affected by Project development.
	Human health	Human health may be affected by Project development.
	Cultural and heritage resources	The Project may impact cultural and heritage resources.

Group	VEC	Rationale for Inclusion
	Other undertakings in the area	The Project may affect other undertakings in the area.

10.4 Characterization of Environmental Effects

To determine the level of residual effects to each VEC that remains after mitigations are implemented, the Project team considered the magnitude, likelihood, duration, and frequency of the Projects impact. As the Project is proposed for a finite time and will be fully reclaimed, all VECs have been considered reversible (partially to fully). Table 10-3 provides a description of each characterization criteria and the degrees in which they can contribute to an effect. These criteria were defined in relation to assessing the significance of the residual adverse effects for the VECs.

Table 10-3. Characterization Criteria for Environmental Effects

Characterization	Description	Category Definitions
Magnitude	Refers to the expected size or degree of the effects compared against baseline conditions. If no average values or threshold values are identified, the magnitude determination is subjective based on literature and/or reasonable inference.	**Negligible (N)** – Differing from known average values for the existing environment/baseline conditions to a small degree, but within the range of natural variation and below a threshold value **Low (L)** – Differing from the average value for the existing environment/baseline conditions, outside the range of natural variation, and less than or equal to appropriate guideline or threshold value **Moderate (M)** – Differing from the existing environment/ baseline conditions and natural variation, and marginally exceeding a guideline or threshold value **High (H)** – Differing from the existing environment/ baseline conditions and natural variation, and exceeding a guideline or threshold value
Likelihood	Refers to the probability of the impact occurring.	**Unlikely (UL)** – expected to occur with a low degree of certainty **Possible (P)** – expected to occur with a low to medium degree of certainty **Likely (L)** – expected to occur with a medium to high degree of certainty

Characterization	Description	Category Definitions
		Almost Certain (AC) – expected to occur with a high degree of certainty
Duration	Refers to the time period over which the effects are likely to persist.	**Short-Term (ST)** – construction, decommissioning and reclamation (effects are limited to occur from as little as 1 day to 2 years) **Long-Term (LT)** – operations (35 years) **Permanent (P)** – valued component unlikely to recover to baseline conditions
Frequency	Refers to the rate of recurrence of the effects (or conditions causing the effect).	**Once (O)** – effects occur once **Sporadic (S)** – effects occur at irregular intervals throughout the Project **Regular (R)** – effects occur at regular intervals throughout the Project **Continuous (C)** – effects occur continuously throughout the Project

10.5 Determination of Significance of Effects

Table 10-4 outlines the approach to determine the significance of effects from the Project on VECs. Significance is based on the category (e.g., high, moderate, low, or negligible) for each characterization (e.g., magnitude) per VEC. Certain combinations of categories will result in a determination of a significant adverse effect, while other combinations will not. For example, a VEC with a high magnitude, almost certain likelihood, permanent duration, continuous frequency, and irreversible impact will result in a significant adverse effect.

Table 10-4. Evaluation of Significance for Adverse Effects

Magnitude	Likelihood	Duration	Frequency	Significance
Negligible	All	All	All	Not significant
Low	All	All	All	Not significant
Moderate	Unlikely Possible Likely	Short term Long term	Once Sporadic	Not significant

Magnitude	Likelihood	Duration	Frequency	Significance
	Unlikely Possible Likely	Short term Long term	Regular Continuous	Significant
	Almost certain	All	All	Significant
	Unlikely Possible Likely Almost certain	Permanent	All	Significant
High	Unlikely	Short term	Once Sporadic	Not significant
	Unlikely	Short term	Regular Continuous	Significant
	Unlikely	Long term Permanent	All	Significant
	Possible Likely Almost certain	All	All	Significant

An evaluation has been completed to determine the significance of residual effects (based upon significance criteria) for each VEC resulting in the interaction from Project activities once appropriate mitigation has been completed. Potential effects, mitigation, monitoring, and residual effect for each VEC is provided in Section 13.

11 BASELINE SURVEY METHODS

The EARD for the Project describes VECs that were identified, and the potential for interaction between individual VECs and Project activities. Methods to minimize and mitigate environmental effects resulting from the Project are provided in this document.

The Project team, through an evaluation of the VECs, identified Project environmental effects that, post-mitigation, have the potential for a residual effect on the environment. The significance of these residual effects was then determined and evaluated (Section 13).

This chapter details the following key aspects of the baseline survey methodologies:

- **Atmospheric:** weather conditions, air quality, and noise.
- **Geophysical:** geology and groundwater.
- **Terrestrial:** habitat, flora, lichens, fauna, and avifauna.
- **Aquatic:** wetlands, surface water, and fish and fish habitat.
- **Socioeconomic conditions:** economy, land use and value, transportation, recreation and tourism, human health, cultural and heritage resources, and other undertakings in the area.

11.1 Atmospheric

The following subsections describe the baseline survey methods for weather conditions, air quality, and noise.

11.1.1 Weather Conditions

Weather conditions in Nova Scotia are monitored by weather stations under the operation of ECCC, Nav Canada and various other stakeholders. Data collected from these stations includes temperature (°C), precipitation (mm), relative humidity (%), pressure (kPA) wind direction and wind speed (km/hr). Recent data from the Yarmouth Airport (YQI) (Climate ID 8206495) weather station was obtained to summarize weather conditions in proximity to the Project Area. The Yarmouth Airport weather station is approximately 8.5 km northwest of the Project Area, in the same Ecoregion, Atlantic Coast (#125) and is similar to the Project Area as both are situated along the southwestern coast of the province (Webb, 1999).

Additionally, a literature review of climate conditions within the ecoregion was completed.

11.1.2 Air Quality

As recommended by Health Canada (2016), available data from air quality monitoring stations was assessed to describe the existing environment. The Air Quality Health Index (AQHI) was assessed in Greenwood and Kentville, Nova Scotia, the nearest AQHI stations to the Project (~161 km and ~190 km northeast of the Study Area). AQHI is calculated based on values for ground-level ozone (O_3), particulate matter ($PM_{2.5}/PM_{10}$), and nitrogen dioxide (NO_2). The AQHI is a scale from 1-10+, representing the following health risk categories: Low (1-3), Moderate (4-6), High (7-10), and Very High (10+) (ECCC 2021).

Based on the type of project and limited related particulate or air quality concerns, no baseline particulate monitoring or air quality modelling were completed for the Project.

11.1.3 Noise

Health Canada (2017) defines noise as any unwanted sound and provides qualitative descriptions of community types and estimated baseline sound levels per community type. The community type in the vicinity of the Project Area was determined and based on the Health Canada guidance document, estimated baseline sound levels were determined.

For the purposes of the current Project, no onsite baseline noise monitoring was completed. Predictive modelling for operational noise has been completed (Appendix K) to ensure that the maximum allowable sound level from wind turbines at an existing residential receptor does not exceed 40 dBA (Section 13.1.3).

11.2 Geophysical

The following subsections describe the baseline survey methods for topography, geology and groundwater.

11.2.1 Topography

Topography within the Project Area was assessed via a review of the Nova Scotia Topographic Database contour lines (5 m), LiDAR, and from the completion of an elevation profile (north to south and east to west) using Google Earth (2022).

11.2.2 **Geology**

The assessment of site geology has been divided into surficial geology and bedrock geology. These are described in the following subsections.

11.2.2.1 *Surficial Geology*

A review of geologic units provided by NSDNR (Stea, et al., 1992), information available in the 2012 EARD completed by Stantec for the Project (Stantec 2012) and site observations was completed to determine characteristics of surficial geology within the Study Area.

11.2.2.2 *Bedrock Geology*

A review of the Geological Map of the Province of Nova Scotia (Keppie, 2000) and information provided in the 2012 EARD (Stantec 2012) was completed to determine bedrock geology within the Study Area.

Acid Rock Drainage (ARD) potential has been evaluated for the Project Area, based on a review of the NSDNRR ARD Risk Map (Trudell and White, 2013). In Nova Scotia, bedrock groups such as the Goldenville Formation and Halifax Formation of the Cambro-Ordovician Meguma Group are more likely to comprise acid producing rock. Exposing and physically disturbing sulphide-bearing rocks can cause ARD to develop which can negatively impact the environment and human health. Acidic runoff, with pH levels as low as 3, can be harmful for aquatic habitats and can cause fish kills. ARD can contaminate drinking water supplies with increased concentrations of toxic and carcinogenic heavy metals (The Province of Nova Scotia, 2017).

Uranium also has the potential to elevated within the Project Area. A review of the Uranium Potential Map of Nova Scotia (O'Reilly et al., 2009) was completed. According to Kennedy et al., 2020, and Health Canada Maximum Allowable Concentration (MAC), long-term ingestion of well water from bedrock aquifers with high levels (>0.02 mg/L) of uranium can cause kidney disease. No samples were collected for ARD or uranium potential testing.

11.2.3 **Groundwater**

While depth to groundwater is challenging to determine without drilling groundwater wells, a number of variables can be considered to predict groundwater levels. These variables include a review of:

- Adjacent surface water feature elevations at presumed groundwater discharge locations;

- Underlying rock type (Monzogranite);
- Hydrologic characterization (Kennedy, Drage, and Fisher, 2008);
- Information sourced from the Nova Scotia Groundwater Well Network;
  - The Nova Scotia Groundwater Observation Well Network was established in 1965 and includes 40 active well observations across the province. The closest observation sites to the Project Area are located in Hebron (063), approximately 15 km to the northwest, and Hayden Lake (059), approximately 64 km to the east. Note: These wells are situated outside of the applicable groundwater zones and information reliability is limited to average groundwater fluctuations
- Information sourced from the NS Well Logs Database;
  - The NS Well Logs Database provides information on more than 100,000 water wells in the province, including information on well locations, geology and well construction, well depth and yield. General conclusions relating to the groundwater resource in the Study Area were derived from this information.
  - To determine a more precise location for adjacent residential wells, the Nova Scotia Topographic Database (NSTDB) and aerial imagery was reviewed to identify buildings within 1 km of the Study Area.

11.3 Terrestrial

Biophysical field components of the EA were initiated in April of 2022. These field components continued through until September 2022, complying with the requirements for a *Class I* undertaking under Section 9(1A)(x) of the *Nova Scotia Environmental Assessment Regulations*. The field studies were focused on highlighting the ecological linkages within the Project Area. The field components, survey timing, and surveyors that completed the assessments are outlined in Table 11-1.

Table 11-1. Biophysical Assessment Components, Timing, and Surveyors

Survey		Date	Surveyor(s)
Vegetation Community and Classification (i.e., habitat)		April to September, 2022	Mark MacDonald John Gallop, P.Biol
Vascular Plant Surveys	Early botany	June 8 to 10, 2022	Mark MacDonald
	Late botany	September 12 to 16 and 26 to 28 2022	Mark MacDonald Emma Halupka
Lichen Survey		April 26 to 29, 2022	John Gallop, P.Biol
Wildlife Surveys	Incidental observations	Opportunistically throughout all biophysical surveys	All surveyors
	Bat acoustic monitoring	May 10 to October 31, 2022	NA
Avian Surveys	Waterfowl	April 21 to October 24, 2022	Jessica Lohnes Mark MacDonald Nick Doan Melvin Pothier
	Nocturnal Owl	April 20, May 1, and 24, 2022	
	Spring migration	April 21 to May 26, 2022	
	Breeding bird	June 8 to 30, 2022	
	Common nighthawk	June 15 and July 7, 2022	
	Fall migration	August 15 to May 1, 2022	
	Acoustic	July 15 to November 30, 2022	NA
	Radar	May 25 to November 30, 2022	NA
Wetland and watercourse evaluations		July to September 2022 and November 17, 2022.	Jeff Bonazza, Lee Pominville, Brayden Thomas, Emma Halupka, Lucas Bonner, Lee Pominville, Hannah Machat, Destin Gardner, Sadie Jacobs-Peters, Sasha Chillibeck
Fish and fish habitat assessment		July to September 2022	
Species at Risk	Incidental	All seasons	All surveyors

The following subsections describe the baseline survey methods for priority species, habitat, flora, lichens, fauna, and avifauna.

11.3.1 **Priority Species**

Assessment of wildlife and habitat was completed based on the requirements outlined in the *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSE, 2009). The priority species list was created in accordance with this guide as outlined below; and it is used for the following purposes:

- To identify which targeted surveys were recommended based on species and habitats available within the Study Area;
- To identify key detection times for targeted surveys; and,
- To inform field staff of priority species which may be encountered during biophysical surveys.

11.3.1.1 *Development of a Priority Species List*

In support of the assessment of priority species occurrences and use of the Project Area, a priority species list was created. The purpose of the priority species list is to identify a broad list of species that have the potential to be present within the Project Area. Priority species include Species of Conservation Interest (SOCI) that are not listed species under provincial or federal legislation (i.e., Committee on the Status of Endangered Wildlife in Canada (COSEWIC) species and/or ACCDC S1, S2 and S3 species or any combination thereof (i.e., S3S4 is considered a SOCI)), and Species at Risk (SAR) which are listed on the *Species at Risk Act* (SARA) and/or the Nova Scotia *Endangered Species Act* (NSESA).

Development of a priority list of species for lichen, vascular plants, mammals, birds, herpetofauna, and fish was completed based on a compilation of listed species from the following sources:

- COSEWIC and the SARA: All species listed as Endangered, Threatened, or of Special Concern;
- NSESA: All species listed as Endangered, Threatened, or Vulnerable; and,
- Conservation Rank: All Species designated as S1, S2, or S3 as defined by the ACCDC (rankings as of May 2022)

Additionally, invertebrates listed under NSESA, COSEWIC and SARA as described above, were also included in the development of the priority species list.

The priority list of species was first narrowed by broad geographic area and then further narrowed by identifying specific habitat requirements for each species. For example, if a listed species on the NSESA required karst topography and no karst topography is present inside the Project Area, this species was not carried forward to the priority species list.

The compilation of a priority species list is habitat driven, rather than observation driven (e.g., ACCDC report of Maritime Breeding Bird Atlas [MBBA]). This is based on the recognition that observation-based datasets are not comprehensive lists of species identified in any given area. As such, the information provided by observation driven sources are supplementary to the priority species list, rather than forming the basis of the priority species list.

A single desktop priority species list is developed for all seasons for the Project using the methodology provided above. The seasonality of mobile species is not used to screen species into, or out of, the desktop priority species list. All field staff reviewed the desktop evaluation for priority species prior to commencing field work to ensure they were familiar with priority species identification and their status ranks. See Table 11-2 for status rank definitions across multiple regulatory levels.

Table 11-2. Status Ranks Definitions

Protection	Status	Definition
COSEWIC	Extinct	A wildlife species that no longer exists.
COSEWIC	Extirpated	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere
COSEWIC	Endangered	A wildlife species facing imminent extirpation or extinction
COSEWIC	Threatened	A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction
COSEWIC	Special Concern	A wildlife species that may become threated or endangered because of a combination of biological characteristics and identified threats.
COSEWIC	Data Deficient	A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.
COSEWIC	Not at Risk	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
SARA	Extirpated	Species which no longer exist in the wild in Canada but exist elsewhere in the wild.
SARA	Endangered	Species facing imminent extirpation of extinction.

Protection	Status	Definition
SARA	Threatened	Species which are likely to become endangered if nothing is done to reverse the factors leading to their extirpation or extinction.
SARA	Special Concern	Species which may become threatened or endangered because of a combination of biological characteristics and identified threats.
NSESA	Endangered	A species facing imminent extirpation or extinction.
NSESA	Threatened	A species likely to become endangered if limiting factors are not reversed.
NSESA	Vulnerable	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
NSESA	Extirpated	A species that no longer exists in the wild in the Province but exists in the wild outside of the Province.
NSESA	Extinct	A species that no longer exists.
ACCDC	SX	Presumed Extirpated - Species or community is believed to be extirpated from the province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
ACCDC	S1	Critically Imperiled - Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
ACCDC	S2	Imperiled - Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
ACCDC	S3	Vulnerable - Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
ACCDC	S4	Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
ACCDC	S5	Secure - Common, widespread, and abundant in the province.
ACCDC	SNR	Unranked - Nation or state/province conservation status not yet assessed.
ACCDC	SU	Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
ACCDC	SNA	Not Applicable - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
ACCDC	S#S#	Range Rank - A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

Protection	Status	Definition
ACCDC	Not Provided	Species is not known to occur in the province.
ACCDC	Breeding Status Qualifiers	
ACCDC	Qualifier	Definition
ACCDC	B	Breeding - Conservation status refers to the breeding population of the species in the province.
ACCDC	N	Nonbreeding - Conservation status refers to the non-breeding population of the species in the province.
ACCDC	M	Migrant - Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the province.

11.3.1.2 *Additional Desktop Priority Species Review*

Several sources were used to supplement the desktop priority species list. These sources are described herein and include observations-based datasets (i.e., ACCDC data) and proximal datasets (e.g., abandoned mine openings database). Proximal datasets are those that provide information that may support the understanding of priority species in proximity to an area. For example, AMOs may support bat hibernacula, but this dataset does not represent known bat hibernacula or observations of the species.

The ACCDC houses the most comprehensive biodiversity database available in Atlantic Canada. The ACCDC compiles and distributes georeferenced data on species occurrences to governments, private industry, and academia. Additionally, the ACCDC data include conservation status ranks that are assessed in collaboration with experts. ACCDC reports provide important supplementary, observation-driven data sources including sightings of priority species recorded within 5 km and 100 km. An ACCDC report (Appendix L) was prepared for the Study Area on May 5, 2022.

When the ACCDC prepares a rare species report, they provide the user with georeferenced shapefile points of rare species records within 5 km of the center of the Study Area. However, NSDNRR has classified several species as 'location sensitive', meaning that ACCDC is not permitted to provide specific location data for these species in their reports. Concern about exploitation of location-sensitive species precludes inclusion of coordinates in the rare species reports. Location sensitive species in Nova Scotia include black ash (*Fraxinus nigra*), Blanding's turtle (*Emydoidea blandingii*), wood turtle (*Glyptemys insculpta*), peregrine falcon populations

(*Falco peregrinus, pop.1*), and any bat hibernaculum or bat species occurrence. If any of these species are present within 5 km of the center of the Project Area, the ACCDC report will simply identify that they are present but will not provide specific location data. Location sensitive species were noted in the ACCDC report, therefore, MEL consulted with NSDNRR to obtain additional information on the observation.

Additional datasets reviewed during the desktop review for priority species include:

- Lichen databases, included those provided by the Mersey Tobeatic Research Institute (MTRI), that were assessed to identify potential for priority lichen species including vole ears (*Erioderma mollissimum*) and boreal felt lichen;
- Provincial government records of AMOs were reviewed as AMOs that are uncapped and unflooded may provide bat hibernacula;
- The NSNDRR significant species and habitats database;
- Maritime Breeding Bird Atlas (MBBA)
- Canada Wildlife Service Migratory Bird Sanctuary (MBS)
- Canada Important Bird Area (IBA)
- SARA critical habitat layers
- SARA recovery strategies
- DFO critical habitat mapping
- Atlantic salmon atlas
- Freshwater fish species distribution records
- Provincial Landscape Viewer (NSDNRR, 2022) – Atlantic Coastal Plain Flora (ACPF) Buffer, Lynx Buffer, Marten Range Patches 2019, Marten Habitat Management Zones, Mainland Moose Concentration Areas, Mainland Moose Core Habitat, Black Ash Core Habitat
- Provincial Special Management Practice layers – wood turtle, vole ears, mainland moose, etc.

Additionally, NSDNRR was consulted with regarding location sensitive species recorded within the ACCDC report and the location of core habitat.

The priority species list is referenced across the various biophysical assessments and is provided in in Appendix M and the ACCDC report is included in Appendix L. Priority vascular plant species, priority lichen species, priority fauna species, and priority avifauna species are discussed in Sections 12.3, 12.3.2, and 12.3.3 as well as Appendix C-1 and N.

11.3.2 **Habitat**

The following are the desktop and field survey methods used during the habitat survey program. Defining the vegetation communities within the Project Area aided in determining different vegetation communities, and what type of species can be supported. Further, it guides biophysical surveys if unique or rare habitats are found.

11.3.2.1 *Desktop Review*

Prior to completing field assessments, several geospatial datasets were reviewed to inform the surveyors of the landscape within the Project Area. These datasets include:

- Project and Study Area Spatial Boundary;
- Nova Scotia forestry inventory;
- Nova Scotia Environment and Climate Change (NSECC) Wetland and Watercourse Inventory;
- Nova Scotia Topographic Database (NSTDB);
- Nova Scotia Department of Natural Resources and Renewables (NSDNRR) Ecological Land Classification (ELC);
- Nova Scotia Old Forestry Policy Polygons;
- 2012 EARD (Stantec 2012); and
- Aerial Imagery.

Aerial imagery and spatial files of wetland features were important in the desktop review to help estimate habitat types within the Project Area and identify if unique habitats are present. Quantum Geographic Information Systems (QGIS) was then used, in conjunction with a reclassification of the Nova Scotia forestry classification layer, to help describe the different habitats in the Project Area.

11.3.2.2 *Field Surveys*

Vegetation community assessments were completed within the Project Area by MEL Terrestrial Ecologists and occurred concurrently with the wetland delineation and rare flora inventory programs throughout the months of April to September 2022. Surveys were completed by walking meandering transects with habitat survey points established based on changes in composition and configuration of vegetation communities.

Several resources were referenced to identify vegetation communities found within the Project Area (Table 11-3). While Nova Scotia has several resources for classified forested and barren communities (Neily et al., 2010), literature is lacking for many of the non-forested communities (e.g., shrub bogs, marshes, fens etc.). By using several different classification systems, communities that were not well defined in the Nova Scotia guides were able to be classified. By merging these classifications, the communities within the Project Area can be accurately described. If Nova Scotia guides were only used, then there would be a bias towards forested and barren communities and many non-forested wetlands communities and their abundance and frequency within the Project Area would not be accurately documented.

Table 11-3 summarizes the classification systems used.

Table 11-3. Classification System Guides Used in the Surveys

Classification System	Author(s)	Vegetation Community Types Defined
Forest Ecosystem Classification System (FEC)	Neily et al., 2010	Forested uplands, forested wetlands, and woodlands.
Natural Landscapes of Maine (NLM)	Susan Gawler & Andrew Cutko, 2018	Defines forested and non-forested communities. This was used to define non-forested wetland communities within the PA.
Classification of Heathlands and Related Plant Communities on Barrens Ecosystem in Nova Scotia	Porter, Basquill, & Lundholm, 2020	Described barrens, heathlands and shrublands.

The Natural Landscape of Maine (NLM) classification was referenced and used as a guideline for non-forested wetland classification systems. Due to the geographical location of Maine and its proximity to Nova Scotia, many parallels exist between the two locations. Nova Scotia and Maine are both within the Acadian Forest region which is characterized by temperate broadleaf and mixed wood forests which are subject to coastal influences. Many of the community types described in the NLM are found in Nova Scotia and attributed to the climatic and geographic similarities between these two provinces/states. Therefore, the use of NLM to describe communities in Nova Scotia is a suitable classification system to use for these surveys. All vegetation community types encountered within the Project Area were georeferenced using a handheld GPS and the following information was collected:

- Dominant tree, shrub and herbaceous species;
- Presence of disturbance;
  - Anthropogenic (e.g., cut over)
  - Natural (e.g., windthrow)
  - None
- Approximate stand age;
  - Regenerative
  - Mature
- Representative photographs; and,
- Vegetation community and classification.

Surveyors opportunistically georeferenced and classified community types whenever a new community type was encountered. This data was then used to interpret and describe the different vegetation community types in the area. Community types were not delineated within the Project Area.

11.3.3 **Flora**

Desktop and field survey methodologies were implemented during the flora survey program and these survey methods are discussed below. Flora includes both vascular and nonvascular plants.

11.3.3.1 *Desktop Review*

Prior to undertaking the field assessment, a detailed desktop review of known flora observations and potential habitat for rare vascular plants within the Project Area was conducted. The desktop review involved four components: a review of the May 2022 ACCDC database results (Appendix L), a review of the 2012 EARD (Stantec 2012), a review of mapped wetland habitat, a review of the vegetation communities and classification, and a review of the MEL-generated Priority Species List (Appendix M). The following databases were also reviewed:

- Atlantic Coastal Plain (ACPF) buffer database;
- Mersey Tobeatic Research Institute (MTRI) vole ears (*Erioderma mollissimum*) and boreal felt lichen (*Erioderma pedicellatum*) database;
- Nova Scotia Department of Natural Resources and Renewables (NSDNRR) Significant Habitats;
- NSDNRR Significant Habitat layers;
- SARA Critical Habitat layers;
- SARA Recovery strategies; and,
- Special Management Practice (SMPs) layers.

Additionally, NSDNRR was consulted with regarding the location of black ash (*Fraxinus nigra*) core habitat in relation to the Project Area.

This background research helped inform field surveys by notifying surveyors if there is an increased likelihood of priority vascular or nonvascular species. The ecological land classifications helped inform surveyors of landscape characteristics that may shape the prevalence of priority vascular plant species. All suitable habitats, as identified within the field, were surveyed.

11.3.3.2 *Field Surveys*

Dedicated vascular plant surveys were completed within the Study Area both early and late in the growing season (June 1st to September 30th), to capture plant species with different phenological characteristics. These surveys were completed between June 8 to 10, 2022 (early botany) and September 12 to 16, 2022 (late botany) by MEL biologist Mark MacDonald. Additionally, late botany surveys were completed by Emma Halupka on September 26 to 28, 2022. Meandering transects were completed on foot and all major habitat types, including wetlands, trails, upland forests, and forestry trails, were assessed to create a species list of the general vascular species and vegetation communities present within the Study Area. Incidental observations were also recorded throughout other targeted biophysical surveys in 2022.

If a species could not be identified in the field, detailed photographs were taken to capture diagnostic features, and, if possible, specimens were collected and preserved for future identification. All priority species observed were georeferenced, counted (when possible), photographed, and their habitat was recorded. When specimens were present in tufts or in large numbers and counting the individuals became a challenge, the areas of these clumps were measured (e.g., 10 m x 10 m). The following primary references were used during the field surveys and identification process:

- Roland's Flora of Nova Scotia (Zinck, 1998);
- Nova Scotia Plants (Munro, Newell, & Hill, 2014);
- Flora of New Brunswick (Hinds, 2000);
- Go Botany (Native Plant Trust, 2020);
- Field Manual of Michigan Flora (Voss & Reznicek, 2012);
- Sedges of Maine (Matt Arsenault, 2013); and,
- Grasses and Rushes of Maine (Glen M. Mittelhauser, 2019).

Based on the vascular plant survey, a list of observed species was developed, and locations of priority vascular flora species were mapped. All plant species were reviewed to determine if they are native or invasive, and if they belong to the ACPFG.

In addition to vascular plants, a list of nonvascular plants (i.e., bryophytes) was also collected during the survey. The following resources were the primary references to help with identification in the field:

- Mosses of Eastern North America Vol. 1 & 2 (Crum & Anderson 1981);
- Mosses and Liverworts of Britain and Ireland – a Field Guide (British Bryological Society 2010); and,
- Common Mosses of the Northeast and Appalachians (McKnight., Rohrer, Ward, & Perdrizet 2013).

11.3.4 <u>Lichens</u>

The following sections outline the desktop and field survey methodologies implemented during the lichen survey program.

11.3.4.1 *Desktop Review*

Prior to the lichen field assessments, a detailed desktop review of known observations and detailed predictive habitat was reviewed. The following databases/resources were reviewed:

- ACCDC report database results (Appendix L);
- NSDNRR predictive habitat mapping for boreal felt lichen (*Erioderma pedicellatum*)
- NSDNRR Forest Inventory GIS database (Nova Scotia Department of Natural Resources 2016);
- Nova Scotia Environment and Climate Change Canada (NSECC) Wetland Inventory;
- Mersey Tobeatic Research Institute (MTRI) vole ears (*Erioderma mollissimum*) and boreal felt lichen (*Erioderma pedicellatum*) database;
- NSECC Wet Areas Mapping (WAM) and Flow Accumulation; and,
- Aerial imagery (provided by Google Earth).
- The Priority Species List (Appendix M)

This background research informs field surveys by notifying surveyors if there is an increased likelihood of priority lichen species present. During the desktop lichen survey design, surveyors screened for mature forested stands, wetlands, and forests adjacent to lakes and watercourses as these habitats have an elevated potential for rare epiphytic lichens. The forest inventory GIS database helped inform surveyors of forest characteristics, including age. Following a categorization of these habitats into groups, specific habitats were chosen for targeted lichen surveys:

- Mature forested softwood stands;
- Mature forested mixedwood stands;
- Mature forested softwood stands;
- Wetlands (i.e., swamps, fens, bogs);
- Anthropogenic (e.g., roads, quarries etc.);
- Open waterbodies; and,
- Areas with edge habitat.

11.3.4.2 *Field Surveys*

Surveys throughout all suitable habitat in the Project Area were completed by John R. Gallop, P. Biol on April 26 – 29, 2022. In addition, lichens were opportunistically searched for during the vascular plant surveys. Boreal felt lichen predictive habitat polygons, mature forested swamps, or mature stands adjacent to watercourses or lakes and areas subject to high humidity were targeted. In general, mature forested stands, either in poorly drained or well drained soils provide a higher likelihood to support rare epiphytic lichen species. Meandering transects were completed on foot and targeted mature trees appropriate for hosting priority lichen species. These trees were visually inspected, focusing on tree trunks, branches, and twigs.

The following information was collected for any priority lichen species identified during field surveys, along with a photograph and any other relevant comments:

- surveyor name,
- site location,
- weather
- date,
- scientific name,
- count,
- size,
- habitat (substrate, general habitat),
- location (waypoint in UTM NAD83).

In the event lichen specimens could not be readily identified in the field, samples were collected (when in abundance on site) in paper bags and stored for future identification. Chemical spot tests were used when necessary for identification and were completed as per methods described in Lichens of North America (Brodo et al. 2001). The following primary references were used during the field surveys and identification process:

- The Macrolichens of New England (Hinds & Hinds, 2007);
- Keys to Lichens of North America – Revised and Expanded (Brodo et al. 2016); and,
- Lichens of North America (Brodo et al. 2001).
- Microlichens of the Pacific Northwest – Volume 1 – Key to The Genera (McCune 2009a);

- Microlichens of the Pacific Northwest – Volume 2 – Key to the Species (McCune 2009b); and
- Common Lichens of Northeastern North America (McMullin & Anderson 2014).

11.3.5 **Fauna**

The following sections outline the desktop and field survey methodologies implemented during the fauna survey program.

11.3.5.1 *Desktop Review*

Prior to undertaking the terrestrial field assessment, a detailed desktop review of known fauna observations and potential habitat for fauna was completed to support the survey design. The following databases were reviewed:

- ACCDC report (Appendix L);
- Nova Scotia Department of Natural Resources and Renewables (NSDNRR) Significant Habitat layers;
- NSDNRR mainland moose shelter patches and moose concentration areas (NSDNRR 2021);
- SARA Critical Habitat layers;
- Government records of Abandoned Mine Openings (AMOs; NSDNRR)
- SARA Recovery strategies; and,
- Special Management Practice (SMPs) layers.
- Priority species list (Appendix M)
- 2012 EARD (Stantec 2012)

These databases were reviewed to determine what wildlife or habitat is potentially within the Project Area and to support wildlife survey design.

Additionally, NSDNRR was consulted with regarding additional details on the location sensitive species recorded within the ACCDC report and the core habitat in relation to the Project Area.

11.3.5.2 *Field Surveys*

Data collection on various terrestrial fauna species, such as mammals, reptiles, amphibians, and invertebrates, occurred through incidental observations. The aim of these observations was to understand which species are present within the Project Area and how they could potentially interact with the Project. Particular attention was paid to SAR and SOCI.

Direct observations of terrestrial fauna, or their signs, within the Project Area were recorded and photographed, when feasible, during all biophysical field surveys. Incidental observations were chosen as the most appropriate method as they provide the broadest coverage of the Project Area, both spatially and temporally. Rather than limiting surveys to transects, incidental observations provide a holistic and overarching understanding of wildlife on the landscape. Signs observed included features such as dens, nests, scat, tracks, and evidence of foraging. The following literature was referenced during the surveys and identification process:

- Mammal Tracks & Signs: A Guide to North American Species (Elbroch 2003);
- A Field Guide to Animal Tracks (Murie 1974);
- Dragonflies and Damselflies of the East (Paulson 2011); and
- Tracking & the Art of Seeing (Rezendes 1999)

In addition to incidental observations, during wetland and watercourse assessments, surveyors searched for and assessed for potential habitat (e.g., nesting or overwintering) of snapping turtle (*Chelydra serpentina;* COSEWIC & SARA Special Concern; NSESA Vulnerable; ACCDC S3) and eastern painted turtle (*Chrysemys picta picta;* COSEWIC & SARA Special Concern; ACCDC S4). If a turtle was observed, the Nova Scotia turtle observation card would be completed, which includes the species, number of notches, turtle sex, date and time, noteworthy observations, habitat description, location, and weather. The known distribution for wood turtle (*Glyptemys insculpta;* COSEWIC, SARA & NSESA Threatened; ACCDC S2) and Blandings turtle (*Emydoidea blandingii*; COSEWIC, SARA & NSESA Endangered; ACCDC S1) does not exist in proximity to the Project Area (ECCC 2020; ECCC 2019).

The Project Area is not located within mainland moose (*Alces alces americana*) core habitat or concentration areas, therefore, no targeted surveys for mainland moose were completed.

11.3.5.3 *Bat Acoustic Monitoring*

Bat acoustic monitoring was completed within the Project Area to confirm species presence and abundance. Acoustic bat detector locations stationed within and surrounding the Project Area are provided in Figure 7 (Appendix A).

Completion of acoustic monitoring for bats was completed between May 10 and October 31, 2022, through the installation of six Wildlife Acoustic SM4BAT FS Bioacoustic data sensors (SM4BAT). SM4BAT detectors record ultrasonic bat calls through a transducer (microphone) and record them on a compact flash card for later download and analysis (Wildlife Acoustics, 2019). Acoustic bat monitoring was conducted to evaluate relative activity patterns by species or species groups over the monitoring period within and adjacent to the Project Area.

Two specialized software systems (Kaleidoscope Pro and Analook) were used by a qualified biologist to identify recorded bat files to species or species group. Each variable was then compared with a library of reference calls collected from individual bats that had been identified to species. Subsequently, the data was reviewed by a qualified biologist in order to define the species producing the bat call.

Once identified, bat passes were analyzed for peak seasonal and temporal activity periods observed in the Project Area. Further analysis was completed to determine the abundance of migratory species (i.e., those at higher risk for mortality).

Refer to the Bat Acoustic Monitoring Baseline Report for additional details (Appendix N).

11.3.6 **Avifauna**

The following subsections describe the desktop, field survey, acoustic monitoring, and radar methodologies implemented during the avifauna survey program.

Refer to Appendix C-1, C-2, and C-3 for detailed methods of the field survey program, acoustic monitoring, and radar, respectively.

11.3.6.1 *Desktop Review*

A review of the Canada Important Bird Areas database, ACCDC report, Maritime Breeding Bird Atlas (MBBA), old forest GIS database, and Canada Wildlife Service Migratory Bird Sanctuaries (MBS) was completed to support bird survey design.

The Provincial Landscape Viewer (https://nsgi.novascotia.ca/plv/) was also reviewed to determine whether the Project Area is within, or adjacent to special features, such as protected areas. To ensure the Project Area is not located within any ecologically sensitive regions, the following databases were also reviewed:

- Nova Scotia Department of Natural Resources and Renewables (NSDNRR) Significant Habitats;
- Maritime Breeding Bird Atlas (MBBA);
- Canada Wildlife Service Migratory Bird Sanctuary (CWS-MBS);
- Canada Important Bird Area (IBA);
- SARA Critical Habitat layers;
- SARA Recovery strategies, and
- Special Management Practice (SMPs) layers.
- The 2012 EARD (Stantec 2012) was also reviewed by MEL.

Refer to Appendix C-1 for additional details.

11.3.6.2 *Field Surveys*

Based on the Wind Turbines and Birds: A Guidance Document for Environmental Assessment (EC CWS 2007a), Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (EC CWS 2007b), The Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSE 2009), Wind Turbines and Birds – Updated Guidance for Environmental Assessment and Monitoring (CWS 2018), and Wind Energy & Birds Environmental Assessment Guidance Update (CWS 2022) as well as findings from the desktop review, the following avifauna survey types were selected:

- Spring and fall migration point count surveys;
- Spring and fall migration diurnal watch count surveys;
- Breeding bird point count surveys;
- Nocturnal owl surveys;
- Nightjar surveys, and

- Waterfowl surveys.

MEL consulted with CWS and NSDNRR on the proposed methods in May/June 2022.

Refer to Appendix C-1 for additional details.

11.3.6.3 *Bird Acoustic Monitoring*

No acoustic monitoring was completed during the spring migration period (March 15 to June 7) as the guidance documents (CWS 2007a, CWS 2007b, and CWS 2018) referenced during the EA planning stage to scope the avifauna program did not require acoustic monitoring. The previously referenced guidance documents recommend radar or acoustic monitoring. NSDRR reviewed the proposed avifauna methods and requested that acoustic monitoring be completed per CWS updated guidance (CWS 2022) which was released in April 2022 (i.e., during the spring migration period) (M. McGarrigle, NSDNRR SAR Biologist, Personal Communications, May 31, 2022). MEL implemented the acoustic monitoring program for the extended fall migration window. Acoustic data was collected between July 15 and November 30, 2022.

Six Wildlife Acoustics™ Song Meter Micro acoustic sensors were placed throughout the Project Area to record the nocturnal flight calls (NFCs) of migratory birds. Data was analysed during active migration when birds make NFCs, between the end of twilight after local sunset, and the beginning of twilight before local sunrise. Analysis of the data was conducted using Rstudio (V. 2021.09.02) running program R (R Statistical Core team; V 4.0.4) and python V.3.8. Processing used custom built software to detect NFCs, developed by Dr. Kitzes at the University of Pittsburgh and software was trained using NCFs identified by John Kearney. NFCs were randomly selected for validation, visually assessed using a spectrogram, then listened to by an expert (Tabanid Consulting Ltd.) to verify their accuracy.

Refer to Appendix C-2 for the Fall Bird Acoustic Monitoring Report.

11.3.6.4 *Radar*

Due to supply chain issues, MEL was unable to secure a radar until May 23, 2022. Radar monitoring commenced on May 25 and ran to June 7 during the spring migration season, and from July 15 through November 30 during the fall migration season, per CWS guidance (CWS, 2022). While continuous radar deployment has occurred from May 25 to November 30, 2022. intermittent interruptions of data collections occurred due to extreme weather events (e.g., radar was dismantled during Hurricane Fiona) and/or technical challenges, such as power interruptions and equipment malfunction.

A Radar system for monitoring bird traffic was installed within the Wedgeport Wind Project Area, approximately 700 m west of the proposed line of turbines. The hardware was a Furuno FR-240 radar system recording to a Windows computer running the Cognitive Tracker software. The radar antennae was installed onto a wooden frame and mounted vertically to facilitate range and altitude measurements within a 25° sector, scanned vertically along the 357 to 177° beam axis, making a complete scan every two seconds. The radar range was calibrated to 2.7 km to the north.

Bird occurrences were counted within five altitude bands (< 225 m, 225 m to 450 m, 450 m to 675 m, 675 m to 900 m, and > 900 m). The 225 m height intervals were selected as the 0 m to 225 m band was considered the altitude range in which birds would be at highest risk of collision with proposed turbines (turbine blades reaching up to 195 m high, and an additional 30 m safety margin).

The Cognitive Tracker software converted radar data into bird tracks, which were subsequently used to calculate Migrating Traffic Rate (MTR). MTR was calculated to standardize the traffic rate numbers, to make radar data comparable independent of radar hardware specifications, such as antenna size or radar power. MTR is an extrapolated calculation of the number of birds per hour, flying through a one-kilometer wide corridor. Bird counts were profiled into three size categories, small (<25 g), medium (25-150 g), and large (>150g). Size profiles were estimated by comparing the maximum on-axis and cross-axis detection ranges of range-elevation plots recorded by the radar. Approximately four terabytes of data were digitized and processed into bird tracks by the Cognitive Tracker software.

Refer to Appendix C-3 for the Radar Monitoring Report.

11.4 Aquatic

The following subsections describe the baseline survey methods for wetlands, surface water, fish and fish habitat.

11.4.1 Wetlands

The Nova Scotia Environment Act (2006) defines wetlands as:

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

Wetland functions are the natural processes associated with wetlands and include, but are not limited to; water storage, pollutant removal, sediment retention and provision of nesting/breeding habitat. Functions may also include values and benefits associated with these natural processes such as aesthetics/recreation, cultural values, and subsistence production (NBDELG, 2008). The discussions of wetlands presented herein primarily uses terminology associated with the Canadian Wetlands Classification System (Warner and Rubec, 1997) or in line with the methodologies adapted by Nova Scotia for wetland delineation and functional assessment.

In Nova Scotia, wetlands are protected under the Activities Designation Regulation of the *Environment Act* and the Wetland Conservation Policy (NSE, 2019). The *Environment Act* defines a wetland as "Land referred to as a marsh, swamp, fen, or bog that either periodically or permanently has a water table at, near, or above the land surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation, and biological activities adapted to wet conditions".

Nova Scotia's Wetland Conservation Policy (NSE, 2019) applies to all freshwater and certain tidal wetlands with the objectives to prevent net loss of wetland area or function, promote wetland protection and net gain, and enhance impact mitigation efforts. Under this policy and the *Environment Act*, approvals are required to alter wetlands, with certain exceptions (e.g., area <100 m^2, specific linear developments).

The policy also provides a mechanism for the province to designate Wetlands of Special Significance (WSS), which are described in Section 11.4 and includes wetlands known to support SAR, and their residences, with legal protection under SARA include those listed as extirpated, endangered, or threatened. These same protections apply to endangered and threatened species listed under NSESA.

A desktop review and field survey were implemented during the wetland survey program and these methods are discussed below.

11.4.1.1 *Desktop Review*

A desktop review of available topographic and provincial databases, and aerial photography was completed to aid in the determination of wetland habitat in the larger Project Area and support the field assessment process within the Study Area. The NSECC Wetland Inventory Database was used to identify predicted wetland areas. The Nova Scotia Wet Areas Mapping (WAM) database, the provincial flow accumulation data set and LiDAR data was reviewed to identify potential un-mapped wetlands. A predictive WSS layer, provided by NSECC, was consulted for the presence of expected and potential WSS within the Study Area.

Stantec conducted a wetland assessment (combination of field and desktop) for much of the Project's current Study Area in 2012. MEL used these findings to support field planning and assessments.

11.4.1.2 *Field Surveys*

Following the initial desktop review, wetland field surveys were completed by MEL within the Study Area from July 2022 through September 2022. An additional assessment was completed on November 17, 2022, to determine if wetlands were present along a new collector line and access road route. The initial wetland assessments conducted by Stantec in 2012 were opportunistically verified by MEL during subsequent field surveys.

Wetland delineation and assessment took place within the growing season (i.e., June 1 to September 30), with the exception of the one assessment day on November 17. Wetland characteristics and functional assessments can be completed sufficiently during any time of the growing season, however seasonal factors were considered for the identification of priority species and their habitat. As necessary, targeted species surveys were completed within identified wetland habitat to further support functional and effects assessments. Species assemblages found within wetlands are described in respective VEC baseline sections.

Targeted wetland surveys were completed within the Study Area where previously mapped systems (i.e., NSECC Wetland Inventory Database and Stantec 2012 wetlands) were present to confirm and delineate known wetland habitat. Meandering transects were also completed across the Study Area to support efforts to delineate additional wetlands, beyond those identified in the available desktop resources. All field surveys were completed by trained wetland delineators and evaluators. Delineated wetlands that extended outside of the Study Area were only delineated to the Study Area boundary (as per predicted extent of potential indirect impacts).

Wetland delineation was conducted in accordance with the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987) and the Regional Supplement to the United States Army Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (United States Army Corps of Engineers 2012). In each wetland, vegetation, hydrology, and soils data were recorded at both wetland and upland data points on either side of the wetland boundary in accordance with the Corps of Engineers Wetland Delineation Manual (Environmental

Laboratory, 1987). Wetland classes were determined using the Canadian Wetland Classification System (Warner and Rubec 1997).

According to guidance from the US Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987), at least 50% vegetation cover must be present to be classified as wetland, as such, habitats lacking vegetation cover in observed low flow periods were described as open water features. Open water features are discussed specifically relating to fish and fish habitat in Section 12.4.2.

Wetland boundaries were documented using a handheld Garmin GPS units, with sub-5 m accuracy. Any inlet and outlet watercourses or other notable features were marked during the delineation processes. All watercourses observed within the boundaries of the wetland were mapped (Figure 1). Pink flagging tape was used to mark wetland boundaries in the field. Refer to Section 11.4.2 for more information on watercourse delineation and assessment.

In keeping with the Army Corps of Engineers (Environmental Laboratory, 1987) methodologies for wetland delineation, three criteria are required for a wetland determination to be made:

- Presence of hydrophytic (water loving) vegetation;
- Presence of hydrologic conditions that result in periods of flooding, ponding, or saturation during the growing season; and,
- Presence of hydric soils.

Hydrophytic vegetation is defined as the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanent or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present (Environmental Laboratory, 1987). Hydrophytic vegetation should be the dominant plant type in a wetland habitat (Environmental Laboratory, 1987).

Dominant plant species observed at each data point were classified according to their indicator status (probability of occurrence in wetlands) in accordance with the Nova Scotia Wetland Indicator Plant List. Further relevant information was reviewed in Flora of Nova Scotia (Roland 1998) and Nova Scotia Plants (Munro, Newell & Hill 2014).

If the majority (greater than 50%) of the dominant vegetation at a data point is classified as obligate (OBL), facultative wetland (FACW), or facultative (FAC) (excluding FAC-), then the location of the data point is considered to be dominated by hydrophytic vegetation.

A hydric soil is defined as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in its upper strata (United States Department of Agriculture 2003). Indicators that a hydric soil is present include soil colour (gleyed soils and soils with bright mottles and/or low matrix chroma), aquic or preaquic moisture regime, reducing soil conditions, sulfidic material (odor), soils listed on the hydric soils list, iron and manganese concretions, organic soils (histosols), histic epipedon, high organic content in surface layer in sandy soils, and organic streaking in sandy soils.

A soil pit was completed at each data point. These pits were excavated to a depth of 40 cm or refusal. The soil in each pit was then examined for hydric soil indicators. The matrix colour and mottle colour (if present) of the soil were determined using the Munsell Soil Colour Charts.

Wetland habitat, by definition, either periodically or permanently, has a water table at, near, or above the land surface or has persistent near-surface saturation. To be classified as a wetland, a site should have at least one primary indicator or two secondary indicators of wetland hydrology. Examples of primary indicators of wetland hydrology include surface saturation, watermarks, drift lines, and water-stained leaves. Examples of secondary indicators of wetland hydrology include oxidized root channels, dry season water table, and stunted or stressed plants. Each area of expected wetland habitat was assessed for signs of wetland hydrology through observations across the area and assessment of soil pits at each data point. Data determination forms describing vegetation cover, soil characteristics, and hydrology indicators were collected for each wetland and adjacent upland habitat. This data is available to support wetland alteration applications in the permitting phase of the Project.

Priority species (i.e., SAR and SOCI) surveys were completed in suitable habitat throughout the respective assessment areas (see Section 10.2.1), including wetland specific priority species surveys and habitat potential, and according to species-specific methodologies (e.g., both early and late season botany surveys, avian migration and breeding surveys). Information on these baseline survey methods, including survey locations and timing, and species observed, can be found in the respective VEC baseline sections. It should be noted that, while it was not possible to confirm a species' absence from the landscape if unobserved, all care was taken to identify the presence of preferred SAR habitat and target survey effort accordingly.

11.4.1.3 *Functional Assessment*

Wetland functional assessments were completed for any field delineated wetlands proposed to be directly impacted or within a conservative extent of reasonable potential for indirect impacts (e.g., within 30 m of planned Project infrastructure). Functional assessments were completed for 13 wetlands within the Study Area using the Wetland Ecosystem Services Protocol – Atlantic Canada (WESP-AC) evaluation technique. The WESP-AC process involves the completion of three forms; a desktop review portion (Office Form) that examines the landscape level aerial conditions to which the wetland is situated, and two field forms identifying biophysical characteristics of the wetland (Field Form) and stressors to the wetland (Stressors Form), if any. The process serves as a rapid method for assessing individual wetland functions and values. WESP-AC addresses 17 specific functions that wetlands may provide (Table 11-4).

The specific wetland functions are individually allocated into grouped wetland functions and measured for "functional" and "benefit" scores. Wetland function relates the wetland's natural ability (i.e., water storage), whereas wetland benefits are benefits of these functions, whether it is ecological, social, or economic. The highest functioning wetlands are those that have both high 'function' and 'benefit' scores for a given function. WESP-AC enables a comparison to be made between individual wetlands within a province to gain a sense of the importance each has in providing ecosystem services.

Table 11-4. WESP-AC Function Parameters

Grouped Wetland Function	Specific Wetland Functions
Hydrologic Function	Surface Water Storage
Aquatic Support	Aquatic Invertebrate Habitat
	Stream Flow Support
	Organic Nutrient Export
	Water Cooling
Water Quality	Sediment Retention & Stabilization
	Phosphorus Retention
	Nitrate Removal & Retention
	Carbon Sequestration
Aquatic Habitat	Anadromous Fish Habitat
	Resident Fish Habitat

Grouped Wetland Function	Specific Wetland Functions
	Waterbird Feeding Habitat
	Waterbird Nesting Habitat
	Amphibian and Turtle Habitat
Terrestrial Habitat	Songbird, Raptor, & Mammal Habitat
	Pollinator Habitat
	Native Plant Habitat

In addition to the grouped wetland functions above, WESP-AC also measures the following specific wetland functions, however, these are only evaluated by their benefit scores:

- Wetland Condition; and
- Wetland Risk (i.e., sensitivity to potential impacts).

The following individual functions are assessed to determine the benefit scores associated with each wetland:

- Public Use & Recognition;
- Wetland Sensitivity;
- Wetland Ecological Condition; and
- Wetland Stressors.

For each wetland evaluated, the WESP-AC process calculates the overall score for the seven grouped wetland functions and the 17 specific wetland functions listed in Table 11-4. One score each is provided for function and benefit. Scores are ranked as 'Lower', 'Moderate', or 'Higher', allowing for analysis of the wetland as compared to calibrated baseline wetland scores in Nova Scotia to date. A 'Higher' WESP-AC score means that wetland has a greater capacity to support those processes as compared to other wetlands in the province. A 'Higher' WESP-AC score in both the function and benefits category means the wetland supports the natural ecosystem functions and provides services with potentially societal importance.

The WESP-AC Functional WSS Interpretation Tool is discussed in Section 11.4.1.4. A summary of the WESP-AC results is provided in Appendix B. The raw WESP-AC Excel files can be provided to the NSECC Wetland Specialist(s) upon request and/or through the permitting process.

The WESP-AC functional evaluation technique recognizes that, in many cases, delineation of entire wetlands where they extend beyond a Study Area is not always feasible (e.g., property ownership) or required to complete an appropriate assessment using this tool (NBDELG 2018). Instead, WESP-AC permits the delimitation of an Assessment Area (AA), defined as the wetland or portion of wetland physically assessed in the field, while the Office Form considers the broader landscape characteristics and functions that extend beyond the AA and/or Study Area.

11.4.1.4 *Wetlands of Special Significance*

The Wetland Conservation Policy was developed by Nova Scotia Environment in 2011 and amended in 2019 (NSE, 2019). Its mandate is to provide a framework for the conservation of wetlands. Furthermore, it provides a framework for the identification of WSS. According to NSECC (2019, p.11-12), the following criteria may define Wetlands of Special Significance:

- All salt marshes;
- Wetlands that are within or partially within a designated Ramsar site, Provincial Wildlife Management Area (Crown and Provincial lands only), Provincial Park, Nature Reserve, Wilderness Areas or lands owned or legally protected by nongovernment charitable conservation land trusts;
- Intact or restored wetlands that are project sites under the North American Waterfowl Management Plan and secured for conservation through the NS-EHJV;
- Wetlands known to support at-risk species as designated under the federal *Species at Risk Act* or the *Nova Scotia Endangered Species Act*; and,
- Wetlands in designated protected water areas as described within Section 106 of the Environment Act.

NSECC Wetland Specialists have provided guidance that the presence of a sessile or mobile SAR within a delineated wetland triggers the determination of that wetland as a WSS, unless it can be clearly demonstrated that the wetland does not provide suitable habitat for the SAR (mobile species). These may be field observed or from a database. During WSS determination assessments MEL considers species-specific and site-specific conditions, including the following factors:

- whether the species was observed during field surveys within the wetland;
- whether the species was observed historically (e.g., ACCDC) within the wetland and the temporal and spatial accuracy of the observation point; and,
- whether suitable habitat is present within the wetland, in consideration of:

- what the wetland habitat is used for (i.e., does the habitat provided within the wetland provide necessary life functions (i.e., nesting, or overwintering habitat)); and,
- the discreteness or specificity of habitat use by the mobile species (i.e., wood turtles have specific and discrete nest beach requirements, compared with the in-discrete and non-specific foraging habitat usage by mainland moose, for example).

A framework for determination of WSS designation based on functional benefit using WESP-AC has recently been developed and implemented by NSECC in August 2021. A Functional WSS Interpretation Tool automatically assesses the subject wetland based on the WESP-AC functional results. The grouped functions in Table 11-4 are used to calculate a "Functional Benefit Product" (FBP). The FBP is categorized into scores of "low", "moderate" and "high". The thresholds for these categories are calibrated by WESP-AC assessments across Nova Scotia. These categories are used to create WSS determination rules. The grouped functions are further combined into "supergroups" for habitat (Aquatic Habitat and Transition Habitat) and support (Hydrologic Support, Water Quality Support and Aquatic Support) functions. The wetland could be designated as a WSS if certain 'high' or combination of 'moderate and 'high' scores are satisfied within these supergroups.

NSECC has also developed a WSS predictive GIS layer (Ian Bryson, former NSECC Wetland Specialist, Personal Communications September 2020), which was consulted during the desktop evaluation for wetlands prior to field delineations by MEL. The layer overlies mapped wetlands with protected areas layers, and rare species observations from ACCDC, among other attributes. According to NSECC, this WSS GIS layer is intended to be used as a planning tool and should be interpreted as potential WSS, as it incorporates all ACCDC rare species observations which fall within NSECC mapped wetlands, regardless of the species' ranking or status, positional accuracy of the data points, observation date, etc. As such, it is used as a predictive tool only to support WSS determination.

Final WSS designation will be determined by NSECC with guidance from data collected through Project field surveys. The Project Team will continue to engage with NSECC to discuss WSS designation on a site-specific basis.

11.4.2 Surface Water, Fish and Fish Habitat

The Nova Scotia *Environment Act* requires that an approval from NSECC be obtained before any watercourses or water resource can be altered, including the flow of water (Environment Act c.1, s.1, 1994-95). Therefore, it is necessary to understand what watercourses and water resources are present within the Study Area prior to development.

The Nova Scotia Environment Act (2006) defines a watercourse as:

> "Any creek, brook, stream, river, lake, pond, spring, lagoon, or any other natural body of water, and includes all the water in it, and also the bed and the shore (whether there is actually any water in it or not".

Using this guidance, watercourses have been identified and described throughout the Study Area to support the description of fish habitat, and effects to regulated watercourses which may require provincial approval.

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".

Within the *Fisheries Act*, activities which result in the harmful alteration, disruption or destruction (HADD) of fish habitat are prohibited. Under Section 35(2) of the *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.

Throughout this EARD, fish habitat is described in the context of watercourses. The Nova Scotia *Environment Act* defines a watercourse as:

(i) the bed and shore of every river, stream, lake, creek, pond, spring, lagoon or other natural body of water, and the water therein, within the jurisdiction of the province, whether it contains water or not; and,
(ii) all groundwater.

While groundwater is included in the regulatory definition of a watercourse under the *Environment Act*, this section focuses on surface water features in the context of fish habitat provision. In addition to the above-mentioned definition and in accordance with the Guide to Altering Watercourses (NSE 2015), the watercourse parameters listed in this document were used to aid in determining the presence of a watercourse.

Refer to Section 11.2.3 for groundwater assessment methods.

The following desktop and field survey methodologies were implemented during the surface water, fish and fish habitat survey programs and are discussed below.

11.4.2.1 *Desktop Review*

The goal of the surface water desktop evaluation was to identify where watercourses, waterbodies, and drainage features are located within or in proximity to the Fish Study Area based on mapped systems, topography, and satellite imagery, while also identifying where the Fish Study Area lies within primary and secondary watersheds. Prior to completing the field evaluation, MEL reviewed all Nova Scotia Topographic Database (NSTDB) mapped watercourses and waterbodies, provincial flow accumulation data, and depth to water table mapping to identify potential surface water features within the Fish Study Area.

A priority species list was used to identify priority fish species that may occur in the Fish Study Area (Appendix M). Information on confirmed and potential fish presence within the Fish Study Area and surrounding surface water features was collected from the following sources:

- ACCDC Report (as presented in Appendix L);
- NSL&F Significant Species and Habitats database;
- Aquatic Species at Risk Map (DFO 2022);
- Fisheries and Oceans Stock Status Reports;
- Description of Selected Lake Characteristics and Occurrence of Fish Species in 781 Nova Scotia Lakes (Alexander, Kerekes, and Sabean 1986);
- Nova Scotia Salmon Atlas (2022);
- Freshwater Fish Species Distribution Records (NSDFA 2019); and
- Nova Scotia Department of Fisheries and Aquaculture (NSDFA) Lake Inventory Maps.

In addition to the sources listed above, the 2012 EARD (Stantec 2012) was reviewed for previous fish and fish habitat characterization within and near the Fish Study Area.

11.4.2.2 *Field Surveys*

During the field program, teams of MEL biologists completed baseline field delineation of watercourses and wetlands, electrofishing, trapping, and preliminary fish habitat characterization in aquatic features with potential to be directly and indirectly affected by Project development.

This section summarizes the methods used during evaluation of fish and fish habitat at linear watercourses, waterbodies, and wetlands in 2022. While the Study Area (Figure 3, Appendix A) is considered the spatial boundary for all wetland and watercourse delineation completed for the Project, additional evaluation of fish and fish habitat was performed within a distinct spatial boundary ("Fish Study Area"), which serves as an extension of the Study Area for the purposes of fish collection. The Fish Study Area (361 ha) includes the entirety of the Study Area and two additional aquatic features to the west - Black Pond and Black Pond Brook (Figure 3, Appendix A). The Fish Study Area was defined to consider fish and fish habitat representation with the Study Area and the maximum extent of potential aquatic impacts. The following discussion of surveys completed will differentiate which spatial boundary they were completed within.

Prior to the commencement of the field program, MEL consulted with DFO on the proposed field survey methods (L. Watkinson, DFO, Personal Communications, June 23, 2023).

11.4.2.3 *Watercourse Delineation*

Watercourse delineation and site drainage characterizations were completed throughout the Study Area in conjunction with wetland delineation and evaluation.

During the field evaluations, MEL used NSECC guidance on watercourse determinations to identify watercourses (NSE, 2015a). The following parameters were used to define watercourses:

- Presence of a mineral soil channel;
- Presence of sand, gravel and/or cobbles evident in a continuous pattern over a continuous length with little to no vegetation;
- Indication that water has flowed in a path or channel for a length of time and rate sufficient to erode a channel or pathway;
- Presence of pools, riffles or rapids;

- Presence of aquatic animals, insects or fish; and,
- Presence of aquatic plants.

According to guidance provided by NSECC, any surface feature that meets two of the criteria above meets the definition of a provincially regulated watercourse. General reconnaissance was conducted via meandering transects within the Study Area by qualified MEL biologists. Any identified watercourses were flagged in the field with blue flagging tape and mapped using a Garmin GPSMAP 64s unit (capable of sub-5m accuracy).

Watercourse identification and description, as well as wetland delineation and evaluation were completed across the Study Area in accordance with Nova Scotia standards for identification of watercourses and wetlands. Watercourses identified within the Study Area were characterized using a MEL field form. The field form included general survey data such as Project name, date, crew member names, weather, watercourse identification information, and stream order. Flow type, entrenchment, gradient, and water quality parameters were also be recorded. Measurement of substrate types, cover, description of riparian habitat, and physical channel measurements (depth, wetted, and bankfull widths) were recorded.

A detailed account of wetland delineation methods are provided in Section 11.4.

Each of the systems identified was evaluated for the presence of fish habitat and potential ability to support fish species during initial identification. Qualitative, rapid fish habitat assessments were carried out at each delineated watercourse using internal MEL protocols. Watercourse descriptions included a characterization of the flow regime (perennial, intermittent, ephemeral), estimates of gradient and velocity, channel widths, water depths, and a description of substrate composition, habitat types (i.e., riffle, run, pool) and cover types (i.e., emergent and submergent vegetation, overhead cover, woody debris, etc.).

Fish habitat is described in the context of any aquatic feature which is contiguous with a fish bearing system, whether it is located within a watercourse, wetland, or waterbody. Throughout this report, fish habitat is described in the context of watercourses and wetlands, as no waterbodies were identified within the Study Area. Where fish habitat is present in a watercourse which flows through a wetland in an entrenched channel, that habitat is described in the context of the watercourse. Where fish habitat is present in a wetland, but outside of an entrenched channel, it is described in the context of the wetland (accessible to fish, or open water feature if that feature is largely un-vegetated).

The results of baseline wetland and watercourse delineation were used to inform sampling locations for fish collection.

11.4.2.4 Water Quality

In-situ water quality measurements were recorded at all 2022 electrofishing and trapping sites prior to each sampling event. In addition, water quality measurements were recorded opportunistically during wetland and watercourse delineation. These water quality measurements were collected using a calibrated YSI Multi-Probe water quality instrument or a combination of a Myron Ultrapen DO Pen Probe and Hannah Combo pH/Conductivity/TDS Probe at the time of the sampling event/survey.

11.4.2.5 Fish Collection

11.4.2.5.1 Electrofishing

Qualitative electrofishing surveys were performed in aquatic features with the goal of evaluating fish species presence and relative abundance under DFO Scientific License #341208.

Electrofishing was completed using internal MEL Standard Operating Procedures (SOP) for fish collection. The methods and data collection forms outlined in the SOP were developed using the following sources:

- A review of fish sampling methods commonly used in Canadian freshwater habitats (Portt et al. 2006);
- New Brunswick (NB) Aquatic Resources Data Warehouse, the NB Department of Natural Resources and Energy, and the NB Wildlife Council (2002, updated 2006); and
- Fisheries and Oceans Canada's Interim Policy for the Use of Backpack Electrofishing Units (2003).

Fisheries and Oceans Canada's Interim Policy for the Use of Backpack Electrofishing Units (2003) was reviewed and followed by all members of the electrofishing crew. This document provides a detailed list of standard equipment, safety, training, and emergency response procedure requirements for electrofishing. Each electrofishing crew consisted of two individuals, one of which (the crew lead) was a qualified person as defined under the DFO Interim Electrofishing Policy. The crew lead is responsible for operating the backpack electrofisher according to their training and the Policy, and for communicating safety policies and electrofishing procedures to the second crew member.

Fish were sampled using a Halltech Battery Backpack Electrofisher (HT-2000) with un-pulsed direct current (DC). A crew member walked alongside the electrofisher operator to net any stunned fish using a D-frame landing net (1/8” mesh). All captured fish were held in a live well containing ambient stream water, which was kept out of the sun and fish were checked regularly for any signs of stress. At the conclusion of each pass, fish in the live well were identified (species confirmation), weighed, and measured for length. After recuperating, all fish were released back into the watercourse.

Qualitative electrofishing surveys were performed using an “open” site methodology with no barrier nets. One pass with a backpack electrofisher was performed unless crew members noted a high number of fish that evaded capture. In that case, a second or third pass was performed to obtain greater species representation. In the Salmonid Field Protocols Handbook: Techniques for Assessing Status and Trends in Salmon and Trout Populations, Temple and Pearsons (2007) describe the use of single-pass electrofishing without barrier nets and provide a summary of academic reports supporting this method (Johnson et al. 2007). Though the technique does not support estimates of absolute abundance or population estimates, research has found that single-pass electrofishing works well to determine species richness (Simonson and Lyons 1995), and relative abundance (Kruse et al. 1998). Qualitative species abundance estimates were calculated using electrofishing Catch Per Unit Effort (CPUE) indices, standardized to 300 seconds of effort (Scruton and Gibson 1995).

The following three sampling reaches were selected for electrofishing surveys in linear watercourses within the Fish Study Area:

- Black Pond Brook 1;
- Black Pond Brook 2; and,
- WC7.

These three reaches were selected based on suitability of the habitat to conduct electrofishing surveys (i.e., deep enough to submerge the anode), fish habitat potential and access considerations. All are first order streams. Additional electrofishing planned for systems adjacent to the Fish Study Area including watercourses and open water features in proximity to Little River Harbour and Goose Bay. After field reconnaissance, these sites were abandoned due to extreme conductivity which would make electrofishing impossible. Dry conditions or minimal water levels within these systems excluded trapping as a viable fish collection option. Fish collection efforts were further hindered within the Fish Study Area by minimal water levels, subterranean flow, and accessibility for fishing equipment.

Details of electrofishing locations and survey dates are provided in Table 11-5. Electrofishing locations are shown on Figure 8 (Appendix A).

Table 11-5: Qualitative Electrofishing Locations and Details

Electrofishing Location	Survey Dates	Upstream Coordinates (UTM)		Downstream Coordinates (UTM)		Reach Length (m)
		Easting	Northing	Easting	Northing	
Black Pond Brook Reach 1	July 27, 2022	739474	4848209	739517	4848177	100
Black Pond Brook Reach 2	July 27, 2022	735580	4848078	739595	4848028	100
WC7	September 28, 2022	741516	4849040	741512	4848952	100

11.4.2.5.2 Trapping

Trapping was used to supplement fish collection efforts within the Fish Study Area when electrofishing was not practicable (e.g., in open water areas, unconsolidated substrate, temperatures exceeding 22°C, etc.). At each the sampling location, biologists deployed baited minnow traps and eel pots. Fyke nets were also used at Black Pond. CPUE was determined for each trap type and fish species based on trapping effort, which was calculated as total catch or total catch per species per wetted hour. All traps were soaked overnight and picked up the following day. Details of fish collection locations, survey dates, and traps deployed provided in

Table 11-6. Trap locations are shown on Figure 8 (Appendix A).

Table 11-6: Trapping Locations and Details

Trapping Location	Stream Order	Survey Dates	Traps Deployed[1] (#)
Black Pond	N/A	July 27-28	MT(12) EP(4) FN(2)
WC7	1	September 27-28	MT(6) EP(2)

[1]Trap Types – Minnow Trap (MT), Eel Pot (EP) and Fyke Net (FN).

11.5 Technical Methods

For information on methods used for the Technical Studies please refer to Section 13.5 Technical Components.

11.6 Socioeconomic

The socioeconomic environment was evaluated by reviewing background literature as well as communicating with local residents via an in-person information session which took place on April 20, 2022.

The following subsections describe the baseline survey methods for economy, land use and value, transportation, recreation and tourism, cultural and heritage resources, and other undertakings in the area.

11.6.1 Economy

To understand the economy in proximity to the Project, statistical information was obtained from the most recently available National Census data from Statistics Canada. The 2021 National Census (Statistics Canada, 2021) provided population data and the 2016 National Census (Statistics Canada, 2016b) provided economic data including labour force information on Yarmouth County, where the proposed Project is located. The updated Statistics Canada force data from the 2021 National Census will be released on November 30, 2022 (Statistics Canada, 2022). Statistics Canada's Census data for Yarmouth County was compared with Census data for the province. Additionally, a review of the 2012 EARD (Stantec, 2012) was completed.

11.6.2 Land Use and Value

A GIS specialist utilized GIS software, datasets, and aerial photos to determine present day land use in and around the Project Area. This complemented land use as determined by field biologists during the field assessment. Search results from the Nova Scotia Property Online website were used to verify land use on PID 90093055 (Nova Scotia Property Online, 2022). Additionally, a review of the 2012 EARD (Stantec 2012) was completed to better understand land use and value for the local region.

11.6.3 Transportation

A review of the Nova Scotia Department of Department of Public Works (NSDPW 2022) transportation data of provincial series highways in proximity to the Project was completed. The

2012 EARD (Stantec 2012) was also reviewed to understand transportation near the Project and in surrounding communities.

Wedgeport Wind consulted with Nav Canada to discuss the potential impact of the Project on air navigation systems and airports in the vicinity of the Project and with the Department of National Defense (Table 9-1).

11.6.4 Recreation and Tourism

Recreation and tourism data for the county of Yarmouth was sourced from Tourism Nova Scotia (Nova Scotia Tourism 2021; Nova Scotia Tourism 2022), the Yarmouth Acadian Shores (Acadian Shores Tourism, 2022), and the Yarmouth Recreation (Yarmouth Recreation, 2022). Additionally, a review of the 2012 EARD (Stantec 2012) was completed to understand recreation and tourism near the Project and surrounding communities.

11.6.5 Cultural and Heritage Resources

Cultural Resource Management Group Limited (CRM Group) was retained to complete an Archaeological Resource Impact Assessment (ARIA) for the proposed Project. This assessment consisted of three components:

- Background study
- Mi'kmaw engagement
- Archeological reconnaissance

The methodologies of these components are described below. This ARIA has been undertaken under Heritage Research Permit (HRP) A2022NS180. The final report was reviewed and accepted by the Special Places Program of Community, Culture, Tourism, and Heritage (CCTH).

Refer to Appendix O for the ARIA and CCTH acceptance letter.

11.6.5.1 *Background Study*

As part of this assessment, a historic background study was conducted. Historical maps, manuscripts and published literature were consulted. The Maritime Archaeological Resource inventory was searched. Topographic maps and aerial photographs were used in conjunction with LiDAR Digital Elevation Models to evaluate the Project footprint.

11.6.5.2 *Mi'kmaw Engagement*

As part of Mi'kmaw engagement, CRM Group contacted the Kwilmu'kw Maw-klusuaqn Negotiation Office's Archaeological Research Division (KMKNO-ARD) requesting information pertaining to historic or traditional Mi'kmaw use of the land. This information provided CRM Group with a better understanding of the cultural and archeological importance of the Project footprint.

11.6.5.3 *Archeological Reconnaissance*

CRM Group conducted a field reconnaissance of the Project footprint on November 2, 3, 4, and 24, 2022. GPS tracklogs of all reconnaissance areas were retained for records, and any sites determined to have potential for archaeological resources were recorded with photographs and GPS coordinates. The terrain and vegetation were noted in the interest of recording negative evidence for historic cultural activity.

11.6.5.3.1 2012 ARIA

As part of the 2012 EARD an ARIA was completed on the previous Project layout. Similar to the methods of the 2022 ARIA, the 2012 ARIA included a background study and field work. The background study involved a review of the Maritime Archeological Resource Inventory database and historic maps/aerial images. The field work included a pedestrian survey of seven turbine locations (2012 Turbine IDs; 1, 2, 4, 6, 9, and 20; Table 11-7).

Table 11-7. 2012 ARIA Areas Assessed in Relation to Proposed Project Footprint

2012 Turbine ID	2023 Project Footprint				
	2012 Turbine Location Overlaps 2023 Project Footprint (Y/N)	Location	Nearest Project Component	Distance to nearest Project Component (m)	Direction to nearest Project Component
1	Y	Construction pad for WTG14	NA	-	-
2	N	NA	Access road	65	E
4	N	NA	Access road	127	W
6	Y	Cleared area surrounding WTG11	NA	-	-
9	N	NA	Access road	46	E
20	N	NA	Collector line	173	N

2012 Turbine ID	2023 Project Footprint				
	2012 Turbine Location Overlaps 2023 Project Footprint (Y/N)	Location	Nearest Project Component	Distance to nearest Project Component (m)	Direction to nearest Project Component
23	N	NA	Substation	872	SE

Two of the turbine locations assessed in 2012 are located within the proposed Project footprint (Figure 2; Appendix A). The remaining five 2012 turbine areas assessed are between 46 m and 872 m of the proposed Project infrastructure. Refer to Appendix P for the 2012 ARIA report.

11.6.6 Other Undertakings in the Area

The type, size, and location of other relevant undertakings or developments in proximity to the Project was completed via a review of aerial imagery (imagery dates: 3/27/2010, 3/29/2013, 6/7/2017, 6/24/2019, and 5/5/2020) by a GIS specialist.

12 EXISTING CONDITIONS

The following sections outline the results of the baseline surveys.

12.1 Atmospheric

12.1.1 Weather Conditions

The Project Area is in the Atlantic Coastal Ecoregion (800) and the Tusket Islands (840) Ecodistrict (Neily et al., 2017) Climate in the Atlantic Coastal ecoregion is moderated by the effects of proximity to the Atlantic Ocean with short, cool summers and relatively mild, wet winters (Webb, 1999).

Records from the Yarmouth Airport (Climate ID 8206495), located 8.5 km northwest of the Project Area, were reviewed and available records from 2019-2022 are presented in Table 12-1. It is worthwhile to note that the Yarmouth Airport weather station is not in the same ecoregion as the Project Area, instead it is in the Tusket River Ecodistrict (513) of the Southwest Nova Scotia Uplands Ecoregion (124), also located near the southwestern coast of the province.

Table 12-1. 2019 to 2022 Weather Information – Yarmouth, NS

Yarmouth, NS - Weather Station #8206495	Avg. Mean Temp. (°C)	Max. Temp. (°C)	Min. Temp. (°C)	Max. Daily Precip. (mm)	Avg. Daily Precip. (mm)	Total Precip. (mm)	Max. Wind Gust (km/h)	Average Wind Gust (km/h)
2019	7.1	25.5	-14.7	78.8	4.2	1,541.7	130	51.4
2020	8.3	29.4	-14.0	68.9	2.7	999.3	118	50.3
2021	8.8	27.1	-13.0	51.6	2.9	1051.4	93	50.0
2022*	9.5	27.5	-14.6	52.8	3.5	1064	94	48.0
Totals 2019 - 2022	8.4	29.4	-14.7	78.8	3.33	4,656.4	130	50.0

* Note: Data for 2022 obtained for Jan. 1 – Oct. 31, 2022.

Available data from ECCC (2022), indicates the maximum low temperature based on records from 2019-2022 as -14.7°C and the maximum high temperature was 29.4°C (ECCC, 2022). The coldest period of the year is found to be between December and February (daily mean of -2°C), the warmest period of the year is between June to August, with a daily mean of approximately 15.7°C (ECCC, 2022). The average daily mean temperature in the area is 8.4°C (ECCC, 2022).

The total precipitation in 2021 at this weather station was 1,051.4 mm, overall, the daily mean precipitation amounts were approximately 3.33 mm (ECCC, 2022). The maximum daily precipitation registered at this location was 78.8 mm in 2019.

The average maximum wind gust at this location was registered at 130 km/h in 2019, with an average wind gust speed of 50.0 km/h between 2019 and 2022 (ECCC, 2022).

12.1.2 Air Quality

As recommended by Health Canada (2016), available data from air quality monitoring stations were used to describe the existing environment. Information obtained from the Yarmouth Airport monitoring station was limited in scope and availability. The Kentville monitoring station and Greenwood Airport are both used in place of local representative air quality monitoring facilities. The Study Area is located approximately 161 km southwest of Greenwood, Nova Scotia, and approximately 190 km southwest of Kentville, where the nearest stations monitoring AQHI are located. The AQHIs in Greenwood and Kentville were considered low risk when assessed in October of 2022 (Government of Canada, 2022).

Average air quality data from the nearest station in Greenwood (2022) is provided by NAPS Network and is described as "Good" with little indication of persistently elevated particulate or gas concentrations above the typical background levels for a rural setting. Average air quality data from Greenwood is provided by NAPS Network and is presented in Table 12-2. Please note that this information is considered to be of low reliability due to the distance from the Project Area to the nearest monitoring station.

Table 12-2. Air Quality Data, Greenwood NS

Station	SO_2 (ppb)	NOX (ppb)	NO (ppb)	NO_2 (ppb)	PM2.5 (ug/m^3)	O3 (ppb)
Greenwood	0.58	3.57	0.65	2.90	4.97	26.5

According to data from the NAPS Network ambient air quality monitoring reports for Greenwood, Nova Scotia (Environment Canada, 2021) the following summaries can be provided:

- No exceedance of ozone ambient air quality was recorded within the subject monitoring station;
- Nitrogen dioxide concentrations did not exceed the 1-hour or Annual objectives, and
- Particulate matter less than 2.5 microns in diameter have generally been low.
- According to Stantec (2012), "Given the fact that there is no ambient air monitoring station located on or in the immediate vicinity of the Study Area, that there is limited data available from the ambient air monitoring station in Yarmouth, and that the Kentville ambient air monitoring station did not demonstrate harmful concentrations of the contaminants measured, it can be reasonably estimated that the Project Study Area is representative of a rural environment where all contaminant concentrations would meet the Ambient Air Quality Objectives."

Based on a review of the available information, air quality in this area is anticipated to be predominantly controlled by the Atlantic Ocean and associated interactions between water temperatures, currents, and local airmasses. Available information from NSMNH (2022), shows that the southern coastal region of Nova Scotia (Region 800), is characterized by a strong coastal influence that produces the coolest summer and the warmest winter temperatures in the province. This effect extends only a few kilometers inland. The moderating influence is the strongest in the extreme southwest, where coastal waters are well mixed and unstratified. Rainfall amounts are high and there is frequent heavy sea fog (NSMNH, 2022).

12.1.3 Noise

The community type in the vicinity of the Project Area meets the Health Canada (2017) qualitative description of a quiet rural area. A quiet rural area is based on dwellings being >500 m from heavily travelled roads and not subject to frequent aircraft flyovers. A quiet rural area has an estimated baseline sound level of ≤45 dBA (Health Canada, 2017). Construction estimates for forested landscapes estimate that forest habitats have a dBA range between 25 dBA (low end) and 45 dBA (high end), averaging to 34.5 dBA (California Department of Transportation, 2016).

Available information collected during the various baseline field assessments reported ambient background noise levels encountered were typical of a rural setting but were not measured with by a decibel metre. These included, but were not limited to the sounds of birds, insects, small animals, windblown debris, trees, vegetation and running water in select sites. Additionally, the existing COMFIT turbines can be heard in the northern portion of the Project Area and vehicular traffic can be heard in portions of the Project Area in proximity to Black Pond Road and Comeaus Hill Road. No specific setbacks or distances were measured and this only provides a general description of the quiet rural area.

The nearest residential receptors to the Project Area, as identified via a review of aerial imagery, review of GIS datasets, and field surveys are situated along Black Pond Road and Comeaus Hill Road (Figure 9; Appendix A).

12.2 Geophysical

12.2.1 Topography

Based on a review of NSTDB contour lines, the Project Area records its lowest elevation at sea level along the southeastern boundary and its peak elevation of 45 masl along a ridge in the center of the Project Area (Figure 4; Appendix A).

The elevation profile indicated in Figure 12-1 depicts topography that ranges between sea level on sections of the eastern and western Study Area boundaries. The central portion of the site reach a maximum elevation of 36 masl. This east-west profile suggests groundwater movement within the Study Area can range depending on location and does not occur primarily in one direction within the immediate area. The range of elevations observed along this profile is 0 to 36 masl within this cross-section of the Study Area.

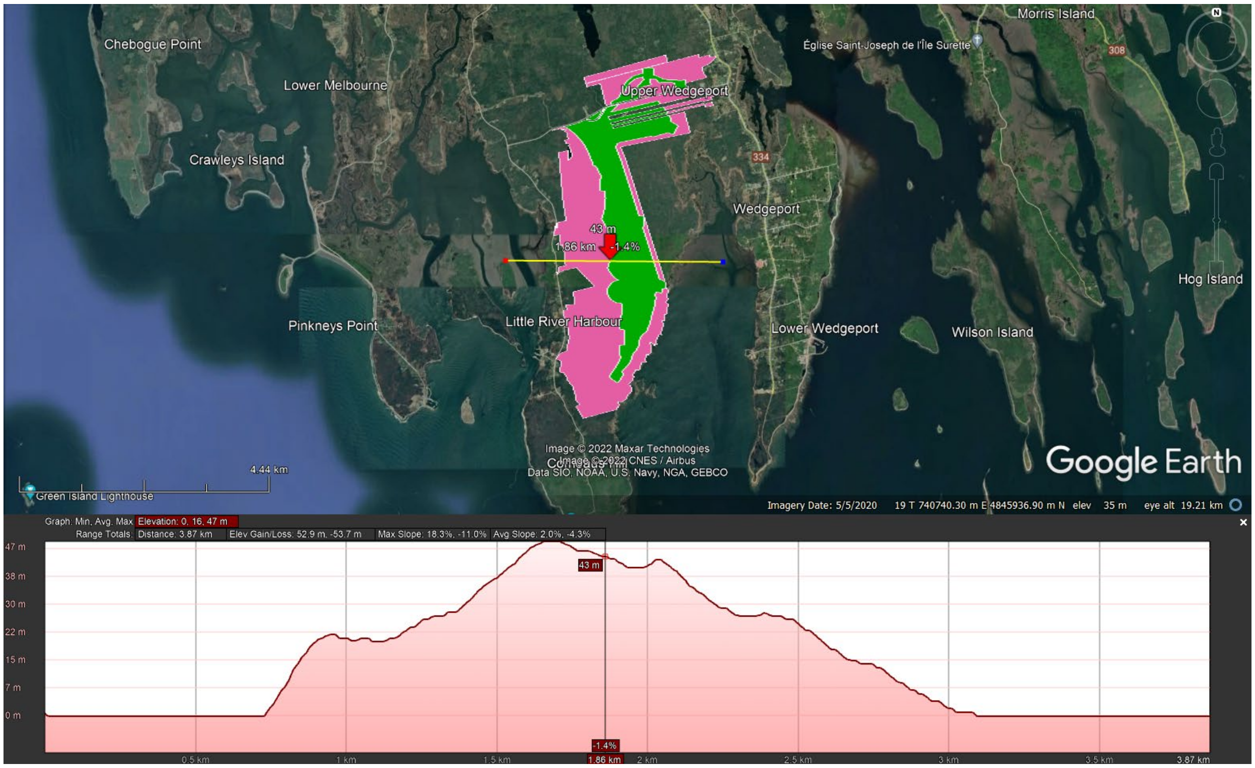

Figure 12-1. West-East Elevation Profile through the Project Area (Source: Google Earth, 2022) Please be aware of the scale as topography is not this pronounced in the field.

The elevation profile indicated in Figure 12-2 depicts a significant range in slope across the site. Elevation ranges from to the northeast of the Study Area boundary at approximately 36 masl, undulating and then rising in the approximate center to 45 masl, then dropping toward the southern Study Area boundary to a height of 5 masl. The elevation profiles provided in Figure 12-1 and Figure 12-2 illustrates the elevation change across the Study Area.

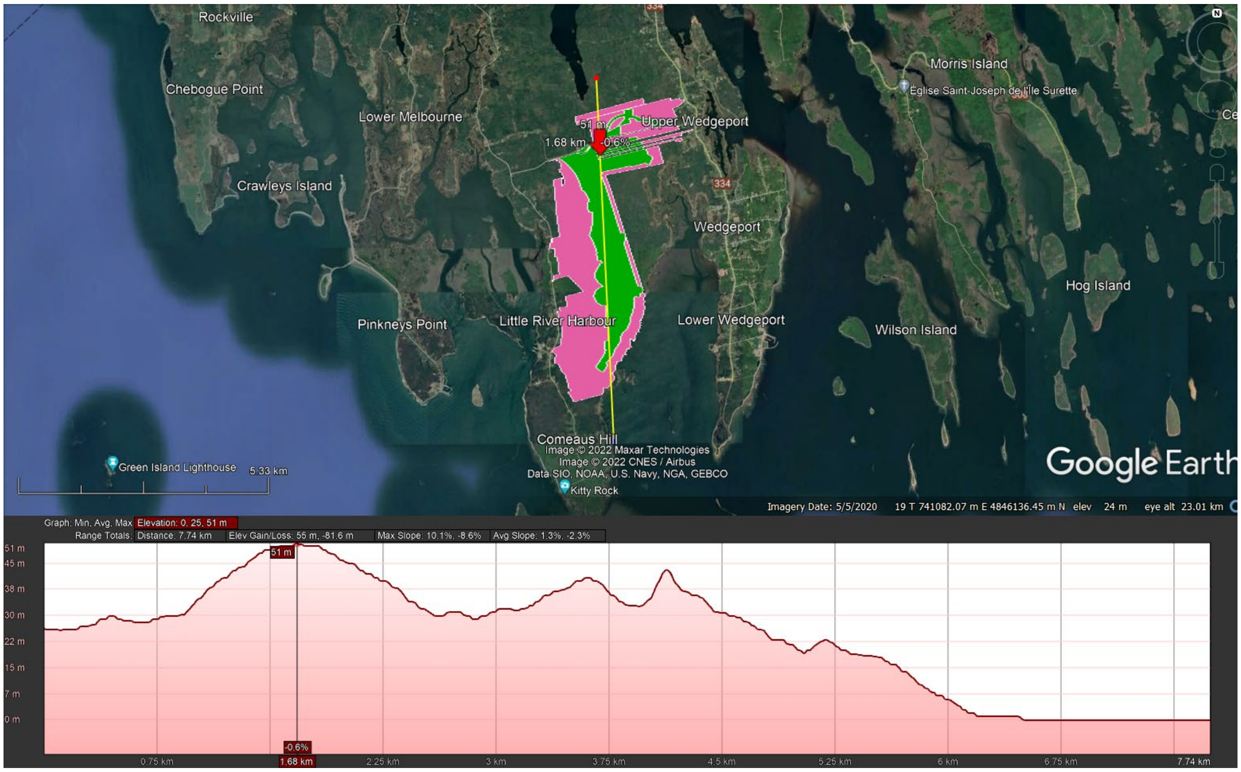

Figure 12-2. North-South Elevation Profile through the Project Area (Source: Google Earth, 2022)

12.2.2 Geology

Geology has been divided into surficial and bedrock geology.

12.2.2.1 *Surficial Geology*

According to the Nova Scotia Surficial Geology Map of the Province of Nova Scotia (Stea, et al., 1992), soil classifications within the Tusket River ecoregion include Silty till plain and drumlins (Figure 10; Appendix A). Till is silty and compact, with material derived from both local and distant sources. Drumlin facies are comprised of siltier till due to erosion and incorporation of older till units by glaciers. Generally, till and drumlin material in these areas range between 2 to 20 m and from 4 to 30 m in depth, respectively. Material in these regions is typically released from the base of an ice sheet by melting; these tills are deposited by ice sheets centered over Nova Scotia (Stea, et al., 1992).

According to information available in the 2012 EARD (Stantec 2012), the Project Area is overlain by thin deposits of sandy glacial till, with exposed bedrock, and in local depressions a combination of organic and alluvial deposits. The granite till facies of the Beaver River Till sheet, is comprised of grayish orange to yellowish brown, loose, sandy glacial till with angular, cobble-sized locally derived granite clasts (Stea, et al., 1992).

Soil in this area potentially has factors that may affect use for construction. These include shallowness, stoniness and high-water table; poor buffering capacity for acid rain (Stea, et al., 1992).

According to Stea, et al. (1992), soil within the Project Area has factors that include shallowness, stoniness and high-water table; poor buffering capacity for acid rain.

Surficial geology within the Project Area is shown on Figure 10 (Appendix A).

12.2.2.2 *Bedrock Geology*

According to the Geological Map of the Province of Nova Scotia, the bedrock geology of the Project Area (Figure 11; Appendix A), is comprised of Monzogranite, intruded into the surrounding Goldenville Formation. The localized monzogranite is formed by an intrusion of igneous material into the surrounding Goldenville Formation substrate. This granitic unit intruded into the overlying Cambrian – Ordovician age, Goldenville Formation material, during the Carboniferous period (Keppie, 2000).

12.2.2.2.1 Acid Rock Drainage

In Nova Scotia, bedrock groups such as the Goldenville Formation and Halifax Formation of the Cambro-Ordovician Meguma Group are more likely to comprise acid producing rock. Exposing and physically disturbing sulphide-bearing rocks can cause ARD to develop which can negatively impact the environment and human health. Acidic runoff, with pH levels as low as 3, can be harmful for aquatic habitats and can cause fish kills. ARD can contaminate drinking water supplies with increased concentrations of toxic and carcinogenic heavy metals (The Province of Nova Scotia, 2017).

NSDNRR has developed an ARD Risk Map (Trudell and White, 2013) and Nova Scotia Department of Energy and Mines provide an Interactive Map for Viewing the Bedrock Drainage Potential for Southwestern Nova Scotia (NSDEM, 2022) which were reviewed. This review found that the Project Area is located in an area with low bedrock ARD potential (NSDEM, 2022; Figure

12, Appendix A). Due to the low potential for ARD within the Project Area, no samples were collected for testing.

12.2.2.2.2 Uranium Rock Potential

Uranium, radon, radium, and lead are common radioactive elements that naturally occur in rocks and soils across Nova Scotia (O'Reilly et al. 2009). The Uranium Potential Map of Nova Scotia (O'Reilly et al., 2009) delineates the province into Level 1 (~40 % of Nova Scotia) and Level 2 areas (~60% of Nova Scotia. Level 1 and Level 2 areas are more likely and less likely to have groundwater with elevated levels of uranium, respectively (O'Reilly et al. 2009). The Project Area is located within a Level 1 area. The Uranium in Well Water Risk Map for Nova Scotia (Kennedy et al., 2020), indicates that the Project Area is situated in a medium-risk area, with adjacent sampling locations in Wedgeport, Nova Scotia, having concentrations of uranium in well water of less than 0.05 mg/L.

Pre-construction sampling was not completed.

12.2.3 **Groundwater**

The Project Area records its lowest elevation at sea level along the southeastern boundary and its peak elevation of 45 masl along a ridge in the center of the Project Area (Figure 13; Appendix A).

Within the Project Area there are two NSECC mapped watercourses (Figure 13, Appendix A). One mapped watercourse, located in the northern extent of the Project Area, flows north and is an inflow into Goose Lake. The second mapped watercourse, located along the northwestern Project Area boundary, is an outflow from Black Pond that flows southwest and empties into Little River Harbour.

Flow accumulation lines and wet areas mapping was also reviewed. Per Figure 13 (Appendix A), predicted depth to water nearest the surface (i.e., 0 to 0.10 m) exist around the flow accumulation lines. These areas exist throughout the Project Area and generally flow east or south to Goose Bay or west to Little River Harbour. Groundwater flow within the Project Area is anticipated to follow the general drainage trend from higher elevations along the central ridge of the Project Area to the east, west, and south to the surrounding Atlantic Ocean and to the north toward Goose Lake.

Hydrogeologic characterization of Nova Scotia's Groundwater Regions indicates that the Project Area is located on an area of igneous (monzogranite) rock (Kennedy, et al., 2008). A review of the 104 residential wells within 1 km of the Project Area indicates yields of 18.2 to 1,136.5L/min (median 468.2 L/min; NSWLD and Stantec 2012). These wells are either within the Monzogranite

formation of the Project Area or within the adjacent Goldenville Formation material of the surrounding region. Hydraulic conductivity for the bedrock type underlying the Project Area (i.e., igneous rock) is low (Heath, 1983). Low hydraulic conductivity is also evident by the relatively low yields from the closest known wells, both within and outside the metamorphic groundwater region (Heath, 1983). The available recorded static water levels in the vicinity of the Project Area are shown to range between 1.83 and 6.09 m below surface in dug wells (Table 12-3). Note: Static water levels were not recorded in drilled well information provided on the NSWLD (2022).
The closest Nova Scotia Groundwater Observation Well Network (NSGOWN) observation sites to the Project Area are located in Hebron (063), approximately 15 km to the northwest, and Hayden Lake (059), situated 64 km to the east. These NS Observation Well Network sites are located within a metamorphic area and are not situated within the same igneous groundwater region as the Study Area and are therefore not directly applicable to the Project.

According to the NS Well Logs Database, there are 15 domestic wells identified within 1 km, and nine domestic wells identified within 750 m of the Study Area as presented in Table 12-3 and shown on Figure 9 (Appendix A). According to the user's manual of the NS Well Logs Database, wells were based off the NS Map Book, the NSPRD, the Atlas, the well UTM Well Log and the map reference (NTS), (NSE, 2016).

Table 12-3. Peripheral Groundwater Wells Identified within 750 m of the Study Area

Identification	Well Number	Civic Address	Number of Structures	Distance (m) and Direction from Study Area	Static Water Level (m below surface)	Type
NS Wells Logs Database	001603	N/A – Little River Harbour	1	750 m E	N/A	Domestic Dug
NS Wells Logs Database	001605	N/A – Wedgeport, Upper Wedgeport	1	353 m N	N/A	Domestic Dug
NS Wells Logs Database	030586	N/A – Black Point Road, Wedgeport	1	50 m N	6.09	Municipal Drilled
NS Wells Logs Database	051687	2246 Highway #334, Upper Wedgeport	1	450 m E.	N/A	Domestic Drilled
NS Wells Logs Database	180152	2228 Highway #334, Wedgeport	1	520 m E	1.83	Domestic Dug
NS Wells Logs Database	670932	N/A – Little River Harbour	1	690 m S.W.	3.65	Domestic Dug

Identification	Well Number	Civic Address	Number of Structures	Distance (m) and Direction from Study Area	Static Water Level (m below surface)	Type
NS Wells Logs Database	711355	N/A – Wedgeport	1	550 m N.E.	N/A	Domestic Drilled
NS Wells Logs Database	140333	49 Deerwood Drive	1	290 m N.E.	N/A	Domestic Dug
NS Wells Logs Database	802461	RR#1 Arcadia	1	Within Study Area	1.83	Domestic Dug

Source: Online NS Well Logs Database (NSECC, 2022)

Location accuracy of wells varies identified within the NS Well Logs Database varies. For example, well 802461 has an accuracy of 1,130 m. It was not identified in the field and likely does not exist as presented in Figure 9 (Appendix A).

As indicated in Table 12-3, wells located within or immediately adjacent to the Study Area have been identified for the purposes of this evaluation. A review of aerial imagery did not identify any additional structures or potential well sites surrounding the perimeter or within the Study Area (Google Earth aerial imagery 5/5/2020).

The information obtained for wells identified within 1 km of the Study Area by the Nova Scotia Well Logs Database are presented in Table 12-4 in further detail. This information includes records of geological conditions.

Table 12-4. Characteristics of Groundwater Wells within 1 km of the Study Area

Measurement	Drilled Wells			Dug Wells		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum
Well Casing (m)	10.3	30.5	4.4	5.6	11.9	0.9
Well Depth (m)	49.1	155.2	15.3	5.6	12.1	3.5
Water level (m)	5.7	12.2	0.3	2.5	6.1	0.6
Till thickness (m)	6.2	29.0	0.0	2.4	5.5	0.3
Groundwater flow (L/min)	60.2	909.2	0.1	390.3	1136.5	18.2

Source: Online NS Well Logs Database (NSECC, 2022)

The wells presented in Table 12-4 are dug or drilled to varied depths but are otherwise relatively similar in their attributes. The yields presented in this table, provide information on background conditions that can be reviewed in the context of groundwater within the Study Area. These wells are drilled from depths of 15.3 m to 155.2 m. Depth to bedrock ranges from surface to 29 m and yield ranged from 0.1 L/min to 1,136.5 L/min.

To add context to the general local groundwater discussion, a comparison was made between the elevation of the Study Area, ranging from roughly 45 masl, down to sea level toward the southeast extent of the Study Area, including surface water features, and adjacent water wells. The drilled municipal well noted along Black Pond Road to the northeast of the Study Area (030586), has an approximate elevation of 20 m and a yield of 31.78 L/min. The elevation profiles provided in Section 12.2.1 (Figure 12-1 and Figure 12-2) illustrates the elevation change across the Study Area.

12.3 Terrestrial

12.3.1 Habitat, Flora, and Lichens

Habitat and vegetation community assessments and surveys for vascular plants and lichens were completed to determine potential impacts to species or their specific habitat which may be protected under legislation.

Vegetation community assessments were also completed to address key topics regarding species habitat as discussed in *The Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSECC, 2005).

12.3.1.1 *Desktop Review*

The Project Area is in the Atlantic Coastal Ecoregion (800) and the Tusket Islands (840) Ecodistrict (Neily et al., 2017). The Tusket Islands Ecodistrict is one of the smaller ecodistricts in the province, extending from Pubnico to Yarmouth Harbour and occupying less than 1% of the total provincial area. The topography, geology, and soils are heavily influenced by the Gulf of Maine, bringing a moderating effect to the area. Lined by coastal areas and having a history of human activity, many of the forests are dominated by black spruce (*Picea mariana*), white spruce (*Picea glauca*), and balsam fir (*Abies balsamea*). Saltmarshes are extensive along the coastline of this ecodistrict, encompassing 9.2 % of the total area (Neily et al. 2017).

Table 12-5 and Figure 14 (Appendix A) displays the desktop identified land classifications (i.e., habitat) within the Project Area. These estimations are based on the forest inventory GIS database (NDNRR, 2021).

Table 12-5. Desktop Calculations of Habitat within the Project Area

Habitat Type	Area (ha)	Approximate Percentage of Project Area (%)
Alders	119	13
Barrens	280	30
Cutover	5	1
Hard wood	10	1
Mixed wood	122	13
Softwood	331	36
Urban Development	14	2
Watercourses	2	0
Wetland[1]	36	4
TOTAL PROJECT AREA	919	100

[1]Includes wetlands from provincial forestry layer (NSDNRR 2021) and does not include field delineated wetlands.

Habitat in the Project Area consist mainly of softwood stands (331 ha, 36% of the Project Area) followed by barrens (280 ha, 30 %). Alder (119 ha) and mixed wood (122 ha) stands are the third most dominant habitat types and both comprise 13% of the Project Area. The majority of the Project Area is intact forest (97%). Only 2% (14 ha) and 1 % (5 ha) of the Project Area is classified as disturbed (urban and cutover, respectively).

Softwood stands are mainly concentrated from the central portion of the Project Area to the north (Figure 14; Appendix A). Smaller pockets of softwood stands are identified along the coast at the southeastern extent of the Project Area. Barrens are more dominant in the southern portion of the Project Area, in closer proximity to the coast. Both alder and mixed wood forests are scattered throughout the Project Area in smaller parcels.

Mapped wetland habitat in the Project Area includes 36 ha (4%). Mapped wetlands are present surrounding Black Pond in the northwestern portion of the Project Area and along the coast (i.e., salt marsh; Figure 14, Appendix A). Refer to Section 12.4.1 for additional details on wetlands.

Significant habitats are those habitats that ensure the continued presence and survival of specific species throughout the landscape. Significant habitats can include, deer wintering areas, or other areas that have been identified as habitat for rare species or potential habitat for rare species. It is not uncommon to move Project components from the optimal location, if that location encroaches or disrupts a significant habitat. No significant habitat is present within the Project Area, however, significant habitat for migratory birds is present on either side of the peninsula the Project is located on (in Little River Harbour and Goose Bay; Appendix C-1). Additionally, the Project Area is not situated in defined critical habitat[4] for any wildlife species.

No Old Forest polygons are present within the Project Area (NSDNRR 2020).

The ACCDC report identified nine priority vascular plants within 5 km of the Project Area (Figure 15; Appendix A). All priority flora species within 5 km of the Project Area are listed in Table 12-6.

Table 12-6. Priority Flora Species within 5 km of the Project Area as listed by the ACCDC Report

Scientific Name	Common Name	COSEWIC	SARA	NSESA	SRank	Distance
Agalinis maritima	Saltmarsh agalinis	-	-	-	S2	2.7 ± 0.0
Iva frustescens	Big-leaved marsh-elder	-	-	-	S3	3.4 ± 0.0
Primula laurentiana	Laurentian primrose	-	-	-	S3	2.5 ± 7.0
Eleocharis rostellata	Beaked spikerush	-	-	-	S3	2.4 ± 0.0
Schoenoplectus americanus	Olney's bulrush	-	-	-	S3	1.8 ± 0.0
Neottia bifolia	Southern twayblade	-	-	-	S3	1.8 ± 0.0
Vaccinium corymbosum	Highbush blueberry	-	-	-	S3S4	0.2 ± 0.0
Fagus grandifolia	American beech	-	-	-	S3S4	3.4 ± 0.0
Symplocarpus foetidus	Eastern skunk cabbage	-	-	-	S3S4	2.5 ± 7.0
Note: highbush blueberry was identified within the Project Area in eight locations						

[4] As defined by Canada's *Species at Risk Act*; **critical habitat** is the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species critical habitat in the recovery strategy or in an action plan for the species.

No ACPFG buffers are found within the Project Area, however, four exist within 1.5 km of the Project Area (Figure 15; Appendix A).

No priority bryophytes were documented within 5 km of the Project Area in the ACCDC report.

No priority lichen species were documented within 5 km of the Project Area in the ACCDC report.

Several boreal felt lichen (BFL; *Erioderma pedicellatum*) predictive habitat polygons are present within the Project Area (Figure 15; Appendix A). According to the MTRI databases, no extant BFL populations are within the Project Area. The closest BFL critical habitat is located 66 km northeast of the Project Area. The closest vole ears lichen (*Erioderma mollissiumum*) critical habitat is located 85 km northeast of the Project Area.

The 2012 EARD (Stantec 2012) found that the most abundant vegetation types within the Project Area are the following: immature forest, barrens, mature softwood, shrub thicket, wetland and mature mixedwood forest. The report concludes that the Project Area was predominantly mature softwood forest, barrens and immature forest based on their analysis with the NSDNRR Forest Inventory mapping (Stantec 2012). MEL confirmed this is accurate.

In the 2012 EARD (Stantec 2012), a total of 186 vascular plant species were observed within their larger study boundary during their targeted biophysical surveys in 2011. The 2012 EARD identified the four priority vascular plant species, however, two of these species, Elliott's goldenrod (*Solidago latissimifolia*, S4) Nova Scotia agalinus (*Agalinis neoscotica*, S4S5), have recently had their SRanks changed and are no longer considered priority species. The two species that remain priority species and are as follows:

- Southern twayblade (*Neottia bifolia*, S3)
- Highbush blueberry (*Vaccinium corymbosum*, S3S4)

NSDNRR confirmed that the Project Area is not located within core habitat for black ash (S. Spencer, NSDNDD, Personal Communications, September 26, 2022).

The 2012 EARD (Stantec 2012) did not include lichen surveys.

12.3.1.2 <u>Field Surveys</u>

12.3.1.2.1 <u>Vegetation Community and Classification</u>

There is extensive anthropogenic disturbance in the northern portion of the Project Area, north of Black Pond Road that includes a retired municipal dump, stockpiled boulders, and cutovers. Firewood is also harvested along trails throughout the Project Area.

The Project Area is comprised of a mosaic of barrens, softwood forests, mixedwood forests and speckled alder (*Alnus incana*).

In April and September 2022, MEL biologists identified 16 habitat points across the Project Area. These habitat points included the following vegetation types (Table 12-7): White Spruce/ Bayberry, Shrubland and Barren, three types of Wet Coniferous Group, two types of Wet Deciduous, three types of Intolerant Hardwood, and the Marsh group.

Table 12-7. Vegetation Groups and Vegetation Types Observed within the Project Area

Community Type	Habitat Point	Vegetation Group	Vegetation Type (VTs)	Classification System[1]
Upland Communities	HP1	Coastal Forest Group	CO7 – White Spruce/ Bayberry	FEC
	HP4, HP8, HP15, HP16	Shrubland and Barren Group	S3 – Mixed Tall Shrubland	Classification of Heathlands and Related Plant Communities on Barrens Ecosystem in Nova Scotia
	HP12	Intolerant Hardwood Forest Group	IH1- Large-tooth aspen / lambkill/ Bracken	FEC
	HP11		IH6- White birch- Red maple / Sarsaparilla- Bracken	FEC
	HP13		IH7- Red maple/ Hay-scented fern – Wood sorrel	FEC
Wetland Communities	HP7	Wet Coniferous Forest Group	WC1 – Black spruce / Cinnamon fern / Sphagnum	FEC
	HP10		WC2 – Black spruce/ Lambkill – Labrador tea/ Sphagnum	FEC
	HP5		WC6- Balsam fir / Cinnamon fern – Three seeded sedge / Sphagnum	FEC
	HP6, HP9	Wet Deciduous Forest Group	WD2 – Red maple / Cinnamon Fern / Sphagnum	FEC

Community Type	Habitat Point	Vegetation Group	Vegetation Type (VTs)	Classification System[1]
	HP14		WD6 - Red maple- Balsam fir/ Wood aster / Sphagnum	FEC
	HP2	Marsh Group	Sweetgale Mixed Shrub Fen	NLM adapted
	HP3		Cattail Marsh	NLM adapted

[1] FEC = Forest Ecosystem Classification (Neily et al. 2010)

NLM = Natural Landscape of Maine (Gawler and Cutko 2018)

Classification of Heathlands and Related Plant Communities on Barrens Ecosystem in Nova Scotia (Porter et al, 2021)

The vegetation groups and vegetation types identified within the Project Area are described in detail within the following subsections.

12.3.1.2.2 Upland Vegetation Type

Coastal Forest Group (CO)

This vegetation group is highly influenced by soil and site conditions. High winds, cool, and moist conditions from coastal exposure create windthrow and alter growth forms of trees. Due to these conditions, trees termed 'tuckamores' are common (Neily et al. 2010). Most of this forested group are often dominated by coniferous trees such as black spruce (*Picea mariana*), white spruce (*Picea glauca*), and balsam fir (*Abies balsamea*) with scattered hardwood species such as red maple (*Acer rubrum*). One vegetation type belonging to this group, CO7, was observed within the Project Area at HP 1 (Figure 14; Appendix A).

CO7 – White Spruce/ Bayberry

The vegetation type CO7 – White spruce/ Bayberry is a late-stage successional ecosystem on aeolian and marine landforms (Neily et al., 2010). This community consists of an overstory predominantly of white spruce and minor to moderate levels of white pine, black spruce and/or balsam fir with a sparse herbaceous and shrub layer consisting of bayberry (*Morella pensylvanica*) and other herbaceous plants like baltic rush and beach grass. The degree of exposure of this vegetation group will greatly influence canopy closure and growth. This vegetation type was observed at HP1 (Figure 14; Appendix A).

Shrubland and Barren Group (S)

Barren ecosystems are characterized by harsh climatic and/or edaphic conditions and by low shrub communities (Porter et al, 2021). These communities are largely associated with shrubs from the heath family (*Ericeacea*), shallow soils and often exposed bedrock. These communities can occur in a coastal setting (<500 m from the coastline) or inland (>500 m from the coastline). Barrens are divided into herbaceous, dwarf shrublands, and shrubland associations (Porter et al, 2021).

S3 – Mixed Tall Shrubland

This vegetation type is characterized by high shrub cover, often comprising false holly (*Ilex mucronata*), black chokeberry (*Aronia melanocarpa*), sheep laurel (*Kalmia angustifolia*), and wild raisin (*Viburnum nudum*) (Porter et al, 2021). This community is successionally dynamic, and dominant ericaceous shrub species can vary between sites. Soils are often shallow, overlain stony till. The tree and herbaceous layer are usually sparse and consists of various species such as red maple (*Acer rubrum*) and northern starflower (*Lysimachia borealis*) (Porter et al, 2021). The bryoid layer often consisted of many of the broom moss species (*Dicranum spp.*), Schreber's moss, and pincushion moss (*Leucobryum glaucum*). Within the Project Area, this vegetation type was observed at the following habitat points: HP4, HP8, HP15, HP16 (Figure 14; Appendix A).

Intolerant Hardwood (IH)

This forest group is typically comprised of early to mid-successional communities with a range of soil and site conditions. This forest group is dominated by hardwoods such as red maple, white birch (*Betula papyerifera*), gray birch (*Betula populifolia*), trembling aspen (*Populus tremuloides*), and large-toothed aspen (*Populus grandidentata*) (Neily et al. 2010). There were three different vegetation types found in the Project Area, IH1, IH6 and IH7 (Figure 14; Appendix A).

IH1- Large-tooth aspen / Lambkill / Bracken

The IH1 large-tooth aspen / lambkill / bracken vegetation group is an early successional forest, found on fresh, nutrient poor soils. The overstory is dominated by large-tooth aspen (*Populus grandidentata*) and red maple (*Acer rubrum*) with a well-developed shrub layer (Neily et al. 2010). Species in the shrub and herbaceous layer include wild raisin, serviceberry (*Amelanchier sp.*), velvet-leaved blueberry (*Vaccinium myrtilloides*), and it is also common to see regenerating balsam fir, red maple, and red oak (*Quercus rubra)*. There is not typically a well-developed shrub layer (Neily et al. 2010). This vegetation group was observed at HP12 (Figure 14; Appendix A).

IH6- White birch – Red maple / Sarsaparilla – Bracken

The IH6 white birch - red maple / sarsaparilla / bracken vegetation group is an early successional forest, which can grow on a variety of soil conditions. White birch and red maple are most seen in the overstory, and the shrub layer is well developed with regenerating tree species, wild raisin and serviceberry (Neily et al. 2010). An herbaceous layer is common, and the species found will vary depending on the site conditions, however it is common to see starflower, bunchberry (*Cornus canadensis*), sarsaparilla (*Aralia nudicaulis*), and bracken fern (*Pteridium aquilinum*) (Neily et al. 2010). It is not typical to have a well-developed bryophyte layer. This vegetation group was observed at HP6 (Figure 14; Appendix A).

IH7- Red maple / Hay-scented fern – Wood sorrel

The IH7 red maple / hay-scented fern – wood sorrel vegetation type is an early to mid-successional community that is found on fresh and medium to rich soils. This community is dominated by a red maple overstory and has a diver herb layer comprised of several species of ferns, wood sorrel (*Oxalis sp.*), violet species (*Viola sp.*) and cucumber root (*Medeola virginiana*) (Neily et al. 2010). This vegetation group was observed at HP13 (Figure 14; Appendix A).

12.3.1.2.3 <u>Wetland Communities</u>

Wetland vegetation communities observed within the Project Area are discussed below. For further details on wetland types, classification, landscape position and overall wetland functions, refer to Section 12.4.

Wet Coniferous and Deciduous Forest Group (WC)

The Wet Coniferous and Wet Deciduous Forest Groups are wet forested ecosystems which often have water at or near the surface of the soil for most of the year (Neily et al., 2010). These forested vegetation groups are typically found within swamps in Nova Scotia. Stand cover of trees is often moderate to high, often with extensive sphagnum cover and acidic and nutrient poor soils. Fern species, such as cinnamon fern (*Osmundastrum cinnamomeum*) and sedges such as the three-seeded sedge (*Carex trisperma*) are often associated with this vegetation community group.

Common sphagnum species associated with this vegetation group are *S. palustre, S. capillifolium* and *S. girgensohnii.*

WC1 – Black spruce / Cinnamon fern / Sphagnum

The WC1 – Black spruce / Cinnamon fern / Sphagnum vegetation type is a common climax community found on wet, nutrient poor soils. The overstory canopy of this vegetation type is predominantly black spruce and balsam fir with extensive cover of cinnamon fern and a variety of sphagnum species including *S. squarrosum*, *S. capillifolium* and *S. palustre* (Neily et al. 2010). This vegetation type does not have a well-developed shrub layer, with higher cover from the herbaceous layer comprising of creeping snowberry (*Symphoricarpos albus*), false holly, three-seeded sedge and goldthread (*Coptis trifolia*). This vegetation type was found at HP7 (Figure 14; Appendix A). Three wetlands within the Study Area (WL8, 9, and 13) were also determined to be of this vegetation type.

WC2 - Black spruce/ Lambkill – Labrador tea/ Sphagnum

The WC2 - Black spruce/ Lambkill – Labrador tea/ Sphagnum vegetation type is typically a mid-successional edaphic climate community, moderated by nutrient poor and poorly drained soils (Neily et al. 2010). This vegetation type is dominated by black spruce (*Picea mariana*) and high shrub cover with species such as lambkill (*Kalmia angustigolia*), labrador tea (*Ledum groenlandicum*), rhodora (*Rhododendron* canadense), and false holly (*Ilex mucronata*) (Neily et al. 2010). A dense cover of sphagnum moss is common. This vegetation type was found at HP10. Six wetlands within the Study Area (WL4, 7, 16, 22, 27, and 31) were also determined to be of this vegetation type.

WC6 – Black spruce / Cinnamon fern / Sphagnum

The WC6 – Balsam fir / Cinnamon fern – Three seeded sedge / sphagnum vegetation type is characterized by balsam fir being the dominant tree species with extensive sphagnum and cinnamon fern cover. Within the Project Area, this vegetation type was found on wet soils, however, this community can also occur on imperfectly drained soils (Neily et al., 2010). The shrub layer is often variable and can range from low to high, which often comprise of mountain holly and speckled alder. The dominant graminoid and bryophyte species in this vegetation type is three seeded sedge and sphagnum. This vegetation type, if present with a suite of lichen indicator species and mature balsam fir stands, can often provide suitable habitat for the SAR boreal felt lichen (*Erioderma pedicellatum*). This vegetation type was found at HP5 (Figure 14; Appendix

A). Three wetlands within the Study Area (WL19, 30, and 38) were also determined to be of this vegetation type.

WD2 – Red Maple / Cinnamon fern / Sphagnum

The WD2 – Red Maple / Cinnamon fern / Sphagnum vegetation type is common throughout coastal and inland Nova Scotia and found within treed swamps. Red maple is the dominant hardwood treed species with scattered balsam fir and black spruce. Cinnamon fern cover is extensive and often form dense clumps which cover the forest floor completely (Neily et al. 2010). In this vegetation type, sphagnum cover is extensive and species such as mountain holly, three-seeded sedge, wild raisin, speckled alder, and bunchberry are commonly found. This vegetation type, like many within this forest group, provide suitable habitat for many rare lichen species when mature red maple stands are present. This vegetation type was found at HP6 and HP9 (Figure 14; Appendix A). Twenty field identified wetlands within the Study Area were determined to be of this vegetation type as well (WL1, 3, 5, 6, 10, 11, 12, 14, 15, 17, 18, 21, 24, 26, 28, 29, 33, 34, 35, and 37).

WD6 – Red Maple – Balsam fir / Wood aster / Sphagnum

The WD6 – Red maple – Balsam fir / Wood aster / Sphagnum vegetation type is a relatively common wet mixedwood forest. This vegetation type is characterized by a dominant overstory from red maple and balsam fir, whereas the understory is less abundant (Neily et al. 2010). The woody and herbaceous layer supports vascular plants like false holly, cinnamon fern, creeping snowberry and three-seeded sedge. It is common to have a moderate level of sphagnum cover, and a more developed cover is dominant on poorly drained mineral soil (Neily et al. 2010). This vegetation type was found at HP14 (Figure 14; Appendix A). Two wetlands (WL20 and 23) within the Study Area were also determined to be of this vegetation type.

Sweetgale Mixed Shrub Fen

The Sweetgale mixed shrub fen vegetation type is typically found bordering lakes and ponds and often associated with larger wetland complexes. Out of all the vegetation types within the Peatland Group observed within the Project Area, the PG2 is the most widespread within Nova Scotia (S. Basquill, 2020, personal Communication, 10 September). This vegetation type is characterized by the high shrub cover consisting of sweetgale, alder and leatherleaf (*Chamaedaphne calyculata*). Within this vegetation type, graminoid cover was low, and consisted primarily of Pickering's reed grass (*Calamagrostis pickingerii)*, although, according to NLM, bluejoint grass (*C. canadensis*) is also characteristic of this vegetation type. Cotton grass and sedges such as tussock sedge (C*arex stricta)* are common within this vegetation type. Trees are often not present and in areas with low shrub cover, sphagnum moss cover is present often comprising of *S. rubellum* and *S. fallax.* This vegetation type was found at HP2 (Figure 14; Appendix A).

Cattail Marsh

The Cattail marsh vegetation type is a group dominated by cattails and other deciduous shrubs, which are found adjacent to open/ standing water. This vegetation type will also have shrub species such as winterberry (*Ilex verticillata*) and meadowsweet (*Spirea alba*). A muck or mineral soil substrate is typical, with limited number of herbaceous species. It is not common to have a well-developed bryophyte layer, unless there are vegetation hummocks present (Grawlor and Cutko 2018). This vegetation type was found at HP3, in a wetland located beyond the Study Area boundary.

12.3.1.3 Vegetation Types Summary

The Study Area is comprised of vegetation types within the Coastal Forest Group (CO), the Shrubland and Barren Group (S), the Intolerant Hardwood Forest group (IH), the Wet Coniferous Forest Group (WC), the Wet Deciduous Forest Group (WC) and the MEL-defined swamp group (Figure 14; Appendix A). The vegetative communities identified within the Project Area are common in the surrounding landscape and the province.

Provincial rankings for vegetation communities currently do not exist within Nova Scotia, and not all communities found in Nova Scotia have been described and researched. These lack of data and rankings make it difficult to designate a community as rare. However, all communities with the Project Area are common and widespread throughout Nova Scotia (Neily et al. 2010; Porter at al. 2021; Gawler and Cutko 2018). Some vegetation types present are restricted to coastal and near-coastal areas, such as the vegetation types observed belonging to the Coastal Forest Group (CO).

12.3.1.3.1 Flora

A total of 171 vascular plant species and 11 bryophyte species were identified within the Study Area. Refer to Appendix Q for a complete plant list. Of the 171 vascular plant species identified, only two (or 1%), highbush blueberry (*Vaccinium corymbosum*, S3S4 [n=11]) and eastern skunk cabbage (*Symplocarpus foetidus*, S3S4 [n=12]), are SOCI (Figure 16; Appendix A). **No SAR vascular plants were identified.**

Highbush blueberry

Highbush blueberry is a tall shrub that dominates in bogs, rock barrens, and lakeshore habitats (Munro et al. 2014). The range in Nova Scotia is distinctly found in coastal plains (Munro et al. 2014). Throughout the Project Area, five occurrences of highbush blueberry were identified during dedicated botany surveys and six occurrences were observed incidentally during other biophysical surveys. These occurrences were found in either treed swamps or shrub habitats across the entirety of the Study Area (Figure 16; Appendix A).

Eastern skunk cabbage

The eastern skunk cabbage is a perennial with broad, green leaves and flowers that typically appear before the leaves (Munro et al. 2014). It is commonly found throughout wet environments such as bogs, wet forests, or along coastal habitats (Munro et al. 2014). There were twelve occurrences of eastern skunk cabbage throughout the Project Area with fifteen individuals (Figure 16; Appendix A). Five of those occurrences were during dedicated botany surveys, while the other seven occurrences were observed incidentally during lichen surveys. All occurrences were observed in or immediately adjacent treed swamps, including WL14 and 17.

Within the Study Area, 96% (n=164) of the vascular plants are native and the remaining 4% (n=7) are exotic. Of all species observed, 6% (n=5) belong to the Atlantic Coastal Plain Flora Group (ACPFG).

Five species belonging to the ACPFG were observed within the Study Area. The ACPFG is a unique group of vascular plants found in a narrow range from Florida to Nova Scotia, with a few disjunct communities along the Georgian Bay region in Ontario. Many of the SAR within Nova Scotia belong to this group. Although most ACPFG are common in Nova Scotia and have no regulatory protection, they are a unique association of species which have a very narrow range in North America. The ACPFG species observed within the Study Area are dwarf huckleberry (*Gaylussacia bigeloviana*), northern bayberry (*Morella pensylvanica*), Virginia St. John's-wort (*Hypericum virginicum,* highbush blueberry (*Vaccinium corymbosum*)*,* and skunk cabbage (*Symplocarpus foetidus*). Of the five ACPFG observed, only two priority species were identified – Skunk cabbage and highbush blueberry.

None of the 11 bryophytes identified are listed as a priority species (Table 12-8).

Table 12-8. Bryophytes Identified within the Study Area

Scientific Name	Common Name	SRank
Rhytidiadelphus triquetrus	Electrified cat's- tail moss	S5
Climacium dendroides	Northern tree Moss	S5
Ulota crispa	Crisped pincushion moss	S5
Sphagnum angermanicum	A peatmoss	S4S5
Sphagnum magellanicum	Magellan's peat moss	S5
Hylocomium splendens	Stairstep moss	S5
Neckera pennata	Feathery neckera moss	S5
Pleurozium schreberi	Red-stemmed feather moss	S5
Brachythecium laetum	Long-capsuled ragged moss	S4?
Mnium hornum	Swan's-neck leafy moss	S4S5
Sphagnum capillifolium	Northern peatmoss	S5

12.3.1.3.2 Lichens

During the field surveys, 14 lichen species were observed within the Project Area (Table 12-9; Figure 16, Appendix A). One was determined to be a SAR, blue felt lichen (*Pectenia plumbea*, SARA & COSEWIC Special Concern, NSESA Vulnerable, ACCDC: S3 [n=1]), and five were determined to be a SOCI, *Usnea rubicunda* (S2S3 [n=2]), *Fuscopannaria sorediata* (S2S3 [n=1]), *Parmotrema perlatum* (S3S4 [n=11]), *Coccocarpia palmicola* (S3S4 [n=1]), *Heterodermia neglecta* (S3S4 [n=1]).

Table 12-9. Lichen Species Identified within the Project Area

Scientific Name	Common Name	COSEWIC	SARA	NSESA	SRank
Pectenia plumbea	Blue felt lichen	SC	SC	V	S3
Usnea rubicunda	Red beard lichen	-	-	-	S2S3
Fuscopannaria sorediata	a shingle lichen	-	-	-	S2S3
Parmotrema perlatum	Powdered ruffle lichen	-	-	-	S3S4

Scientific Name	Common Name	COSEWIC	SARA	NSESA	SRank
Coccocarpia palmicola	Salted shell lichen	-	-	-	S3S4
Heterodermia neglecta	Fringe lichen	-	-	-	S3S4
Collema subflaccidum	Tree tarpaper lichen	-	-	-	S5
Cladonia crispata	Organpipe lichen	-	-	-	S5
Lobaria quercizans	A lichen	-	-	-	S5
Plastimatia tuckermanii	A lichen	-	-	-	S5
Pannaria rubiginosa	Brown-eyed shingle lichen	-	-	-	S4
Pseudocyphellaria perpetua	A lichen	-	-	-	S3S4
Parmelia squarrosa	Bottlebrush shield lichen	-	-	-	S5
Lobaria pulmonaria	Lungwort lichen	-	-	-	S5

Blue Felt Lichen

Blue felt lichen are large, blue-grey lichens, with a prominent black-blue fungal mat and red-brown fruiting bodies (COSEWIC 2010). Blue felt lichen is commonly found on the trunks of old hardwood trees, especially red maple (*Acer rubrum*), in moist habitats or near streams or lakes. It prefers cool, humid woodlands with mixed coniferous/hardwood or deciduous dominant swamps (COSEWIC 2010). One observation of blue felt lichen (three thalli) were observed on a red maple in a wetland within the Project Area during dedicated lichen surveys (Figure 16; Appendix A). This wetland was not delineated as it exists beyond the Study Area boundary.

The *At-Risk Lichens – Special Management Practices* (NSDNRR 2018) considers blue felt lichen a rare and sensitive lichen and recommends a 100 m buffer with no forest harvesting or road construction to occur within the buffer area.

Usnea rubicunda

Usnea rubicunda has a distinct red-orange colour with a shrubby thallus (Brodo et al. 2001). It is commonly found on branches and trunks of trees in more open forest environments (Brodo et al. 2001). Two occurrences of *Usnea rubicunda* were observed throughout the Project Area, one observation (four thalli) was on a mature black spruce in a field identified wetland (not delineated as it was beyond the Study Area boundary) and the second occurrence was on a white spruce along the coast at the southern extent of the Project Area (Figure 16; Appendix A).

Fuscopannaria sorediata

Fuscopannaria sorediata has brown fungal mats and blue-black hyphal mat (Brodo et al. 2001). They are typically found in moist areas, or on rocks (Brodo et al. 2001). One occurrence with one thallus was found on a red maple in a swamp (not delineated as it was beyond the Study Area boundary) within the Project Area (Figure 16; Appendix A).

Parmotrema perlatum

Parmotrema perlatum lichen can be found in different habitats, but is typical is deciduous trees in the shade, and on conifer bark along the coast (McMullin & Anderson 2014). It is characterized by white-gray lobes and, brown lobe edges with small clumps of soredia at the end of the lobes (McMullin & Anderson 2014). There were 11 occurrences of *Parmotrema perlatum* throughout the Project Area, that included a total of 64 thalli (Figure 16; Appendix A). The observations were identified on black spruce along the coast, white spruce in upland and coastal habitat, and on red spruces in treed swamps (not delineated as they are beyond the Study Area boundary).

Coccocarpia palmicola

Coccocarpia palmicola are thick, rounded, silver-grey lobed lichens that can be fuzzy with downturned edges (McMullin & Anderson 2014). *Coccocarpia palmicola* are commonly found in damp habitats, growing with other liverworts. If this lichen is found in sphagnum-rich habitats, it is typically considered an indicator species for boreal felt lichen (*Erioderma pedicellatum*; (McMullin & Anderson 2014), which was not found in the Project Area. One occurrence of *Coccocarpia palmicola* was identified on a balsam fir in a treed swamp (not delineated as it was beyond the Study Area boundary) during a dedicated lichen survey (Figure 16; Appendix A).

Heterodermia neglecta

Heterodermia neglecta is typically found on mature, deciduous trees in moist habitats (McMullin & Anderson 2014). This lichen has distinctive light gray-green lobes and long dark rhizines on the edges of the lobes (McMullin & Anderson 2014). *Heterodermia neglecta* (one thallus) was identified at one location Project Area and was found on a red maple in a treed swamp (not delineated as it was beyond the Study Area boundary) during a dedicated lichen survey (Figure 16; Appendix A).

12.3.1.4 *Habitat, Flora, and Lichens Summary*

Field studies were focused on highlighting the ecological linkages within the Project Area, as well as adjacent habitats.

The Project Area consists of, wetlands, watercourses, regenerative and mature forest stands. During the rare plant and lichen surveys, a total of 196 species were observed and include 171 vascular plants, 11 bryophytes and 14 lichen species. One SAR and five SOCI lichen; were observed (Figure 16; Appendix A). **No SAR vascular or SAR nonvascular plants were identified during the field surveys.**

Rare Vascular Plants

- Highbush blueberry (S3S4)
- Eastern skunk cabbage (S3S4)

Rare Lichens

- Blue felt lichen (*Pectenia plumbea,* ACCDC: S3, NSESA – Vulnerable, SARA Special Concern)
- *Usnea rubicunda* (S2S3)
- *Fuscopannaria sorediata* (S2S3)
- *Parmotrema perlatum* (S3S4)
- *Coccocarpia palmicola* (S3S4)
- *Heterodermia neglecta* (S3S4).

12.3.2 Fauna

The following sections outline the results from the desktop review and the field surveys completed within the Project Area.

The ACCDC report confirmed two records of seaside dragonlet (*Erythrodiplax Berenice;* S3S4) within 5 km of the Project Area. The NSDNRR considers a number of species "location sensitive" and concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in an ACCDC report.

The ACCDC report identified a bat hibernaculum (or species occurrence) within 5 km of the Project Area. NSDNRR confirmed that the record is of a bat species occurrence and it was observed 1.3 km to the northeast of the Project Area. NSDNRR also confirmed that no known bat hibernacula are within 5 km of the Project Area (S. Spencer, NSDNRR, Personal Communications, August 31, 2022).

The results of the review for significant habitat, critical habitat SMPs, abandoned mine openings and ACCDC results is provided in Figure 15 (Appendix A). There are no terrestrial fauna or invertebrate significant habitat, critical habitat, SMPs, or abandoned mine openings within the Project Area. The Project area is not within core habitat or a concentration area for mainland moose, although mainland moose have been observed within the Project Area (S. Spencer, NSDNDD, Personal Communications, September 26, 2022).

The 2012 EARD (Stantec 2012) identified five herpetofauna and eight mammalian species within the surrounding area through field observations. These species are provided in Table 12-10.

Table 12-10. Species Observed in Support of the 2012 EARD with Updated (March 2022) Conservation Rankings (Stantec 2012)

Scientific Name	Common Name	COSEWIC	SARA	NSESA	SRank
Ursus americanus	American black bear	-	-	-	S5
Odocoileus virginianus	White-tailed deer	-	-	-	S5
Sorex cinereus	Maritime shrew	-	-	-	S5
Tamiascriurus hudsonicus	Red squirrel	-	-	-	S5
Canis latrans	Eastern coyote	-	-	-	S5
Procyon lotor	Northern racoon	-	-	-	S5
Erethizon dorsatum	Porcupine	-	-	-	S5
Lepus americana	Snowshoe hare	-	-	-	S5
Thamnophis sirtalis pallidulus	Maritime garter snake	-	-	-	S5

Scientific Name	Common Name	COSEWIC	SARA	NSESA	SRank
Rana clamitans	Green frog	-	-	-	S5
Liochlorophis vernalis	Eastern smooth green snake	-	-	-	S4
Hyla crucifer	Spring peeper	-	-	-	S5
Storeria occipitomaculata	Redbelly snake	-	-	-	S5

The desktop review reveals a diversity of terrestrial fauna species observed within and surrounding the general location of the Project Area. These occurrences provide a snapshot of what could occur within the Project Area.

Terrestrial fauna species, including mammal, herpetofauna and insect species, were observed incidentally within the Project Area during the biophysical surveys. See Table 12-11 for all incidental wildlife observations confirmed either visually or by sign (scat, tracks, etc.).

Table 12-11. Confirmed Terrestrial Fauna Species Observed within the Project Area.

Taxon	Scientific Name	Common Name	COSEWIC	SARA	NSESA	SRank
Mammal	*Odocoileus virginianus*	White tailed deer	-	-	-	S5
	Tamiasciursus hudsonicus	American red squirrel	-	-	-	S5
	Ursus americanus	American black bear	-	-	-	S5
	Erethizon dorsata	North American porcupine	-	-	-	S5
	Ondatra zibethicus	Common muskrat	-	-	-	S5
	Castor canadensis	North American beaver	-	-	-	S5
	Canis latrans	Eastern coyote	-	-	-	S5
	-	Unknown bat species	NA	NA	NA	NA
	Lepus americanus	Snowshoe hare	-	-	-	S5
Amphibians	*Lithobates palustris*	Pickerel frog	-	-	-	S5

Taxon	Scientific Name	Common Name	COSEWIC	SARA	NSESA	SRank
	Pseudacris crucifer	Spring peeper	-	-	-	S5
	Lithobates pipiens	Northern leopard frog	-	-	-	S5
	Ambystoma maculatum	Spotted salamander	-	-	-	S5
Reptile	*Opheodrys vernalis*	Eastern smooth greensnake	-	-	-	S4
Arthropods	*Danaus plexippus*	Monarch	E	SC	E	S2?B, S3M

Two of the 15 terrestrial species observations (monarch and unidentified bat species) are classified as priority species. Figure 16 (Appendix A) shows the locations of where priority species were observed in and surrounding the Study Area.

- Monarch (S2?B, S3M, COSEWIC & NSESA Endangered, SARA Special Concern)
- Unknown bat species (All bat species have a provincial SRank of S1 or SUB, S1M)

12.3.2.1 *Monarch Butterfly*

Monarch (*Danaus plexippus*) was identified within 10 km of the Project Area by the ACCDC report. MEL biologists observed the monarch in the southeast portion of the Project Area, in a predominantly barren habitat. Monarchs are found in areas where their preferred host plant, swamp milkweed (*Asclepias incarnata*), grows and includes habitats such as meadows, open wetlands, sandy area, or grass prairies (COSEWIC 2010). No swamp milkweed was identified within the Study Area during vascular plant surveys or incidentally.

12.3.2.2 *Turtles*

No turtles were identified incidentally or during wetland and watercourse delineation and assessment.

Black Pond and Black Pond Brook offer suitable overwintering habitat for snapping turtle. Snapping turtles use a variety of habitats; however, the preferred habitat is slow-moving water with a soft mud bottom and dense aquatic vegetation. Hibernation sites are aquatic environments (e.g., lentic, lotic, and mud) where water will not freeze to the bottom, the substrate is a thick layer of mud, and other cover (e.g., large woody debris) is present (ECCC 2016). **None of the watercourses delineated within the Study Area offer suitable overwintering habitat.**

Snapping turtles typically nest in sand or gravel banks in proximity to water with sparse vegetative cover (ECCC 2016). Eastern painted turtle typically nest in habitats are open areas with south facing slopes that have a sandy loamy and/or gravel substrate (COSEWIC 2018). **No nest beaches were identified within the Study Area.**

The known distribution for wood turtle and Blanding's turtle does not exist in proximity to the Project Area (ECCC 2020; ECCC 2019).

12.3.2.3 *Mainland Moose*

No mainland moose or their sign were identified incidentally during the field program.

12.3.2.4 *Bats*

All bat species found within Nova Scotia have a provincial SRank of S1 or SUB,S1M with little brown bat (*Myotis lucifugus),* northern myotis *(Myotis septentrionalis)* and tricolored bat *(Perimyotis subflavus)* all listed as Endangered under SARA.

Little brown bat was identified within 5 km while northern myotis and tricolored bat were identified within 50 km of the Project Area by the ACCDC. An unknown bat species was incidentally identified during a nocturnal bird survey in the western portion of the Project Area. No previously known hibernacula are within the Project Area, as confirmed by NSDNRR, nor were any potential bat hibernacula identified during biophysical surveys. Potential roosting habitat (i.e., snags and mature stands) for bats was observed in select sites within the Study Area, predominantly in wetlands (e.g., WL1, WL4, WL28, WL44).

The following is a summary of bat acoustic monitoring results. Please refer to the report provided in Appendix N and Figure 7 (Appendix A) for more details.

Acoustic monitoring surveys for bats were completed at six locations (Figure 7; Appendix A) continuously from May 10 to October 31, 2022, through the use of Wildlife Acoustic SM4BAT-FS detectors. The following observations were made from the data collected by the SM4BAT detectors:

- There are low levels of bat activity across the Project Area. Peak bat activity occurred in late September with a total of 20 bat passes recorded in a single night.

- 191 total bat passes were recorded.
- 164 migratory bat species passes were recorded (86%).
- The average total passes per detector night for the Project Area over the entire survey period for all species was 0.18. The average migratory passes per detector night for the Project Area over the entire survey period was observed to be 0.15.
- Migratory species or species group comprised 86% of the bat passes recorded. The most common species groups recorded during the monitoring period were the silver-haired bat (58%) followed by eastern red bat (13%), high frequency bats (12%), and little brown myotis (11%). Hoary bat, the myotis species group, and tricolored bat were also recorded comprising the remaining 6% of bat passes.

12.3.3 **Avifauna**

The following subsections outline the results of the desktop review, field surveys, acoustic monitoring, and radar.

Refer to Appendix C-1, C-2, and C-3 for detailed results of the field survey program, acoustic monitoring, and radar, respectively.

12.3.3.1 *Field Surveys*

In spring 2022, biophysical field surveys were initiated and continued through October 2022 and a total of 202.6 hours of surveys were completed by biologists. The field studies were completed as follows:

- Spring migration surveys (April – May, 2022);
- Breeding bird surveys (June 2022);
- Fall migration surveys (August – October, 2022);
- Nightjar surveys (June – July, 2022);
- Nocturnal owl surveys (April – May, 2022), and
- Waterfowl surveys (April – October, 2022).

Field surveys resulted in the observation of 16,020 individuals, representing 100 bird species within and outside the Project Area.

The most abundant bird group observed (by total number of individuals) was shorebirds accounting for 61% of total individuals, followed by passerines (29%), waterfowl (5.6%), other landbirds (2.1%), diurnal raptors (1.3%), other waterbirds (0.94%), and nocturnal raptors (0.07%).

Passerines had the highest species diversity with 51 species observed, followed by shorebirds (19 species), diurnal raptors (9 species), waterfowl (7 species), other landbirds (7 species), other waterbirds (4 species), and nocturnal raptors (3 species).

Throughout the avifauna baseline surveys, no colonies of birds were observed within or adjacent to the Project Area. During the fall migration, no distinct migration corridors or patterns were noted by surveyors within the Project Area. Overall, the same behaviour from spring migration and breeding bird seasons was noted.

Open habitat such as barrens/heathlands and saltmarshes provided suitable foraging habitat for willets (*Tringa semipalmata*) and various types of warblers, sparrows, and predatory birds such as Northern harrier (*Circus hudsonius*), turkey vultures (*Cathartes aura*), and various buteo species.

During the spring, fall, and breeding bird surveys, survey locations associated with saltmarsh and/or coastline had the highest species richness and abundance (most of which are outside the Project Area). The proposed turbine layout for this Project is mostly centered down the middle of the Comeaus Hill peninsula. The Project footprint excludes the coastline, protected areas and far south parts of the peninsula where a higher occurrence of fly-overs were observed. Survey locations along the coastline generally had the highest species abundance and diversity.

A general trend of fall migration counts that are, on average 24% higher than the spring migration counts at the same point count (PC) locations. Overall, Fall Migration counts had 924 more individuals (38%) than the overall Spring Migration counts. But the percent of individuals across all point counts remained consistent, averaging 2.3% at all PCs.

The trend line shows that spring migration counts were highest at PCs located on the southern end of the Project Area, within Crown lands and generally trended lower the further north from the ocean and more inland. The trend line shows that fall migration followed a similar trend but the counts were generally higher than the spring counts. The highest counts were at PC 47, which is outside the Project Area, and located on the shoreline of the Tusket Island Wilderness Area (TIWA), where counts had the highest diversity and individual count with 24 species observed and 561 individuals. This PC was on the coastline where various flocks of shorebirds and seabirds were observed that resulted in a high individual count (e.g., herring gull, great black-backed gull, sanderling, short-billed dowitcher, etc). PC 47 also had a variety of habitat including open ocean off the coast, saltmarsh, barren/heathland with high shrub cover, and forested habitats located behind the PC location. This diversity of habitat would attract a variety of shorebirds, waterfowl, passerines, raptors, and more.

During avifauna baseline surveys, most bird groups were observed flying under 100 m in height and observations of groups of passerines, shorebirds, and waterfowl close to the coastline were common. This suggests the coastline is being used as a streamlined way to move around the area. Observations during surveys suggest coastline is the predominant habitat used for movement around the peninsula. There was some evidence of flyover of the Project Area, but shoreline movement clearly outnumbered overland flyovers.

All bird groups were observed flying over the peninsula; however gulls, herons, and diurnal raptors had the highest occurrences of fly-overs above 100 m during the avifauna baseline surveys. Fly-over activity was recorded during all seasons and the most common fly-over height recorded for all bird groups was between 50-100 m.

No common nighthawk (*Chordeiles minor*) were observed during the nightjar surveys. This was expected due to the lack of suitable breeding habitat for this species throughout the Project Area. No Eastern whip-poor-will were observed either during the nightjar surveys. During the nocturnal owl surveys, the northern saw-whet owl and great horned owl were detected. No SAR or SOCI owl species were observed.

The barn swallow (*Hirundo rustica*) was the only avian SAR observed during the avifauna baseline surveys. The barn swallow was observed outside of the Project Area on the coastline, close to a fish processing facility. Although there is foraging habitat for this species within the Project Area, such as swamps and open barrens/heathlands, there is no suitable breeding habitat for the barn swallow within the Project Area.

Across all survey seasons, a total of 16 avian SOCI were observed however these SOCI were mostly observed in habitats that do not represent what is found within the Project Area.

Overall, there is consistency in use by birds based on habitat types in all seasons. The highest bird counts were outside the Project Area and along the coastlines. There was no evidence of fly-over/migration corridors over the Project Area, but birds do fly through the area. The total abundance of birds is not considered high relative to other Projects that have been approved in Nova Scotia[5], and the results are consistent with those found for the 2012 EARD (Stantec 2012).

Refer to Appendix C-1 for more detailed results of the avian field survey program.

12.3.3.2 *Bird Acoustic Monitoring*

During the acoustic monitoring period a total of 821 detector-nights were monitored out of a possible 852 (i.e., 96%). A total of 28,853 NFCs were recorded, averaging approximately 35 NFCs per detector-night. Considerations should be taken into account when interpreting the results, as many variables can affect the number of NFCs detected. For example, multiple NFCs detections may represent a single individual calling multiple times within a short period. Therefore, results should be considered as to provide general insight into migratory activity, and not absolute numbers of migrants.

The majority of NFCs detected were warblers (83%), then sparrows (17%), followed by thrushes (<1%). The bulk of the detections (42%) were made across just seven nights: August 12, 25, 27, 28, and September 6, 28, and 29, 2022. The majority of NFCs detected on peak nights were warblers, except during late September there were high numbers of sparrow NFCs. It is believed that adequate coverage of the fall migration was achieved, and the results are consistent with other migratory studies conducted in southwestern Nova Scotia (e.g., Peckford and Taylor, 2008).

Refer to Appendix C-2 for the Fall Bird Acoustic Monitoring Report.

12.3.3.3 *Radar*

The bird MTR recorded during nights (between sunset and sunrise) was expected to be primarily migrating birds, while MTR recorded during the day was expected to be primarily resident birds. Throughout the migration periods, and within the lowest altitude band (0 m to 225 m), the weekly average nightly MTR continuously exceeded the weekly average daily MTR. April and September, the peaks of spring and fall migration respectively, had the highest weekly average night MTRs out of all radar study months.

Nightly migration tracks throughout the recording period totaled 165,862, for all heights. During this time the tracks considered most at risk (<225 m) numbered 76,552. This shows that a

[5] The Amherst Wind Project, currently operational, counted 20,677 birds during all seasons. https://novascotia.ca/nse/ea/amherst.wind.energy.project.asp

maximum of 47% of tracks throughout the entire nightly migration periods could be considered at risk.

Within the lowest altitude band, during both migration periods, small birds made up the highest percentage of migrants, with 61% in spring and 47% in the fall. In both periods, the percentage of migrants decreased as size category increased. During fall migration, the percentage of small birds was found to increase with increasing altitude bands up to the 675 m to 900 m band. This was not true of the spring migration. During early and peak migration, birds were found to mostly fly above the lowest altitude band. The proportion of birds flying above 225 m was found to steadily decrease as migration periods ended.

Average MTR across altitude bands was found to be higher during lower wind speeds. In the fall, small and medium sized birds were found to more often fly in winds below 20 kph, while large birds preferred a larger range, up to 35 kph. Average MTR was found to rapidly increase after sunset during both spring and fall migrations. During spring migration, this rise tended to be maintained longer throughout the night. In fall, traffic tended to steadily decline until sunrise. November was a notable exception with a rapid increase in average MTR right before sunrise.

Refer to Appendix C-3 for the Radar Monitoring Report.

12.4 Aquatic

12.4.1 <u>Wetlands</u>

The following sections outline the wetland findings from the desktop review and field surveys within the Study Area.

A review of the NSECC Wetlands Inventory Database identified three mapped wetlands within the Study Area (ID# 2769, 2345 and 2139; Figure 13; Appendix A). The NSECC wetland south of the southern access road (ID# 2139) was not observed to be present as mapped and no wetland was field identified within the Study Area at this location.

The provincial Wet Areas Database identifies areas within the Study Area that have modelled water table depth ranges varying from 0 to 10.0 m below ground surface. Modelled depth to water table <2.0 m from the surface was predominantly located in the southern portion of the Study Area. The central portion of the Study Area has a linear feature bisecting the Study Area with water table depth ranges between 0 to 2.0 m from the surface (Figure 13; Appendix A). These features are commonly associated with field mapped wetlands and watercourses and connect into the adjacent tidal waterbodies. Modelled water table are generally deeper (>2.0 m) in the northern portion of the Study Area.

The NSECC mapped wetland on the eastern edge of the Study Area is identified as a WSS (ID# 2769, Figure 13; Appendix A), based on salt marsh designation as per the NSECC predicted WSS database and Wetland Conservation Policy (NSE, 2019). The Study Area does not interact with any Ramsar sites, Provincial Wildlife Management Areas, Provincial Parks, Nature Reserves, Wilderness Areas, known lands owned or legally protected by non-governmental charitable conservation land trusts, intact or restored wetlands under the North American Waterfowl Management Plan, or protected water areas. The nearest protected area is the Tusket Islands Wilderness Area, located adjacent to the Project Area to the east (Figure 3; Appendix A).

A total of 44 wetlands were delineated within the Study Area, consisting of 43 freshwater wetlands and one tidal wetland (salt marsh; Figure 17A-C; Appendix A). A summary of Project wetlands, including type, area, dominant flow path, landform, hydric soil indicators, hydrological conditions, and dominant vegetation, are provided in Table 12-12. Delineated wetlands are shown on Figure 17A-C (Appendix A) and representative photos area provided in a photolog (Appendix R). The **bolded** wetlands in Table 12-12 (i.e., WL6, 7, 13, 23, 25, 28, 32, 38, 40, 41, 42, 43, and 44) indicated wetlands which have been caried froward into the functional and effects assessment due to proposed direct impacts or their proximity (30 m) to the proposed Project infrastructure (e.g., access roads, turbines).

Table 12-12. Wetland Delineation Summary

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
1	Swamp	0.119	Isolated	Flat	A1 Histosol	A1 Surface water, A2 high water table, B9 water-stained leaves	Herbs: *Osmundastrum cinnamomeum, Cornus canadensis* Shrubs: *Kalmia angustifolia, Picea mariana* Trees: *Acer rubrum, Picea mariana*
2*	Salt Marsh	0.122	Tidal	Terrace	F1 Loamy Mucky Mineral	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Schoenoplectus pungens, Eleocharis palustris* Shrubs: *Rosa nitida* Trees: *Picea mariana, Acer rubrum*
3	Swamp	0.072	Isolated	Basin	A1 Histosol	A3 Saturation, B9 water-stained leaves, B13 aquatic fauna	Herbs: *Osmundastrum cinnamomeum, Cornus canadensis* Shrubs: *Ilex mucronata* Trees: *Acer rubrum, Picea mariana*
4	Swamp	0.032	Isolated	Flat	A1 Histosol	A3 Saturation	Herbs: *Gaylussacia baccata, Osmundastrum cinnamomeum, Morella pensylvanica* Shrubs: *Picea mariana, Acer rubrum, Gaylussacia baccata* Trees: *Picea mariana, Acer rubrum*

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
5	Swamp	0.035	Isolated	Flat	A1 Histosol	A1 Surface water, A2 high water table, B9 water-stained leaves	Herbs: *Osmundastrum cinnamomeum, Kalmia angustifolia* Shrubs: *Picea mariana, Gaylussacia baccata* Trees: *Acer rubrum*
6	Swamp	5.387	Outlet Watercourse	Flat	A1 Histosol	A3 Saturation	Herbs: *Osmundastrum cinnamomeum* Shrubs: *Picea mariana, Gaylussacia baccata* Trees: *Acer rubrum*
7	Swamp	0.020	Isolated	Hillslope	A1 Histosol	A3 Saturation	Herbs: *Osmundastrum cinnamomeum* Shrubs: *Ilex mucronata* Trees: *Picea mariana, Acer rubrum*
8	Swamp	0.037	Isolated	Basin	A1 Histosol, A4 Hydrogen Sulfide	A1 Surface water, A3 saturation, B9 water-stained leaves	Herbs: *Osmundastrum cinnamomeum, Linnaea borealis* Shrubs: *No dominant shrubs* Trees: *Picea mariana, Acer rubrum*
9	Swamp	0.223	Isolated	Flat	A1 Histosol, A4 Hydrogen Sulfide	A1 Surface water, A3 saturation, B9 water-stained leaves	Herbs: *Osmundastrum cinnamomeum, Solidago rugosa, Rhododendron groenlandicum* Shrubs: *Picea mariana* Trees: *Picea mariana, Acer rubrum, Sorbus americana*

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
10	Swamp	1.024	Isolated	Flat	A1 Histosol	A3 Saturation	Herbs*: Osmundastrum cinnamomeum* Shrubs*: Ilex mucronata* Trees*: Acer rubrum, Picea mariana*
11	Swamp	0.099	Isolated	Flat	A1 Histosol	A1 Surface water, A2 high water table, A3 saturation	Herbs*: Osmundastrum cinnamomeum, Kalmia angustifolia, Ilex mucronata* Shrubs*: Picea mariana, Morella pensylvanica, Ilex mucronata* Trees*: Acer rubrum*
12	Swamp	0.079	Isolated	Basin	A1 Histosol	A2 High water table, A3 saturation, B9 water-stained leaves	Herbs*: Osmundastrum cinnamomeum, Osmunda regalis, Rhododendron groenlandicum, Rubus hispidus, Gaultheria hispidula* Shrubs*: No dominant shrubs* Trees*: Acer rubrum, Picea mariana*
13	Swamp	0.020	Isolated	Basin	A1 Histosol	A2 High water table, A3 saturation, B9 water-stained leaves	Herbs*: Kalmia angustifolia, Cornus canadensis, Picea mariana* Shrubs*: No dominant shrubs* Trees*: Picea mariana, Acer rubrum*

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
14	Swamp	1.810	Isolated	Basin	A1 Histosol	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Osmundastrum cinnamomeum, Kalmia angustifolia* Shrubs: *Gaylussacia baccata, Picea mariana* Trees: *Acer rubrum, Picea mariana*
15	Swamp	0.160	Isolated	Flat	A1 Histosol	A3 Saturation	Herbs: *Osmundastrum cinnamomeum, Kalmia angustifolia* Shrubs: *Ilex mucronata, Vaccinium myrtillus, Gaylussacia baccata* Trees: *Acer rubrum, Picea mariana*
16	Swamp	0.019	Isolated	Basin	A1 Histosol	A2 High water table, A3 saturation	Herbs: *Osmundastrum cinnamomeum, Vaccinium angustifolium, Sarracenia purpurea* Shrubs: *Ilex mucronata, Picea mariana* Trees: *Picea mariana, Acer rubrum*
17	Swamp	0.409	Isolated	Flat	A1 Histosol	A2 High water table, A3 saturation	Herbs: *Osmundastrum cinnamomeum, Carex crinita, Trientalis borealis, Symplocarpus foetidus, Dennstaedtia punctilobula* Shrubs: *Picea mariana* Trees: *Acer rubrum, Picea mariana*

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
18	Swamp	0.042	Contiguous Throughflow Watercourse	Hillslope	A1 Histosol	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Osmundastrum cinnamomeum, Glyceria canadensis, Rubus pubescens* Shrubs: *Morella pensylvanica, Gaylussacia baccata* Trees: *Acer rubrum, Picea rubens*
19	Swamp	0.500	Isolated	Hillslope	A1 Histosol	A2 High water table, A3 saturation	Herbs: *Thelypteris noveboracensis, Cornus canadensis* Shrubs: *Picea rubens, Picea mariana, Abies balsamea* Trees: *Acer rubrum, Picea mariana*
20	Swamp	0.204	Isolated	Basin	A1 Histosol	A3 Saturation	Herbs: *Gaylussacia baccata, Osmundastrum cinnamomeum, Rhododendron groenlandicum* Shrubs: *Picea mariana, Gaylussacia baccata* Trees: *Acer rubrum, Abies balsamea, Picea mariana*
21*	Swamp	1.051	Contiguous Throughflow Watercourse	Hillslope	A2 Histic Epipedon	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Thelypteris noveboracensis, Rubus pubescens* Shrubs: *Picea rubens, Alnus incana* Trees: *Acer rubrum, Picea rubens*

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
22	Swamp	0.077	Isolated	Terrace	A1 Histosol	A2 High water table, A3 saturation	Herbs: *Osmundastrum cinnamomeum, Gaylussacia baccata* Shrubs: *Gaylussacia baccata, Alnus incana* Trees: *Alnus incana, Picea mariana*
23	Swamp	0.080	Isolated	Flat	A2 Histic Epipedon	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Scirpus cyperinus* Shrubs: *Alnus incana, Ilex verticillata* Trees: *Acer rubrum*
24	Swamp	0.029	Isolated	Terrace	A1 Histosol	A3 Saturation	Herbs: *Osmundastrum cinnamomeum, Carex trisperma* Shrubs: *Rhododendron groenlandicum, Alnus incana* Trees: *Acer rubrum*
25	Swamp	0.021	Isolated	Flat	A1 Histosol	A3 Saturation	Herbs: *Osmundastrum cinnamomeum, Rhododendron groenlandicum, Kalmia angustifolia* Shrubs: *Kalmia angustifolia, Rhododendron groenlandicum* Trees: *Acer rubrum*

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
26*	Swamp	0.168	Isolated	Terrace	A1 Histosol	A2 High water table, A3 saturation	Herbs: *Osmundastrum cinnamomeum, Solidago canadensis* Shrubs: *Viburnum nudu, Gaylussacia baccata* Trees: *Acer rubrum*
27*	Swamp	0.021	Isolated	Hillslope	A1 Histosol	A2 High water table, A3 saturation	Herbs: *Solidago canadensis, Rubus pubescens, Osmundastrum cinnamomeum* Shrubs: *Viburnum nudum* Trees: *Acer rubrum, Picea mariana*
28	Swamp	0.265	Isolated	Flat	A1 Histosol	A3 Saturation	Herbs: *Osmundastrum cinnamomeum,* Shrubs: *Gaylussacia baccata* Trees: *Acer rubrum*
29*	Swamp	0.443	Inlet Watercourse	Hillslope	A1 Histosol	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Thelypteris noveboracensis, Osmundastrum cinnamomeum* Shrubs: *Viburnum nudum, Alnus incana* Trees: *Picea rubens, Acer rubrum*

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
30*	Bog	0.105	Isolated	Hillslope	A1 Histosol	A3 Saturation	Herbs: *Kalmia angustifolia, Woodwardia virginica, Chamaedaphne calyculata* Shrubs: *Kalmia angustifolia, Chamaedaphne calyculata* Trees: *Picea mariana, Acer rubrum, Larix laricina*
31	Swamp	0.188	Isolated	Hillslope	A2 Histic Epipedon	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Kalmia angustifolia* Shrubs: *Gaylussacia baccata* Trees: *Picea mariana*
32*	Fen	0.071	Isolated	Flat	A1 Histosol	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Chamaedaphne calyculata* Shrubs: *Gaylussacia baccata, Sorbus americana, Larix laricina* Trees: *Larix laricina*
33	Swamp	0.022	Isolated	Basin	A1 Histosol	A2 High water table, A3 saturation	Herbs: *Osmundastrum cinnamomeum* Shrubs: *Alnus incana, Gaylussacia baccata* Trees: *Acer rubrum*
34	Swamp	0.062	Isolated	Basin	A1 Histosol	A2 High water table, A3 saturation	Herbs: *Osmundastrum cinnamomeum* Shrubs: *Acer rubrum* Trees: *Acer rubrum*

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
35*	Swamp	0.571	Isolated	Basin	A2 Histic Epipedon	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Kalmia angustifolia, Osmundastrum cinnamomeum* Shrubs: *Ilex mucronata, Picea mariana* Trees: *Picea mariana*
36	Swamp	0.076	Isolated	Basin	A2 Histic Epipedon	A2 High water table, A3 saturation	Herbs: *Vaccinium oxycoccos, osmunda regalis* Shrubs: *Myrica gale, Viburnum nudum* Trees: *Acer rubrum*
37	Swamp	0.218	Isolated	Hillslope	A1 Histosol	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Osmundastrum cinnamomeum, Solidago canadensis* Shrubs: *Viburnum nudum, Picea rubens, Picea mariana* Trees: *Acer rubrum, Picea mariana*
38	Swamp	0.146	Isolated	Flat	A1 Histosol	A1 Surface water, A2 high water table, A3 saturation, B9 water-stained leaves, B13 aquatic fauna	Herbs: *Rubus pubescens, Juncus effusus* Shrubs: *Gaylussacia baccata, Alnus incana* Trees: *Picea rubens, Betula papyrifera*

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
39*	Bog	0.090	Isolated	Flat	A1 Histosol	A1 Surface water, A2 high water table, A3 saturation	Herbs: *Vaccinium oxycoccos* Shrubs: *Alnus incana* Trees: *No notable tree stratum*
40	Swamp	0.034	Outlet Watercourse	Hillslope	A1 Histosol	A1 Surface water, A3 saturation	Herbs: *Juncus effusus, Rubus pubescens, Scirpus cyperinus* Shrubs: *Kalmia angustifolia, Alnus incana* Trees: *No dominant tree stratum*
41*[3]	Swamp	0.907	Isolated	Basin	A2 Histic Epipedon	A1 Surface Water A2 High Water Table A3 Saturation D2 Geomorphic Position	Herbs: *Osmundastrum cinnamomeum,, Carex trisperma, Rubus hispidus* Shrubs: *Ilex mucronata, Picea mariana* Trees: *Picea mariana, Acer rubrum*
42*[3]	Swamp	0.869	Outlet Watercourse	Basin, Lotic floodplain	A2 Histic Epipedon	A1 Surface Water A3 Saturation	Herbs: *Osmundastrum cinnamomeum, Cornus canadensis* Shrubs: *Alnus incana* Trees: *Picea rubrum*

Wetland ID	Dominant Wetland Type	Wetland Area (ha)[1]	Water Flow Path[2]	Landform	Hydric Soil Indicator	Hydrological Conditions	Dominant Vegetation
43[3]	Swamp	0.232	Isolated	Basin	A1 Histosol	A2 High Water Table A3 Saturation D2 Geomorphic Position	Herbs*: Osmundastrum cinnamomeum, Coptis trifolium, Kalmia angustifolia* Shrubs*: Ilex mucronata, Picea mariana* Trees*: Picea mariana, Acer rubrum*
44[3]	Swamp	0.336	Isolated	Basin	A2 Histic Epipedon	A3 Saturation D2 Geomorphic Position	Herbs*: Osmundastrum cinnamomeum, Kalmia angustifolia* Shrubs*: Viburnum nudum, Picea mariana* Trees*: Picea mariana, Acer rubrum, Larix laricina*
Total Delineated Wetland Area in Study Area: 16.505 ha (165,050 m²)							

** Wetland continues beyond the Study Area boundary. All field results are based on surveys completed within the Study Area.*

[1] Wetland area within the Study Area

[2] Indicates connectivity to a regulated watercourse.

[3] Wetland was assessed in November 2022.

Bolded wetlands (i.e., WL6, 7, 13, 23, 25, 28, 32, 38, 40, 41, 42, 43, and 44) indicate wetlands which have been caried froward into the functional and effects assessment due to proposed direct impacts or their proximity (within 30 m) to proposed Project infrastructure.

In total, the 44 wetlands account for approximately 16.5 hectares, representing a land cover of 4.7% of the Study Area (353 ha; Figure 17A-C; Appendix A). Representative photos of the assessed wetlands are provided in Appendix R.

Swamp represents the most abundant wetland class in the Study Area (n=40), accounting for 91% of all wetlands and 98% of total wetland area (Table 12-13). Swamps identified in the Study Area are predominantly mixedwood or deciduous dominant, with few coniferous dominant swamps. Ninety-three (93%) percent of swamps had a prominent shrub layer which primarily consisted of saplings including black spruce (*Picea marian*a), red maple (*Acer rubrum*), and tamarack (Larix laricina), as well as woody shrubs such as mountain holly (*Ilex mucronata*), black huckleberry (*Gaylussacia baccata*), northern bayberry (*Morella pensylvanica*), wild raisin (*Vibernum nudum*), and speckled alder (*Alnus incana*).

The majority of swamps delineated within the Study Area (36 of 40, or 90%) are under one hectare in size, and collectively they account for only 42% (6.9 ha) of the total wetland area. Eighty-five percent of swamps delineated within the Study Area are isolated (34 of 40), 7.5% contain a throughflow watercourse (3 of 40), 5% or 2 of 40 have a defined outflow watercourse (e.g., headwater position), and 3% receive surface water through an inflow watercourse but lack a defined outflow.

Two bogs were delineated within the Study Area (WL30 and WL39), which account for 5% of Project wetlands and 1% of the total wetland area (0.2 ha, Table 12-13). Bog dominated wetlands in the Study Area are relatively small and range in size from 0.090 – 0.105 hectares. Wetland 30 is a sparse mixedwood treed bog characterized by black spruce, tamarack, and red maple to a lesser extent. Wetland 39 had no tree cover and was dominated by herbaceous cover (e.g., bog cranberry (*Vaccinium oxycoccos*)). Herbaceous layer diversity within bogs is generally much lower than that of swamps due to the acidic nature of the soil.

One fen (WL32, 0.071 ha) was delineated within the Study Area and accounts for 2% of the Project wetlands and occupies <1% of the total wetland area (Table 12-13). Wetland 32 is large system that extends beyond the Study Area boundary and includes multiple small pond and drainage features. The fen is dominated by graminoid species, has approximately 15% cover of speckled alder (*Alnus incana*) and trees are mainly limited to tamarack and black spruce, in the delineated portion.

No freshwater marshes were observed within the Study Area.

One tidal salt marsh (WL2) has 0.122 ha of overlap with the Study Area (Table 12-13). WL2 is large system that extends beyond the Study Area (Figure 13; Appendix A) and includes several small tidal pools, and drainage features. Salt marshes are typically coastal wetlands that are regularly inundated and drained by saline water brought in by tidal cycles. They provide a wide range of benefits to coastal communities, including shoreline protection, fishery support, carbon sequestration, and habitat provision (Hansen & Reiss, 2015). Within the Study Area, WL2 is dominated by graminoid species, specifically salt-tolerant aquatic emergents such as common spikerush (*Eleocharis palustris*) and three-square bulrush (*Schoenoplectus pungens*). The high tide zone is mostly comprised of shining rose (*Rosa nitidia*) at approximately 10% cover. Tree cover is sparse and mainly limited to black spruce and red maple along the upland edge.

Table 12-13. Summary of Wetland Classes

Wetland Type	Area				Relative Abundance		
	Average (ha)	Minimum (ha)	Maximum (ha)	Total (ha)	# Of Wetlands	% Of all Wetlands	% Of all Wetland Area
Swamp	0.382	0.019	5.387	16.193	40	91%	98%
Bog	0.098	0.09	0.105	0.195	2	5%	1%
Fen	0.071	0.071	0.071	0.071	1	23%	<1%
Salt Marsh	0.122	0.122	0.122	0.122	1	2%	1%

Six wetlands (WL21, WL32, WL38, WL39, WL41, and WL42), or portions thereof beyond the Study Area, may be historically impacted by previously constructed local and development access roads (e.g., Black Pond Road, Comeaus Hill Road). The remaining wetlands have not been subject to historic anthropogenic disturbances and were observed to retain natural functions.

12.4.1.1 *Functional Assessment*

The following sections summarize the results of the WESP-AC functional assessments for the 13 wetlands (WL6, 7, 13, 23, 25, 28, 32, 38, 40, 41, 42, 43, and 44) assessed within the Study Area, broken into the Grouped Functions.

All assessed wetlands were freshwater and thus used the non-tidal WESP-AC assessment tool. The raw scores for the Grouped and Specific Functions are further detailed in the summary tables provided in Appendix S. The raw WESP-AC excel files can be provided to the NSECC Wetland Specialist(s) upon request.

12.4.1.1.1 Hydrologic Group

The Hydrologic Group evaluates the effectiveness of a wetland to store or delay the downslope movement of surface water. However, the model does not account for wetland size, and in turn, the ability of larger wetlands to store more water than smaller wetlands. Wetlands that have the highest functions within this group tend to include those that do not have surface water outlets, and instead, are isolated from flowing surface water. See Table 12-14 for each wetland's function and benefit score.

Table 12-14. Hydrologic Group

Function	Benefit		
	Lower	Moderate	Higher
Lower	WL23, WL32*, WL40,	WL41*, WL42*	None
Moderate	None	None	None
Higher	WL6, WL7, WL13, WL25, WL28, WL38,	WL43, WL44	None

*Wetland extends beyond the Study Area boundary.

All the assessed wetlands scored lower or moderate in benefit. The wetlands that scored higher in function are those that are isolated or do not have watercourse connectivity (with the exception of WL6, a large headwater swamp); thus, they are able to store water on the landscape more effectively. Lower function ranks were awarded to wetlands that either actively convey water with a throughflow or outflow watercourse (WL 40, WL42) or contain surface water (WL23,WL32, WL41). Table 12-12 presents an overview of hydrological connectivity by wetland.

12.4.1.1.2 Water Quality Group

The Water Quality Group is compiled from four different functions: sediment retention and stabilization; phosphorus retention; nitrate removal; carbon sequestration. The main function of this group is to evaluate the wetland's potential to intercept, retain, and filter sediments, particulates, and organic matter. Similar to the hydrologic group, the wetlands that have the higher functions in this regard include those that do not have a surface water outlet, and instead are isolated from flowing surface water. This model also does not account for wetland size and as such, larger wetlands do not necessarily score higher than small wetlands, although size may factor into this function. See Table 12-15 for each wetland's function and benefit score.

Table 12-15. Water Quality Group

Function	Benefit		
	Lower	Moderate	Higher
Lower	None	None, WL41*	None
Moderate	WL23, WL32*	WL40	WL42*
Higher	WL6, WL7, WL13, WL25, WL28, WL43, WL44	WL38	None

*Wetland extends beyond Study Area boundary.

Eight of 13 assessed wetlands scored higher for the Water Quality Group function. As with the Hydrologic Group, higher scoring wetlands did not have watercourse connectivity (with the exception of WL6, a large headwater swamp). WL23, WL32, and WL40 scored moderate in function as a result of the presence of surface water (WL23 and WL32) or an outflow watercourse (WL40/WC7).

Nine of 13 wetlands scored lower in benefit, likely due to the isolation of the Study Area from surrounding developed areas, and the small size of the wetlands compared to their catchment sizes, which limits the potential benefits of the water purification function of the Water Quality Group. Whereas WL42 scored higher in benefit, likely due to it's proximity to residential and non-Project developments

12.4.1.1.3 Aquatic Support Group

The Aquatic Support Group comprises four individual functions: stream flow support; aquatic invertebrate habitat; organic nutrient export; and water cooling. The main function of this group is to determine the wetland's ability to support ecological stream functions that promote habitat health. Wetlands lying adjacent to or containing flowing water score higher than those that do not (e.g., isolated wetlands). In addition, however, headwater wetlands are crucial for supporting stream flow during the dry season by contributing to water flow via groundwater input and storage capacity. See Table 12-16 for each wetland's function and benefit score.

Table 12-16. Aquatic Support Group

Function	Benefit		
	Lower	Moderate	Higher
Lower	None	None	None
Moderate	WL28, WL43	None	None
Higher	WL6, WL7, WL13, WL25, WL38. WL42*, WL44	WL23, WL32*, WL40, WL41*	None

*Wetland extends beyond Study Area boundary.

Eleven of 13 wetlands scored higher in function within the Aquatic Support Group. These wetlands all have evidence of surface water for periods of the year or an outlet watercourse within their boundaries. All other wetlands scored lower in benefit, likely for the same reasons described above for the Water Quality Group. Aquatic habitat and wetland support are further described in Fish and Fish Habitat (Section 12.4.2).

12.4.1.1.4 Aquatic Habitat Group

The Aquatic Habitat Group is compiled from five different functions: anadromous fish habitat, resident fish habitat, amphibian and turtle habitat, waterbird feeding habitat, and waterbird nesting habitat. Wetlands that have the higher functions within this group include those that are adjacent to or contain water features with potential habitat characteristics (e.g., in-stream cover, aquatic vegetation, etc.). See Table 12-17 for each wetland's function and benefit score.

Table 12-17. Aquatic Habitat Group

Function	Benefit		
	Lower	Moderate	Higher
Lower	WL28, WL38	WL6, WL7, WL13, WL25, WL43, WL44	None
Moderate	None	WL23, WL32*, WL40	WL41*, WL42*
Higher	None	None	None

*Wetland extends beyond Study Area boundary.

The eight wetlands (WL6, WL7, WL13, WL25, WL28, WL38, WL 43, and WL44) that scored lower for function do not contain key features to support habitat for fish, herpetofauna, or waterbirds. The remaining five wetlands assessed within the Study Area have moderate function due to evidence of standing or flowing surface water that could provide such habitat. Aquatic habitat and wetland support are further described in Fish and Fish Habitat (Section 12.4.2).

12.4.1.1.5 Transition Habitat Group

The Transition Habitat Group comprises three different functions: songbird, raptor, and mammal habitat, native plant habitat and pollinator habitat. The main function of the collective group is to evaluate the wetland's ability to support healthy habitat for birds, mammals, and native plants. See Table 12-18 for each wetland's function and benefit score.

Table 12-18. Transition Habitat Group

Function	Benefit		
	Lower	Moderate	Higher
Lower	None	None	None
Moderate	WL28	WL6, WL7, WL13, WL25, WL43	None
Higher	WL23, WL32*, WL38, WL40	WL41*, WL42*, WL44	None

*Wetland extends beyond Study Area boundary.

All 13 assessed wetlands scored moderate to high for function in the Transition Habitat Group. Due to the location of the Study Area, many wetlands (e.g., WL6, WL7, WL13, Wl25, WL28, WL43, WL44) provide relatively remote, undisturbed and unfragmented habitat, resulting in a higher average function score for Transitional Habitat. In general, wetlands within the Study Area provide habitat that supports a variety of flora and fauna, which includes specific WESP assessed functions such as downed wood, prevalent ground cover, varied microtopography, tree and shrub cover in and around the wetlands, and naturally vegetated buffer zones. The wetlands have a variety of woody heights and diverse forms, which allows for nesting habitat, perches, and feeding grounds. As such, wetlands within the Study Area generally provide habitat for songbirds, mammals, pollinators, and potentially rare plants. All wetlands scored lower to moderate for the benefit score, likely due to the remoteness of the Study Area, indicating that these wetlands perform at equal or lower rates to others in the area. A detailed assessment of baseline habitat is provided in Vegetation Community and Classification and Flora (Section 12.3).

12.4.1.1.6 Wetland Condition

Wetland Condition refers to the integrity or health of a wetland as defined by its vegetative composition and richness of native species. Scores are derived from the similarity between the

wetland being evaluated and reference wetlands of the same type and landscape setting (Adamus, 1996). Only wetland benefits, not functions, are score in this group.
Wetland Condition within the Study Area ranged from lower (WL23), moderate (WL6, 13, 28, 42, and 43), to higher (WL7, 25, 32, 38, 40, 41, and 44), as shown in Table 12-19 below, indicating that the moderate to higher wetlands carry a relatively good range of vegetative community health and natural functions. WL23 is located adjacent to existing road developments and may be subject to previous anthropogenic influences, likely resulting in its lower score. Higher scoring wetlands may have greater ecological integrity, microhabitats, species diversity, etc., while lower scoring wetlands may have lost their function and integrity due to historical natural or anthropogenic impacts.

Table 12-19. Wetland Condition Group

Benefit		
Lower	**Moderate**	**Higher**
WL23	WL6, WL13, WL28, WL42*, WL43	WL7, WL25, WL32, WL38, WL40, WL41*, WL44

*Wetland extends beyond Study Area boundary.

12.4.1.1.7 Wetland Risk

Wetland Risk takes sensitivity and stressors into account by averaging the two. Sensitivity is the lack of intrinsic resistance and resilience of the wetland to human or naturally caused stress (Niemi et al., 1990). Stress relates to the degree to which the wetland is or has recently been anthropogenically altered in a way that degrades natural condition and/or function.

The functional assessment tool uses five metrics to measure sensitivity: abiotic resistance, biotic resistance, site fertility, availability of colonizers, and growth rate. The model applies four stress groups: hydrologic stress, water quality stress, fragmentation stress, and general disturbance stress. Wetlands that are highly resilient may have lower risk scores despite their exposure to multiple stressors. Additionally, wetlands exposed to fewer threats, but with low resilience may have higher risk scores. Wetland resilience is tied to multiple factors, such as size, proximity to natural land cover, and presence of invasive species.

All but one of the wetlands in the Study Area (WL23) scored moderate or higher for Wetland Risk (Table 12-20), meaning they have a reasonable resilience and are not highly susceptible to change. One wetland, WL23, scored lower, indicating a greater risk and susceptibility to anthropological impacts. As stated above, this is likely a result of adjacent road developments and associated stressors.

Table 12-20. Wetland Risk Group

Benefit		
Lower	**Moderate**	**Higher**
WL23	WL6, WL7, WL13, WL25, WL32, WL38, WL40	WL28, WL40, WL41*, WL42*, WL44

*Wetland extends beyond Study Area boundary.

12.4.1.1.8 Functional Assessment Summary

WESP-AC is a quantitative decision-making tool, but its results must be used qualitatively to form conclusions around wetland functions. The highest functioning wetlands are those that have both higher function and higher benefit scores. No wetlands assessed for the purposed of this Project scored higher in both benefit and function for an individual functional group. The wetlands within the Study Area score higher in function than benefit, likely due to the relatively remote location of the Project.

12.4.1.1.9 Wetland Hydrology

Within the Study Area, four classes of wetland were observed: swamp, bog, fen, and salt marsh.

Wetland hydrology specific to individual wetlands is highly dependent on wetland type and its position on the landscape. The Study Area is located on a peninsula. Generally, water flows perpendicular (east or west) to the peninsula's topographic divide, which runs north to south, terminating in the Atlantic Ocean (Figure 13; Appendix A). Hydrological flow is predominantly influenced by the Study Area's elevated topographic position relative to the surrounding landscape, with primary flow paths originating in the elevated center of the peninsula, including headwater wetland systems (e.g., WL6). Project topography and landscape position are further discussed in Section 12.2.1.

As a result of Study Area topography, most wetlands are small (91% are <1 ha), isolated systems in headwater positions. Some wetlands located on adjacent hillslopes receive surface water throughflow or inflow (e.g., WL18, WL29 and WL40) or may be driven by groundwater inputs.

Swamps may be classified as peatlands (organic) or mineral wetlands depending on their substrate. Water table fluctuations in swamps are often greater than those of bogs and fens (commonly resulting in lower/slower organic acclamation) and are on average drier than most other wetland types, with a water table below the surface for the majority of the year (Warner & Rubec, 1997). Most swamps in the Study Area are small (90% are <1 ha), isolated headwater wetlands with deep organic soils > 40 cm (e.g., histosol) with near/at surface water tables or saturation, and thus are less likely to be subjected to water level fluctuations and seasonal flooding. Swamps located in headwater positions function as groundwater recharge systems, however those on or at the base of hillslopes may function as groundwater seepage or discharge areas.

Bogs (i.e., WL30 and WL39) are ombrotrophic peatlands, meaning they are fed by precipitation, and typically do not receive surface water or groundwater inputs. As a result, they are commonly found in headwater positions and function as groundwater recharge systems. Bogs form through the accumulation of undecomposed organic soils (peat), which results in deep organic depositions and can be elevated above the surrounding landscape (Warner & Rubec, 1997).

Fens (i.e., WL32) are a form of minerotrophic peatland, characterized by surface water and/or groundwater inputs. As a result, fens typically have shallower peat deposits and fluctuating water tables at or just above/below the ground surface (Warner & Rubec, 1997). Fens commonly function as flowthrough wetlands, shuttling surface water or groundwater laterally across the landscape. Fens are often groundwater discharge areas that also receive surface water from watercourses or drainage features (Siegel & Glaser, 1987).

Salt marshes (i.e., WL2) are mineral wetlands associated with tidal waterbodies. Salt marshes are characterized by lateral tidal water fluctuations and have minimal subsurface/groundwater movement (Price, 1990). Below the mean highwater mark (low marsh), salt marshes are influenced by semi-diurnal tides and inundation, whereas above this mark (high marsh), the water table is typically below the ground surface and primarily influenced by less frequent high tide events (e.g., monthly, seasonally). In the case of WL2, the portion delineated in the Study Area is a high marsh, and includes marginal tidal swamp characteristics, such sparse trees and shrub cover which can tolerate short periods of tidal influence (Warner & Rubec, 1997).

12.4.1.2 *Wetlands of Special Significance*

As part of the qualitative wetland field assessments, along with a review of the current (June 2020) NSECC predictive WSS layer, each wetland was reviewed to assess potential for WSS designation. MEL presents their WSS assessment below, in consideration of the desktop and field assessments, the Wetland Conservation Policy (NSE, 2019) and NSECC guidance received to date. However, the following only presents proposed WSS designations and ultimately WSS determination lies with NSECC.

A review of the NSECC predictive WSS layer identified WL2 as a WSS due to salt marsh classification, as per the Wetland Conservation Policy (NSE, 2019). Field surveys confirmed WL2 as a tidal salt marsh and is presented as a WSS herein (Figure 17A-C; Appendix A). WL2 is located within the Study Area. No other NSECC predicted wetlands were observed within the Study Area.

No functional WSS were identified through the non-tidal WESP-AC WSS Interpretation Tool (see Table 3, Appendix B for results). All assessed freshwater wetlands received low Function-Benefit

Product (FBP) scores for each support supergroup. As a result, no WSS are proposed for designation based on the WESP-AC functional assessments.

A review of the Project's ACCDC report (Appendix L) did not identify any SAR observations within the Study Area or delineated wetlands. **No field identified SAR (mobile or sessile) were observed in delineated wetlands during any field surveys, nor within the larger Study Area** (see Figure 16; Appendix A for priority species observations). One blue felt lichen (*Pectenia plumbea*, SARA & COSEWIC Special Concern, NSESA Vulnerable) was observed in wetland habitat beyond the Study Area (see Section 12.3.1.2 for more detail). As the associated wetland is beyond the Study Area and scope of this assessment it is not presented as potential WSS herein and will be delineated and reevaluated should the Project design or Study Area change to interact with it (directly or indirectly).

12.4.1.3 *Wetlands Summary*

Within the Study Area there were 44 wetlands delineated which consist of swamps, bogs, one fen, and one tidal salt marsh (Figure 17A-C; Appendix A). The total wetland area within the Project Area is 16.581 ha. The majority of wetlands are treed swamps (n=40) which make up most of the wetland area within the Study Area (98%). Most individual wetlands are hydrological isolated (n=37), in the sense that they do not have defined surface water connections (i.e., inlets, outlets, throughflow). No SAR (mobile or sessile) were identified during field surveys or the Project's ACCDC report (Appendix L) in any field delineated wetlands within the Study Area. One wetland (WL2) is designated a WSS due to its tidal salt marsh classification. Final WSS determination will be made by NSECC.

WESP-AC results (Appendix S) present that the averaged Group function scores for assessed wetlands within the Study Area range from Moderate to Higher, except for the Aquatic Habitat Group, which had a Lower average function than the other groups. The average Group benefit scores ranged from Lower to Moderate. Generally, lower average benefit scores were observed in comparison to function scores, likely, in part, a result of the remoteness of the Study Area. No functional WSS were identified through the WESP-AC assessments (Appendix S).

12.4.2 Surface Water, Fish and Fish Habitat

The following sections outline the surface water, fish and fish habitat findings from the desktop review and field surveys.

The Fish Study Area is situated entirely within the Tusket River primary watershed (1EA) and the secondary shore direct watershed 1EA-SD6 (Figure 13, Appendix A). Goose Lake and its outflow Heath Brook are the prominent aquatic features within the secondary watershed, but the system drains north and away from the Fish Study Area, eventually terminating at the Tusket River near Plymouth, Nova Scotia. The only other named watercourses or waterbodies within the watershed are Black Pond and Black Pond Brook. Black Pond Brook originates from a wetland north of Black Pond Road, flowing south of the road into a large wetland complex containing Black Pond. From here, the brook flows southwest, crossing Comeaus Hill Road and empties into Little River Harbour.

The Fish Study Area extends south on the Project Area peninsula which is characterized by a series of topographical highs through its center. The topographical high generates a division in flow, with surface water on the western side of the peninsula (including Black Pond and Black Pond Brook) draining west to Little River Harbour, and surface water on the eastern side draining east to into Goose Bay. As the Fish Study Area is mainly situated the eastern side of the peninsula, most of the surface water originating within the Fish Study Area is expected to drain east. Elevation within the Fish Study Area ranges from approximately 10-45 mASL.

The 2012 EARD (Stantec 2012) identified two watercourses within the respective Project Study Area: Black Pond Brook and Heath Brook. No unmapped watercourses were noted (Stantec 2012). Detailed habitat assessments completed by Stantec found that both watercourses were soft-bottomed and slow flowing, typical of wetland watercourses. Neither watercourse was anticipated to contain fish based on insufficient connections between them and larger fish-bearing waters (Stantec 2012). No fish sampling was conducted for the 2012 EARD. Water quality within the Project Study Area was described as *"temperate and acidic with low conductivity, based on conditions observed during the field assessments… these conditions are typical for Nova Scotia" (Stantec 2012).*

The priority species list identified three priority fish species that may occur within the Fish Study Area (Appendix M); Atlantic salmon – Southern upland population (*Salmo salar*; COSEWIC endangered), American eel (*Anguilla rostrata;* COSEWIC threatened), and brook trout (*Salvelinus fontinalis*; S3). No critical habitats for aquatic SAR occur within the Fish Study Area (DFO 2022). Aquatic SAR found or potentially found within the Fish Study Area, according to the aquatic SAR mapping, are limited to marine species including fin whale, blue whale, North Atlantic right whale, spotted wolffish, leatherback sea turtle, and white shark (DFO 2022).

The ACCDC report identified one priority fish species in proximity to the Fish Study Area (Appendix L); Atlantic whitefish (*Coregonus huntsmani;* SAR endangered). Atlantic whitefish were identified within the ACCDC report as being found within 4.9 km of the Fish Study Area. Atlantic whitefish are historically anadromous fish that are now endemic to only three lakes within Nova Scotia (Hebb, Milipsigate, and Minamkeak) (COSEWIC 2010). These land-locked populations now remain within these lakes and connecting watercourses to complete their life cycles (COSEWIC 2010). The Tusket-Annis watershed in Yarmouth, Nova Scotia, historically held Atlantic whitefish, but are now considered extirpated from the watershed (COSEWIC 2010). Atlantic whitefish is considered critically imperiled (S1) by the ACCDC and is listed as endangered through SARA and NSESA.

The following additional fish species have been documented in waterbodies within Tusket River primary watershed (Alexander, Kereks, and Sabean 1986; NSDFA 2019):

- alewife (Alosa pseudoharengus; S3B);
- banded killifish (*Fundulus diaphanous*; S5);
- brown bullhead (*Ameiurus nebulosus*; S5);
- brown trout (*Salmo trutta*; SNA);
- chain pickerel (*Esox niger*; SNA);
- creek chub (Semotilus atromaculatus; S5);
- fourspine stickleback (*Apeltes quadracus*; S5);
- golden shiner (Notemigonus crysoleucas; S4);
- lake chub (*Couesius plumbeus*; S5);
- lake whitefish (*Coregonus clupeaformis*; S4S5);
- mummichog (Fundulus heteroclitus; S5);
- smallmouth bass (*Micropterus dolomieu*; SNA);
- white perch (*Morone americana*; S5);
- white sucker (*Catostomus commersonii*; S5); and,
- yellow perch (*Perca flavescens*; S5).

No additional fish species were identified through the review of Fisheries and Oceans Stock Status Reports or NSDNRR Significant Species and Habitats database.

12.4.2.1 *Fish Habitat*

No waterbodies were identified within the Study Area.

Throughout the Fish Study Area, eight watercourses and two open water features were delineated and qualitatively described. Physical and fish habitat characteristics of the open water feature and each watercourse are provided in Table 12-22 and Table 12-22. Characteristics presented are limited to the extent of watercourse contained within or overlapping the Study Area. A total of 44 wetlands have been identified and delineated throughout the Study Area, which are described in Section 12.4. Wherever fish habitat extends into wetlands, it is described herein under the context of contiguous watercourses and/or open water bodies. Delineated wetlands and watercourses are shown on Figure 2 (Appendix 17A-C), and representative photos of watercourses are provided in Appendix R. All watercourses described within the Study Area are first order streams.

Table 12-21: Summary Fish Habitat Characteristics - Open Water Features

ID	Watercourse Association	Wetland Association	Fish Habitat Characteristics				
			Habitat Type	Substrate	Cover	Average Depth (m)	Area (m^2)
A	WC1	WL18	Small Pond	Muck/Detritus	Submergent vegetation (15%)	0.5	45
B	WC8	WL42	Flooded Wetland	Muck/Detritus, Wetland soils	Emergent wetland vegetation (35%)	0.2	840

Table 12-22. Summary Fish Habitat Characteristics - Watercourses

WC	Flow[1]	Gradient[2]	Velocity[3]	Length (m)	Average Channel Width (m)	Average Depth (m)	Substrate (%)[4]	Habitat Types	Cover Types	Comments
1	I	Moderate	Low	306	1.0	0.3	Boulder (80) M/D (15) Sand (5)	Run, Step-pool	Overhanging and emergent vegetation	Channel discontinuous, intermittently disappears. Water flows underground.
2	I	Low	Low	216	0.3	0.3	Boulder (5) M/D (95)	Run	Large woody debris, overhanging vegetation	Channel discontinuous, intermittently disappears. Water flows underground.
3	I	Flat	Low	13	0.7	0.1	Boulder (10) Rubble (15) Cobble (30) Gravel (5) M/D (40)	Pool, Run	Overhanging and submergent vegetation	Channel discontinuous, intermittently disappears. Water flows underground.
4	P	Low	Low	85	0.3	0.1	Cobble (5) Gravel (20) Sand (30) M/D (45)	Run, Flat	Large woody debris, overhanging and emergent vegetation.	Flows at base of Black Pond Road. Gravel/sand likely sourced from road. Historic berming of channel bank. Channel widens to 5 m as a flat, then continues west along the road just north of the Study Area.

WC	Flow[1]	Gradient[2]	Velocity[3]	Length (m)	Average Channel Width (m)	Average Depth (m)	Substrate (%)[4]	Habitat Types	Cover Types	Comments
5	E	Moderate	Moderate-High	105	0.5	0.2	Boulder (80) M/D (20)	Run, Rapid, Step-pool	Overhanging and submergent vegetation	Channel discontinuous, intermittently disappears. Water flows underground.
6	I	Moderate	Low	428	1.5	0.3	Boulder (50) Cobble (5) Gravel (5) Sand (10) M/D (30)	Run, Flat	Large woody debris, undercut banks, overhanging vegetation	Channel discontinuous, intermittently disappears. Water flows underground.
7	P	Low	Low	90	1.9	0.1	Cobble (10) Silt (5) M/D (85)	Riffle, Run	Emergent vegetation	Dug channel. Continues south of Black Pond Road.
8	I	Low	Low	170	1.0	0.1	M/D (7) Silt (20) Gravel (5) Sand (5)	Run	Emergent vegetation	Flow originates in roadside ditch, floods through WL42 (Open Water B) then flows west under Comeaus Hill Road where it re-channelizes. Channel discontinuous, intermittently disappears. Water flows underground.

[1]Perennial (P) – A stream that flows continuously throughout the year, Intermittent (I) – Streams that go dry during protracted rainless periods when percolation depletes all flow, Ephemeral (E) – A watercourse that flows during snowmelt and rainfall runoff periods only (AT, 2009).
[2]Flat (<1%), Low (1-4%), Moderate (4-7%), High (>7%).
[3]Low velocity (<0.15m/s), Moderate velocity (0.15-0.3m/s), High velocity (>0.3m/s).
[4]M/D – Muck/Detritus (organic origin).

12.4.2.2 *Watercourses*

Common characteristics were noted across watercourses delineated within the Study Area. All eight watercourses within the Study Area are first order streams and do not provide passage to any upgradient aquatic features.

One watercourse, WC7 is a historically excavated channel, as determined from its straightened banks and machine tracks throughout this portion of the Study Area. As a result of this historical impact, it contains flow year-round. Based on provincial flow accumulation, the watercourse would likely contribute flow south to Goose Bay.

The remaining seven watercourses flow intermittently (i.e., seasonally). Another common characteristic of watercourses within the Study Area is a discontinuous channel. The channels of WC1, WC2, WC3, WC5, WC6 and WC8 were all noted to sporadically disappear, up to 50% of the length of the delineated flow line. When this occurred, surface flow water was observed to infiltrate underground or flow between vegetated boulders, with flow being more often heard than seen. Channels with surface flow would often reappear at a natural topographic low. These areas are seasonal barriers to fish passage, as water levels are expected to rise between and above the level of the boulders during periods of high flow. Though not complete barriers, it is likely that these subterranean sections restrict passage by acting as navigational obstacles to upstream and downstream migration, especially during seasonal low flow conditions.

Typical of first-order streams, the watercourse substrates are dominated by organic muck and embedded boulders. Average water depths range from 10-30 cm, and average channel widths range from 0.3-1.9 m. Habitat types are generally homogenous, with low-gradient stretches typified by runs, and more moderate-gradient stretches characterized by step-pools and rapids. Cover is most provided by overhanging vegetation, with less frequent occurrences of large woody debris, instream vegetation, and undercut banks.

All watercourses are presumed accessible to fish from downgradient aquatic features. However, based on the described limitations to passage, access would only be possible to WC1, W2, WC3, WC5, WC6, and WC8 during periods of high flow or after heavy rain events. Fish habitat within these watercourses are limited by dry conditions and subterranean flow. Although only a portion of WC4 was delineated due to landowner restrictions on private land, it is reasonably presumed to continue west at the base of Black Pond Road to Black Pond Brook.

12.4.2.3 *Wetlands*

Wetlands associated with surface water features include WL2, WL6, WL18, WL21, WL29, WL40, and WL42. Wetland 2 is a tidal salt marsh on the western edge of Goose Bay, but all fish habitat (tidal pools) within the wetland is located east of the Study Area and outside the Project Area.

WL6 and WL40 produce outlet watercourses (into WC2 and WC7, respectively), but were not observed to contain any contiguous surface water that would directly support fish. WL21, which is bordered by WC4 to the north, may be temporarily inundated by the watercourse during high flow events but fish habitat is considered limited to the watercourse channel due to the lack of fish habitat features within the wetland.

WC6 flows into the western boundary of WL21. The watercourse channel was not observed to continue through the wetland, but intermittent pockets of surface water were observed and connected by sub-boulder drainage following the gradual topographical slope to the east. Water levels would be expected to rise between and above the level of the boulders within the wetland during periods of high flow, which may provide passage through the wetland into WC6, presuming fish access from downgradient aquatic features outside of the Study Area. Fish habitat provisions within the wetland is limited to this seasonal passage.

As presented in Table 12-21, WL18 and WL42 contain the only open water features within the Study Area. Shortly after the channel of WC1 appears, the linear watercourse opens into a small (45 m^2), vegetated pond at the northern edge of WL18 (Open Water A). The substrate is composed of organic muck and detritus, and average water depth is 50 cm. Variegated pond-lily (*Nuphar variegata*) covers approximately 15% of the pond's surface.

Open Water B forms from WC8, which dechannelizes through WL42. Flow from the watercourse floods into the wetland, dispersing as unconfined sheet flow with an average depth of 20 cm. Surface water from WL42 is then directed west through a culvert under Comeaus Hill Road. The open water feature presented on Figure 17A-C (Appendix A) is anticipated to represent the maximum area of potential fish habitat during normal high flows within the wetland given the time of year it was evaluated (mid-November) and preceding rainfall events. It is anticipated that the surface water extent and depth throughout the wetland protracts considerably if not entirely during summer low-flow periods.

12.4.2.4 *Water Quality*

Water quality results are reported and discussed as it relates to the chemical characteristics required for suitable fish habitat. Where applicable, water quality sampling results are measured against the CCME *Guidelines for the Protection of Freshwater Aquatic Life* (FWALs). Summaries of water quality measurements are presented in Table 12-23. Water quality measurement locations coincide with fish collection locations, shown on Figure 3 (Appendix A). The results shown in the tables above generally provide a snapshot *in-situ* water quality from select aquatic features from mid-summer (July) through the fall (October).

Table 12-23. In-situ Water Quality Measurements recorded during Electrofishing and Trapping Surveys

Site	Sampling Dates	Water Temp (ºC)	pH	DO (mg/L)*	Conductivity (µS/cm)	TDS (mg/L)
Black Pond Brook Reach 1	Jul. 27, 2022	19.7	4.71	-	85	61.1
Black Pond Brook Reach 2	Jul. 27, 2022	16.0	5.12	-	43.2	34.45
Black Pond	Jul. 27, 2022	17.3	4.61	-	64.4	48.75
WC7	Sept. 28, 2022	14.6	5.8	-	93	-
Black Pond Brook	Oct. 27, 2022	13.9	4.3	6.04	102.3	73.3
WC7	Oct. 27, 2022	15.3	5.74	6.80	75.4	53.7
WC8	Nov. 17, 2022	8.9	4.0	9.29	69.2	65.0

Note: Values in bold indicate parameters recorded as below CCME guidelines for the protection of aquatic life, including DO levels not suitable for any life stage of warm or cold-water fish species (<5.5 mg/L) (1999), and pH levels below 5.0 (CCREM, 1987).
*DO = Dissolved Oxygen. DO probe malfunction during Summer 2022 surveys.

Concurrent with the findings of the 2012 EARD (Stantec 2012), surface water features within the Study Area were found to be temperate and acidic, typical for watersheds in south-western Nova Scotia.

Water temperature affects the metabolic rates and biological activity of aquatic organisms, thus influencing the use of habitat by aquatic biota. There are no CCME guidelines related to temperature and aquatic biota. Temperature preferences of fish vary between species, as well as with size, age, and season.

American eel have a broader temperature range and can tolerate temperatures from 4 to 25 ºC (Fuller et al. 2019). All temperatures recorded are considered within the suitable temperature range for cold-water fish species (<20 ºC).

The CCME FWALS suggest a range of pH from 6.5 to 9.0 is suitable within freshwater habitat to support aquatic health. 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 10-20% species loss is apparent when pH <5.5. The pH range for aquatic features sampled within the Fish Study Area was 4.0 to 5.8, with an average pH of 4.9. No sampling sites exhibited pH levels within CCME recommended range for freshwater aquatic life (6.5-9). American eel, however, are more tolerant of low pH than 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 (Jessop 1995).

The CCME FWALs establish a minimum recommended concentration of DO of 9.5 mg/L for early life stages of cold-water biota and 6.5 mg/L for other life stages. For warm-water biota, the CCME guidelines recommend 6.0 mg/L for early life stages, and 5.5 mg/L for all other life stages. Dissolved oxygen (DO) was only recorded in late October and mid-November, after a heavy rainfall events. DO levels in October are at the lower end of the CCME guidelines (6.04-6.08) but are not considered limiting. However, DO can vary daily and seasonally, as the concentration of oxygen in water is affected by several independent variables including water temperature, atmospheric and hydrostatic pressure, microbial respiration, and growth of aquatic vegetation. It is anticipated that DO levels would likely drop during summer low-flow periods as temperatures warm and flow diminishes.

Conductivity and TDS are often used as baseline for comparison with background measurements. Significant changes in these three parameters could indicate that a discharge or some other source of pollution has entered the aquatic resource. Conductivity and TDS levels measured within the Fish Study Area are considered typical for Nova Scotia (NSSA 2014).

12.4.2.5 *Fish Collection Surveys*

The following sections outline the results of fish collection efforts within the Fish Study Area.

12.4.2.5.1 Electrofishing

The results of electrofishing surveys are presented in Table 12-24. Relative abundance has been expressed calculated as the number of fish captured per 300 seconds of electrofishing effort. Electrofishing surveys within the Fish Study Area are presented on Figure 3 (Appendix A).

Table 12-24. Summary of Electrofishing Efforts within the Study Area

Site	Survey Date	Fish Species Collected		Catch Per Species	Total Catch	Total Effort (seconds)	CPUE[1] (fish/300 seconds)
		Common Name	Scientific Name				
Black Pond Brook Reach 1	July 27, 2022	N/A	N/A	0	0	855.3	0
Black Pond Brook Reach 2	July 27, 2022	American eel	*Anguilla rostrata*	1	1	677.0	0.001

Site	Survey Date	Fish Species Collected		Catch Per Species	Total Catch	Total Effort (seconds)	CPUE[1] (fish/300 seconds)
		Common Name	Scientific Name				
WC7	September 28, 2022	N/A	N/A	0	0	554.1	0
[1]CPUE = Catch per unit effort							

Electrofishing surveys within the Fish Study Area resulted in the capture of a single American eel, resulting in a low CPUE of 0.001 fish per 300 electrofishing seconds (Figure 8; Appendix A). No other species of fish were observed or caught during fish and fish habitat surveys.

12.4.2.5.2 Trapping

The results of trapping efforts are presented in Table 12-25. Relative abundance has been expressed through CPUE per trap type and per species.

Table 12-25. Summary of Trapping Efforts within the Fish Study Area

Site	Survey Date	Fish Species Collected	Total Catch	Total Effort Per Trap Type (hours)	Total Catch Per Trap Type	CPUE (per trap type)	CPUE (per species)
Black Pond	July 27-28	American eel	6	MT (288.00) EP (96.00) FN (48.00)	2 1 3	MT-0.007 EP- 0.010 FN- 0.063	American eel – 0.014
WC7	September	None	0	MT (110.25) EP (31.5)	-	0	0

A total of six individual American eel were captured as a result of trapping efforts within the Fish Study Area, all within Black Pond (Figure 8; Appendix A). No fish were captured through trapping efforts in WC7. CPUE across trap types were low, ranging from 0.007 for minnow traps to 0.063 for fyke nets.

12.4.2.5.3 Fish Species Observed

Table 12-26 presents a summary of fish species captured through electrofishing within the Study Area.

Table 12-26. Fish Species Captured within the Fish Study Area

Common Name	Scientific Name	SARA	COSEWIC	NSESA	SRank	Total Catch	
						Total #	% Catch
American eel	Anguilla rostrata	-	Threatened	-	S3N	7	100%

Individual data for fish captured within the Study Area are presented in Table 12-27, and representative photos of fish captured are presented in Appendix R.

Table 12-27. Individual Fish Measurements within the Fish Study Area

Fish ID	Common Name	Scientific Name	Fork Length (mm)	Total Length (mm)	Age Class	Mark Observed
1	American eel	Anguilla rostrata	N/A	650	Yellow	No
2	American eel	Anguilla rostrata	N/A	450	Yellow	No
3	American eel	Anguilla rostrata	N/A	500	Yellow	No
4	American eel	Anguilla rostrata	N/A	1,050	Silver	No
5	American eel	Anguilla rostrata	N/A	170	Yellow	No
6	American eel	Anguilla rostrata	N/A	230	Yellow	No
7	American eel	Anguilla rostrata	N/A	200	Yellow	No

Suitable habitat for eel is varied. As a catadromous species, eel spend the majority of their lives in freshwater, moving to the Sargasso Sea to spawn. Once hatched, American eel larvae drift back to the coast, undergoing several phases of metamorphosis. By the time they reach freshwater, young glass eel have developed pigment and are now referred to as elvers (Scott and Crossman 1973). In freshwater, elvers develop into yellow eel – immature adults and at which point sexual differentiation occurs. As growth proceeds, the yellow eel metamorphoses into silver eel, or mature adults that are now physiologically prepared to return to the sea to spawn (COSEWIC 2012).

American eel are frequently found in watercourses that offer structural complexity and shade in the form of coarse woody debris, rocks, in-stream vegetation for daytime cover, and an available food source of forage fish, invertebrates, molluscs and vegetation. Migrating elvers are bottom dwellers and spend most of their time burrowed or hidden, including directly into soft bottom sediments (Tomie 2011). In freshwater, yellow eel continue their migration upstream into rivers, streams, and muddy or silt bottomed lakes (Scott and Crossman 1973). Like elvers, yellow eel are primarily nocturnal, spending most of the day under cover or buried in soft substrates. These soft substrates are particularly important for overwintering, where the eel hibernate by burying themselves into the bottoms of lakes and rivers (Smith and Saunders 1995; Scott and Scott 1998). Trautman (1981) also reported that eel partially or completely bury themselves in mud, sand and gravel during the day, emerging at dusk to begin feeding.

American eel have been assessed as threatened by COSEWIC (2012) and are considered provincially imperiled by the ACCDC (S2). American eel are not currently protected under SARA or NSESA. During the 2022 field program, American eel was the only species captured during fish sampling. A total of seven American eel, both juvenile and adult, were confirmed in Black Pond and Black Pond Brook.

American eel occur throughout the province and are “highly plastic in habitat use” (COSEWIC 2006). In addition, eel can traverse typical obstacles to fish, such as vertical walls and wet terrain. Eel would be particularly adept at navigating the majority of watercourses within the Study Area that would otherwise pose passage barriers to other fish species through discontinuous channels and subterranean flow. American eel are therefore considered potentially present within all delineated watercourses within the Study Area, though in low abundance. As the most permanent surface water features within the Fish Study Area, Black Pond and Black Pond Brook would be considered to support the most substantial fish community within the Fish Study Area. Watercourses and the two open water feature (A and B) within the Study Area provide preferred habitat for American eel in the form of soft, mucky substrates and a variety of cover types.

Watercourses within the Study Area provide poor quality habitat for other fish species identified in the Tusket River primary watershed including salmonids, suckers and minnows due to the inconsistent flow and subterranean sections acting as impediments to fish passage throughout watercourse.

12.4.2.6 *Surface Water, Fish and Fish Habitat Summary*

Throughout the Study Area, eight watercourses and two open water features were delineated and qualitatively described. Fish habitat has been characterized in all delineated watercourses and the open water feature associated with WL18 and WL42. Electrofishing and trapping surveys in Black Brook and Black Brook Pond resulted in the capture of a single species – American eel - in low abundance (n=7). No fish were captured or observed in WC7 or observed in any other delineated watercourses.

Fish habitat within the Fish Study Area is generally limited by dry conditions and extensive sections of subterranean flow. As first order streams, watercourses within the Study Area do not provide passage to any upgradient aquatic features. Watercourses are largely seasonal, low-gradient, soft-bottomed watercourses with little to no visible flow and moderate cover. Based on these characteristics, these watercourses may provide suitable habitat for American eel, as eel have the ability to travel terrestrially over wet substrates and as such, may be able to circumvent the subterranean reaches. Surface water features within the Study Area provide poor quality habitat for other fish species identified through desktop review including salmonids, suckers, and minnows due to the inconsistent flow and subterranean sections acting as impediments to fish passage.

12.5 Socioeconomic

12.5.1 Economy

The Project Area is located in Wedgeport, Yarmouth County, Nova Scotia. According to the 2021 census, the population of Yarmouth County was 24,947 which was approximately 2.6% of the population of Nova Scotia (Statistics Canada, 2021). From 2016 to 2021, the population within Yarmouth County increased by 2.2%, from 24,419 to 24,947. Table 12-28 presents population and demographics statistics for Yarmouth County (Statistics Canada, 2021).

Table 12-28. Population and Demographics for Yarmouth County (Statistics Canada, 2021)

Information	Yarmouth County
Population in 2021	24,947
Population in 2016	24,419
2011-2016 Population Change (%)	2.2
Total private dwellings (2021)	12,529
Population density per square km (2021)	11.8
Land area (square km) (2021)	2,121.64

According to the 2016 Statistics Canada census, the economy of Yarmouth County is driven by retail trade (16%), followed by health care and social assistance (15.3%), and agriculture; forestry; fishing and hunting (13%). Table 12-29 outlines the percentages of industries which makes up the labour force of Yarmouth County, based on the Statistics Canada Census Profile of Yarmouth County in the 2016[6] Census (Statistics Canada, 2016b).

Table 12-29. Labour Force by Industry, Yarmouth County (Statistics Canada, 2016)

Industry	Total	Percentage (%)
Agriculture; forestry; fishing and hunting	1,685	13
Mining; quarrying; and oil and gas extraction	40	0.3
Utilities	20	0.2
Construction	580	4.8
Manufacturing	1,290	11
Wholesale trade	325	2.7
Retail trade	1,910	16
Transportation and warehousing	320	2.6
Information and cultural industries	135	1.1
Finance and insurance	265	2.2
Real estate and rental and leasing	115	0.9
Professional; scientific and technical services	490	4
Administrative and support; waste management and remediation services	345	2.8
Educational services	830	6.8
Health care and social assistance	1,865	15.3
Arts; entertainment and recreation	165	1.4
Accommodation and food services	790	6.5
Other services (except public administration)	455	3.7
Public administration	575	4.7
Total	12,205	100

[6] 2021 Statistics Canada Census labour data was not available at the time of writing the EARD and is scheduled to be released on November 30, 2022.

According to the Statistics Canada 2016 Census, the labour force in Yarmouth County has a greater percentage of men (51%) than women (49%). The participation rate in the county's labour force is 60%, compared to a provincial average of 61.3%. Yarmouth County's unemployment rate is 9.1%, compared to 10.0 % in the province of Nova Scotia (Statistics Canada, 2016b).

Economic activity within 1 km of the Project Area includes an agricultural production company ~800 m east (Next Gen Soil Kryptonite & Growing Green Worm Castings), a sign shop (Vital Signs) ~900 m east and a general store 1 km east (La Shoppe a Carl). A fishery company (William R. Murphy Fisheries Ltd.) and a seafood wholesaler (Triple M Seafoods) are located within 1.5 km southwest of the Project Area as well as three existing COMFIT WTGs located at northern boundary of the Project Area (Section 6.2.3). Additionally, the 2012 EARD (Stantec 2012) lists small scale forestry harvesting on private land for personal use and some Christmas tree growing for ornaments and shrubs on the lands adjacent to the Study Area (Stantec, 2012).

Additional businesses/facilities further from the Project Area include:

- Yellow Tuna Hotel (~1.4 km west)
- Wedgeport Funeral Home (~1.7 km west)
- Galerie Beaucoup Art Gallery (~2.5 km west)
- Schooner Seafoods (~3 km west)

12.5.2 **Land Use and Value**

Land surrounding the Project Area consists of both private and Crown land (Figure 4; Appendix A). Land in the southern portion of the Project Area is Crown land and is undeveloped, whereas the remaining Project Area is private land (Section 10.2.1). Land use is currently zoned as Coastal Community and Coastal Wetlands by the Municipality of Argyle (The Municipality of the District of Argyle, 2020).

To the east of the Project Area lies the Tusket Islands Wilderness Area which is part of the Eastern Habitat Joint Venture Lands (Figure 15; Appendix A). Land use to the west of the Project Area includes undeveloped areas, a public paved road, Comeaus Hill Road, and residential properties along this road. There are no residential developments within the Project Area.

Three existing COMFIT WTGs are located near the north portion of the Project Area, to the south (n=1) and to the north (n=2) of Black Pond Road (Figure 18; Appendix A). These WTGs have been in operation since 2014 (Scotian Wind, 2020).

Informal recreational activities including ATV trails (Figure 18; Appendix A), hunting (several tree stands observed), and possible berry harvesting evidence was observed during field surveys.

PID 90093055 (302 Black Pond Road, Lot-2 in Upper Wedgeport) within the Project Area (Figure 18; Appendix A) is owned by the Municipality of the District of Argyle and houses a historic municipal dump site, according to Nova Scotia Property Online (Nova Scotia Property Online, 2022) and verified by field biologists during site visits.

12.5.3 Transportation

The NSDPW most recent traffic counts for the area indicate Highway 334 from Trunk 3 (Arcadia) to Plymouth-Upper Wedgeport the average daily traffic count in 2021 was 3,923 vehicles (NSDPW, 2022).

The annual average daily traffic count was 2,930 vehicles (NSDPW, 2022). The difference between the two numbers is likely the result of increased seasonal traffic. The traffic counts for 2021 are generally consistent with traffic counts in the same location from previous years, dating back to 2006 (Years reviewed = 2006, 2009, 2012, 2015, 2018, and 2021).

The current local road network was deemed by Wedgeport Wind to be sufficient to accommodate Project traffic during construction and operation of the proposed Project. Refer to Section 0 for proposed routes to the Project during construction.

12.5.4 Recreation and Tourism

Residents of Yarmouth County have access to several recreational facilities which include baseball fields, multi-purpose fields, residential parks, playgrounds, boat launches, tennis courts, and hiking trails (Yarmouth Recreation, 2022). Residential areas have access to community centres, community use schools, recreation centres, a ball hockey rink, a swimming pool, and skating rinks. Since many areas of the county are rural, residents may also participate in hunting and driving ATVs. None of these features are present within or adjacent to the Project Area.

There are several trail systems within 15 km of the Project Area, including the Saint Peter's Rock trail (~2 km south of the Project Area), the Wedgeport Nature Trails (~3.5 km and across the bay from the Project Area), Yarmouth County Rail Trail, an 87 km multi-use trail, Beaver Lake Trail and the Tusket Falls Walking trail (~12 km north and east of the Project Area), as well as the Chebogue Meadows Wilderness Trail (~15 km north of the Project Area). The Wedgeport Nature Trail, located ~2 km east of the Project Area, and south of the town of Wedgeport contains a Starlight viewing platform for stargazing visitors (Tourism Nova Scotia, 2021).

The Tusket Islands Wilderness Area borders the eastern Project Area boundary (Figure 15; Appendix A) and the nearest provincial park is the Ellenwood Lake Provincial Park which is located approximately 18 km north of the Study Area (Nova Scotia Provincial Parks, 2021).

Nova Scotia relies on the tourism industry. According to a news release from Tourism Nova Scotia, tourism revenues reached an estimated $1 billion in both 2020 and 2021 (Tourism Nova Scotia, 2022). Within Yarmouth County, Yarmouth is a large draw to tourists given the CAT ferry, which operates between Yarmouth and Maine, United States of America. In 2022, the ferry completed 113 round trips, transporting 36,151 passengers and 14,972 vehicles to and from Nova Scotia (Saltwire Magazine, 2022) and drawing tourists to the Yarmouth region. The town of Yarmouth is located ~19 km northwest of the Project Area.

12.5.5 Cultural and Heritage Resources

An ARIA has been undertaken by CRM under Heritage Research Permit (HRP) A2022NS180. The final report was reviewed and approved by the Special Places Program of CCTH (Appendix O). The ARIA includes three phases. The first, was a historical assessment of the potential for archaeological resources to be present within the Study Area (i.e., Background Study). The second, was Mi'kmaw Engagement and the third was the field reconnaissance program within the Study Area. The results described below are taken directly from the assessment completed by CRM Group (Appendix O).

Background Study
No archaeological sites were identified within the Study Area through a historic background study. Two cemeteries exist in proximity to the Study Area, Saint-Michel Parish Cemetery (2.5 km east) and Saint-Gabriel Parish cemetery Church (1.5 km south).

The Maritime Archaeological Resource inventory was searched and revealed that there are two registered sites located within 4.5 km of the Study Area, Turnip Island and Big Tusket Island North.

There is little evidence of historic settlement in the area surrounding the Study Area.

Mi'kmaw Engagement

As part of Mi'kmaw engagement, CRM Group contacted the KMKNO-ARD requesting information pertaining to historic or traditional Mi'kmaw use of the land. KMKNO-ARD provided traditional and historic Mi'kmaw land use information that was taken into consideration when preparing the ARIA. The traditional use information is confidential, but was considered in background research, assessment and field methodology completed by CRM Group.

Archeological Reconnaissance

CRM Group conducted a field reconnaissance of the Project footprint on November 2, 3, 4, and 24, 2022. No archeological resources or other cultural heritage features were identified (Appendix O).

Conclusions & Recommendations

The 2022 ARIA concludes that the Project footprint is of low archaeological resource potential (Appendix O).

12.5.5.1 *2012 ARIA*

In 2012, an ARIA was undertaken under HRP A2012NS120 (Niven, 2012; Appendix P) to support the 2012 EARD. Although assessing a previous infrastructure alignment, the 2012 ARIA study focused on turbine locations in the same general project area as the proposed Project. Niven (2012) found that:

- Desktop Research
    - No archaeological sites were identified within the study area through a historic background study and the closest recorded sites are Turnip Island (AkDm-01) and Big Tusket Islands (AkDm-03).
        - Any historic settlements were most likely along the western shore, outside of the Study Area
    - First Nations archaeological potential is low within the study area
        - No recorded First Nations sites within or adject the study area
        - No major watercourses or waterbodies within the study area

- Field Reconnaissance
    - Two 2012 turbine locations that were assessed overlap with the proposed Project footprint (Table 11-7)
        - 2012 Turbine 1 overlaps the WTG14 construction pad.
            - Elevated area with thick stand of alder and black spruce
            - No watercourses or other resources in the area
            - Considered low potential
    - 2012 Turbine 6 overlaps the cleared area surrounding WTG11.
        - Relatively flat and moderately open with low tree cover of young birch alder, and spruce
        - No exploitable resources in this area.
        - Considered low potential
- The remaining five 2012 turbine locations assessed exist 46 m to 872 m from proposed Project infrastructure (Table 11-7)
    - All were determined to be of low potential

The 2012 ARIA concluded that the Project Area is of low archaeological potential and recommended archaeological clearance.

12.5.6 **Other Undertakings in the Area**

As described in Section 6.2.3, three existing COMFIT projects exist in proximity to the Project (Figure 18; Appendix A). The three projects, Little River Harbour Community Wind Project, Black Pond Community Wind Project, and the Wedgeport Wind Power Project, are all single WTGs that are <2 MW each. The Little River Harbour and the Black Pond Community Wind Projects are owned and operated by Scotian Wind. The Wedgeport Wind Power Project, which is located within the Project Area, is owned and operated by Elemental, a Project partner in the Wedgeport Wind Project.

No other undertakings, industrial facilities (excluding the aforementioned dump site), or industrial or commercial developments are known to be pending within or immediately adjacent to the Project Area.

13 EFFECTS OF THE UNDERTAKING ON THE ENVIRONMENT

The following detailed effects assessment involves the following steps:

1. Identification of potential Project interactions on selected VEC;
2. Identification of potential effects;
3. Description of recommended mitigation and monitoring;
4. Identification of expected residual effects (post mitigation); and,
5. Identification of the significance of residual effects.

Results of the detailed effects assessment process listed above is presented for each identified VEC in the following sections. Refer to Table 13-1 for potential Project interactions with all VECs.
Table 13-1 provides a summary of the potential Project interactions and environmental effects resulting from the Project. The table is divided according to each of the Project phases assessed (construction, operation and maintenance, decommissioning and reclamation) as well as accidents, malfunctions, and unplanned events.

Table 13-1. Potential Project Interactions with Valued Environmental Components

Group	Valued Environmental Component	Construction			Operations and Maintenance		Decommissioning and Reclamation		Accidents and Malfunctions
		Clearing and Grubbing	Access Roads, Collector Lines, Laydown Yards, and Turbine Pads	Turbine Assembly, Erection, and Commissioning	Turbine Operation	Inspection and Maintenance	Infrastructure Removal	Site Reclamation	
Atmospheric	Climate change	X	X	X	X	X	X	X	
	Air quality	X	X	X		X	X	X	X
	Noise	X	X	X	X	X	X	X	X
Geophysical	Surficial and bedrock geology		X						
	Groundwater		X						X
Terrestrial	Habitat, flora, and lichens	X	X					X	X

Group	Valued Environmental Component	Construction			Operations and Maintenance		Decommissioning and Reclamation		Accidents and Malfunctions
		Clearing and Grubbing	Access Roads, Collector Lines, Laydown Yards, and Turbine Pads	Turbine Assembly, Erection, and Commissioning	Turbine Operation	Inspection and Maintenance	Infrastructure Removal	Site Reclamation	
	Fauna	X	X		X		X	X	X
	Avifauna	X	X	X	X		X	X	X
	Bats	X			X				X
Aquatic	Wetlands	X	X				X	X	X
	Surface water, fish and fish habitat	X	X				X	X	X
Visual/Technical	Visual aesthetics				X				
	Shadow flicker				X				

Group	Valued Environmental Component	Construction			Operations and Maintenance		Decommissioning and Reclamation		Accidents and Malfunctions
		Clearing and Grubbing	Access Roads, Collector Lines, Laydown Yards, and Turbine Pads	Turbine Assembly, Erection, and Commissioning	Turbine Operation	Inspection and Maintenance	Infrastructure Removal	Site Reclamation	
	Electromagnetic interference				X				
Socioeconomic	Economy	X	X	X	X	X	X	X	X
	Land use and value	X	X	X	X	X	X	X	X
	Transportation	X	X	X		X	X	X	
	Recreation and tourism				X				
	Human health	X	X	X	X	X	X	X	X

Group	Valued Environmental Component	Construction			Operations and Maintenance		Decommissioning and Reclamation		Accidents and Malfunctions
		Clearing and Grubbing	Access Roads, Collector Lines, Laydown Yards, and Turbine Pads	Turbine Assembly, Erection, and Commissioning	Turbine Operation	Inspection and Maintenance	Infrastructure Removal	Site Reclamation	
	Cultural and heritage resources	X	X	X					
	Other undertakings in the area				X				X

13.1 Atmospheric

This section outlines the effects of the undertaking on the following atmospheric VECs; climate change, air quality, and noise.

13.1.1 Climate Change

Increases in concentrations of GHGs in the atmosphere, from human activities, cause climate change (ECCC 2022). GHGs will be emitted during all phases of the Project, which includes construction, turbine maintenance, and decommissioning and reclamation (Table 13-1). During operations, WTGs produce emission free electricity.

For the purposes of GHG accounting, Project emissions were estimated using the Sacramento Metropolitan Air Quality Management District, Road Construction Emissions Model, Version 7.1.1 (RCEM 2012) to quantify onsite GHG emissions.

The Project phases and associated timelines are as follows:

1. Construction - Site preparation, grubbing, road construction, foundations, WTG equipment and infrastructure installation (~2 years);
2. Operation and Maintenance (~35 years), and
3. Decommissioning and Reclamation (~2 years).

Table 13-2 shows the estimated emissions volumes for the Project, according to the three Project phases. Please note that the construction phase has been divided into two stages, 1A and 1B due to differing durations of activities. 1A includes clearing, grubbing and road construction and 1B includes foundations construction, WTG erection, and infrastructure installation. Reported criteria included within the emissions calculations includes Reactive Organic Gases (ROG), Carbon Monoxide (CO), Nitrous Oxide (NO_X), Total Particulate Matter (PM10), Total Particulate Matter (PM2.5) and CO_2 in total kilograms.

Table 13-2. Total Estimated Emissions by Project Phase

Project Phase	Stage	Estimated Duration (months)	ROG (kg)	CO (kg)	NO_X (kg)	Total PM10 (kg)	Total PM2.5 (kg)	CO_2 (kg)
Construction	1A	8	16	192	112	1,456	304	60,832
	1B	16	64	768	544	32	32	205,952
Operation and Maintenance	2	12 (1 year total at 60 days / year)	0.0	30	6	0.0	0.0	10,902
	2	420 (35 year total at 60 days / year)	0.0	1,050	210	0.0	0.0	381,570
Decommissioning and Reclamation	3	24	48	192	96	0.0	0.0	148,032
Total Emissions by GHG (kg):			128	2,202	1,624	1,482	336	796,386

1. Stage 1A = clearing, grubbing and road construction and Stage 1B = includes foundations construction, WTG erection, and infrastructure installation.
2. GHG emissions data is approximated based on a 20-day working month and according to proposed timelines and is only valid for those days where site activities are underway. Actual Project timeframes and emissions amounts will vary depending on the rate of progress onsite at each individual stage.
3. Emissions data during the Operation and Maintenance Phase will only apply to those days where site maintenance are underway, estimated at 60 days per year.
4. Total emissions calculations for the construction and transportation of individual wind turbines and associated infrastructure has not been included within this assessment.
5. Operations and maintenance emissions are presented as one year and as 35 years (complete Project phase)

The total amount of ROG, CO, NO_X, PM10, PM2.5 and CO_2 emissions generated by the Project are estimated to be 128 kg, 2,202 kg, 1,624 kg, 1,482 kg, 336 kg, and 796,386 kg, respectively. Although the largest volumes of CO and CO_2 are predicted to occur during operations, operations are scheduled to occur over a much longer timeframe (35 years) than the construction (2 years) and decommissioning phases (2 years) of the Project. Table 13-3 provides the estimated emissions per day (kg/day).

Table 13-3. Estimated Emissions per day by Project Phase

Project Phase	Stage	Estimated Duration (months)	ROG (kg/day)	CO (kg/day)	NO_X (kg/day)	Total PM10 (kg/day)	Total PM2.5 (kg/day)	CO_2 (kg/day)
Construction	1A	8	0.1	1.2	0.7	9.1	1.9	380.2
	1B	16	0.2	2.4	1.7	0.1	0.1	643.6
Operation and Maintenance	2	420 (i.e., 35 years; 60 days / year)	0.0	0.5	0.1	0.0	0.0	181.7
Decommissioning and Reclamation	3	24	0.1	0.4	0.2	0.0	0.0	308.4

1. Stage 1A = clearing, grubbing and road construction and Stage 1B = includes foundations construction, WTG erection, and infrastructure installation.

The primary source of GHG emissions per day from the Project is during the construction phase due to the use of heavy equipment for the installation and construction of site facilities.

In a single year during the operational phase, the Project will reduce overall provincial GHG emissions as WTGs provide emission free electricity. Environment and Climate Change Canada's Analysis and Modelling Division in the Strategic Policy Branch projects Nova Scotia's CO_2 emissions (without biomass and RNG) to be 231.3 tonnes of CO_2e/GWhr (based on the average of modelled results from 2025 until 2050). The Project's expected annual production (MWh/year) is confidential and is not included herein. Available information (turbine size, wind generating potential, project lifespan, etc.) estimates that emissions reductions from the renewable energy provided by the Project will be the equivalent of offsetting approximately 63,608 tonnes of CO_2 per year, based on 85.8 MW (6.6 MW/WTG for 13 WTGs) capacity.

The amount of power generation would have an estimated 2,226,263 tonnes of CO_2 offset potential over a 35-year lifespan.

Based on the available GHG emissions calculations, including the production of roughly 796.4 metric tonnes of CO_2 during construction, operations and decommissioning, **the offset potential for the Project is anticipated to be 2,225,466 metric tonnes of CO_2 over the Project's 35-year lifespan.**

At the onset of the Projects operations (2025), Environment and Climate Change Canada's Analysis and Modelling Division in the Strategic Policy Branch predict CO_2e emission for Nova

Scotia to be 410 tonnes of CO_2e/GWhr[7]. This equates to an **offset of 112,750 tonnes of CO_2e during the first year (2025) of operations**.

13.1.1.1 *Mitigation*

The following mitigation measures will be included in the design of the Project to minimize effects to climate change:

- Complete regular maintenance on equipment.
- Trucks will abide by speed limits.
- Speed limit signage to be posted on Project access roads.
- Trucks and heavy equipment will minimize idling.

13.1.1.2 *Monitoring*

Based on the Project scope and information provided above, long-term monitoring of climate change criteria and GHG emissions are not deemed necessary at this time.

13.1.1.3 *Residual Effects and Significance*

Magnitude
The Project is predicted to have a **high** magnitude of effect as the levels of GHGs will differ from the natural baseline conditions to a large degree. The Project is predicted to offset approximately 2,225,466 metric tonnes of CO_2 over the 35-year lifespan of operations.

Likelihood
It is **almost certain** that the Project will have an effect on climate change as GHGs will be emitted during construction, maintenance, decommissioning and reclamation and GHG will be offset by operations.

Duration
The duration of the Projects effect on climate change is **long-term** as the Project will be an emission source for GHG during construction, decommissioning and reclamation (combined 4 years) and during operations (35 years) the Project will a net sink for GHG emissions.

Frequency
The effects on climate change will occur **continuously** throughout the life of the Project.

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[7] The grid electricity intensity in Nova Scotia generally decreases over the modelled time period (2025 to 2050) presented by ECCC due to provincial commitments to increase renewable energy sources.

Significance
The Project will have a **significant** positive effect on climate change (Table 10-4).

13.1.2 Air Quality

Wind Farm operation has very limited potential to have an effect to air quality by changing particulate levels (Table 13-1).

Dust and particulate levels (known as Total Particulate Suspended Matter) can be emitted during the construction, maintenance, and decommissioning/reclamation phases of the Project. Construction activities likely to generate dust include blasting (if required), grubbing, stockpiling material, and travel of trucks on unpaved roads. Maintenance during operations can generate dust from trucks travelling on unpaved roads. Decommissioning and reclamation activities likely to elevate dust and particulate levels include earthwork and the travel of trucks on unpaved roads.

An increase in particulate levels can act as a cause of nuisance to local residents or people in proximity to the Project. The unpaved access road proposed from Comeaus Hill Road to access WTG13 is the portion of the Project in the closest proximity to residential receptors. This access road is situated 90 m northwest of 1857 Comeaus Hill Road and 130 m south of 1803 Comeaus Hill Road.

Activities with potential to generate dust may result in deposition of dust on vascular plants and lichens within proximity of the Project Area, especially when conditions are dry. Dust on the leaves of vascular plants can temporarily reduce evapotranspiration and photosynthesis and over time this may reduce overall growth rates (Farmer 1993). Refer to Section 13.3.1 for more details.

13.1.2.1 *Mitigation*

The following mitigation measures will be included in the design of the Project to minimize effects to air quality:

- Should it be required, dust emissions will be controlled with the application of water imported via a water truck.
- Trucks will cover loads and minimize dust.
- Trucks will abide by speed limits.
- Speed limit signage to be posted on Project access roads.

- Use alternatives to water on roads if evaporation is too rapid, such as calcium chloride, magnesium chloride, potassium chloride and sodium chloride (the use of alternative methods may be confined to within 200 metres of homes and residences, or further depending upon traffic requirements in specific areas during construction).
- Monitor the need for dust suppression and its effectiveness and consider changes in speed limits, alternative routes, and timing of activities where appropriate.
- A Complaints Resolution Plan will be developed, should members of the public have any air quality related complaints about the Project.
- A Project Contingency Plan will be developed and will include site specific measures to reduce and mitigate dust levels during all Project phases, in consideration of on-going engagement with closest residents to understand their concerns.

13.1.2.2 *Monitoring*

No dust emission or particulate matter monitoring is proposed.

13.1.2.3 *Residual Effects and Significance*

Magnitude
The Project is predicted to have a **low** magnitude of impact as air quality anticipated to remain less than or equal to the maximum permissible ground level concentrations as defined by NSECC within the Air Quality Regulations made under Section 25 and 112 of the *Environment Act*.

Likelihood
The probability of impact to air quality is **possible** as activities during the construction and decommissioning and reclamation phase of the Project may generate dust.

Duration
The duration of the effects on air quality are confined to the construction, decommissioning and reclamation phases of the Project, therefore, are considered to be **short-term**.

Frequency
Potential impacts on air quality will be **sporadic** during the construction and decommissioning and reclamation phases of the Project. Increases in Project generated dust are dependent on the activity taking place and the site conditions (i.e., dry ground).

Significance
The Project is predicted to have a **not significant** effect on air quality (Table 10-4).

13.1.3 Noise

Noise can be created as a result of multiple activities during all phases of the Project, as noted in Table 13-1.

Construction projects are usually implemented in a series of steps or phases. The noise associated with each phase can vary greatly (refer to
Table 13-4). Different types of equipment are used for different tasks (individually and in combination), which vary in noise production, duration, and frequency of use (California Department of Transportation, 2016). The use of heavy equipment, hauling of material by trucks, blasting and or drilling operations, are examples of activities that result in noise. Blasting using explosives is a primary source of noise and vibration and can act as a nuisance for adjacent residents. Potential impacts to humans associated with noise could include noise-induced hearing loss, noise-induced sleep disturbance, and interference with speech comprehension (Health Canada, 2017). Noise and vibration are provincially regulated via the *Occupational Health and Safety Act (*OSHA, 1996) which protect the health of site workers and the general public at the property boundaries of the Project.

The surrounding area currently has three existing COMFIT wind turbines which have been in operation for multiple years with no known incidents of exceedance. The proposed activities are a continuation and expansion of current operational scopes within the immediate area.

Changes to ambient noise levels and the presence of periodic vibrations also have the potential to adversely affect fauna and birds by potentially influencing migration and behavioural patterns. Additional details related to effects of noise on wildlife and avifauna are provided in Section 13.3.2 and Section 13.3.4, respectively.

Forested lands separating local residences and the Project Area are expected to aid in muffling noise being produced. Wind direction will also play a role in dominant sound propagation directions surrounding the Study Area. Additional factors can influence the actual noise level that reaches a receiver. Physically blocking the line of sight between the noise source and the receiver can result in a 5 dB reduction (California Department of Transportation, 2016). Dense vegetation can reduce noise levels by as much as 10 dB over 200 feet (61 m; U.S. Department of Transportation 2011). Atmospheric conditions can have a profound effect on noise levels within 200 feet of a highway (California Department of Transportation 2011, 2013, 2016). Vertical air temperature gradients have increasing effects with distance. Wind can reduce or increase noise levels at long distances (California Department of Transportation, 2016). All noise attenuates (diminishes) with distance from the source (see California Department of Transportation, 2016).

This occurs through geometric spreading and signal reduction from ground and atmospheric absorption. Noise from point sources (i.e., construction equipment) traveling through a soft site (e.g., a forest or meadow), are reduced by attenuation rates of 7.5 dBA for each doubling of distance (based on 50 feet (15 m)) (California Department of Transportation, 2016).

The following table provides estimates for point source noise from construction related equipment (as per California Department of Transportation, 2016) based upon the information provided in Section 0 (above).

Table 13-4. Point Source Sound Levels During Construction

Construction Sound Source	Low (dBA)	High (dBA)	Average (dBA)
Rock Blast	112	112	112
Track Hoe	91	106	98.5
Truck Horn	104	104	104
Dump Truck	82	98	90
Rock Drills and Jackhammers	82	97	89.5
Diesel Truck	85	96	90.5
Pneumatic Chipper	91	95	93
Hydromulcher	87	94	90.5
Grader	85	89	87
Dozer	84	88	86
Crane	85	88	86.5
Pumps, Generators, Compressors	81	87	84
Front-end Loader	80	87	83.5
Pump	77	85	81
Concrete Truck	81	85	83
Concrete Mixer	80	85	82.5
Auger Drill Rig	85	85	85
Flat Bed Truck	84	84	84
Backhoe	80	84	82
Generator	52	84	68
Ground Compactor	80	82	81
Concrete Pump	82	82	82
Cat Skidder	81	81	81
Roller	74	80	77
Welder	73	73	73

Construction Sound Source	Low (dBA)	High (dBA)	Average (dBA)
Pickup Truck	55	71	63
Background Sound Level—Forest Habitats	25	44	34.5

A quiet rural area has an estimated baseline sound level of ≤45 dBA (Health Canada, 2017). Construction estimates for forested landscapes estimate that forest habitats have a dBA range between 25 dBA (low end) and 45 dBA (high end), averaging to 34.5 dBA (California Department of Transportation, 2016).

Because these factors can vary greatly at any location on a project-specific basis, they are difficult to include in a general analysis. Therefore, they are identified but generally not taken into account in environmental noise analyses over short distances. However, as all noise attenuates with distance from the source (see California Department of Transportation, 2016), based upon an attenuation distance of 7.5 dBA over 50 feet (15 m), the following table shows how noise from the construction of the project is expected to attenuate.

Table 13-5. Sound attenuation from construction through forested habitats[8]

Construction Sound Source	Avg dBA at 0 m	15 m	30 m	45 m	60 m	75 m	90 m	105 m	120 m	135 m	150 m	165 m
Rock Blast	112	105	97	90	82	75	67	60	52	45	37	30
Track Hoe	99	91	84	76	69	61	54	46	39	31		
Truck Horn	104	97	89	82	74	67	59	52	44	37	29	
Rock Drill	92	84	77	69	62	54	47	39	32			
Dump Truck	90	83	75	68	60	53	45	38	30			
Rock Drills and Jackhammers	90	82	75	67	60	52	45	37	30			
Diesel Truck	91	83	76	68	61	53	46	38	31			
Pneumatic Chipper	93	86	78	71	63	56	48	41	33			
Hydromulcher	91	83	76	68	61	53	46	38	31			
Grader	87	80	72	65	57	50	42	35				
Dozer	86	79	71	64	56	49	41	34				
Crane	87	79	72	64	57	49	42	34				
Pumps, Generators, Compressors	84	77	69	62	54	47	39	32				
Front-end Loader	84	76	69	61	54	46	39	31				

8 Green cell indicates distance at which sound attenuates to background forest conditions.

Construction Sound Source	Avg dBA at 0 m	15 m	30 m	45 m	60 m	75 m	90 m	105 m	120 m	135 m	150 m	165 m
Pump	81	74	66	59	51	44	36	29				
Concrete Truck	83	76	68	61	53	46	38	31				
Concrete Mixer	83	75	68	60	53	45	38	30				
Auger Drill Rig	85	78	70	63	55	48	40	33				
Flat Bed Truck	84	77	69	62	54	47	39	32				
Backhoe	82	75	67	60	52	45	37	30				
Generator	68	61	53	46	38	31	23	16				
Ground Compactor	81	74	66	59	51	44	36	29				
Concrete Pump	82	75	67	60	52	45	37	30				
Cat Skidder	81	74	66	59	51	44	36	29				
Roller	77	70	62	55	47	40	32	25				
Welder	73	66	58	51	43	36	28	21				
Pickup Truck	63	56	48	41	33	26	18	11				
Background Sound Level—Forest dBA (average)	35											

Nortek Resource Solutions Inc. has completed a Noise Impact Assessment for the proposed Wedgeport Wind Project (Appendix K). The objective of the analysis was to assess the impact of the wind turbine sound emissions on surrounding dwellings. There are no municipally or provincially regulated restrictions on sound pressure levels from wind turbines, however, NSECC requires that predicted levels should not exceed 40 dBA for residential receptors which include homes, daycare facilities, hospitals and schools. **Noise modelling indicates that turbine generated noise levels will not exceed 40 dBA at any existing residential receptors.**

13.1.3.1 *Mitigation*

The results of the analysis indicate that predicted sound pressure levels will not exceed 40 dBA for existing receptors for either construction or proposed turbine location locations. This meets the existing threshold levels recognized by Nova Scotia Environment and no noise mitigation measures will be required.

The following mitigation measures will be included in the design of the Project to minimize the effects of noise:

- Blasting (if required) will be completed in accordance with regulatory requirements.

- Municipal noise bylaws will be followed during construction.
- A Complaints Resolution Plan will be developed, should members of the public have any noise related complaints about the Project.
- If a complaint is received, Wedgeport Wind will follow a protocol to investigate the complaint, attempt to determine the source of the noise source, and once determined, create and implement a mitigation strategy to effectively reduce the source of noise to an acceptable level. This protocol will be developed and may include:
    - Evaluation and investigation of the complaint(s), desktop assessment and documentation of the conditions that has led to the complaint.
    - Scheduled monitoring, at the residence of concern. Scheduled monitoring will be performed by a qualified technician within 15 m of the residence (with the landowners' permission) during which overall A-weighted sound levels will be measured and recorded.
        - Scheduled monitoring will be undertaken over a one-week sampling period to allow for the meaningful assessment of variations in wind speed, wind direction, and humidity.
        - One-hour average (Leq) sound levels will be recorded continuously, when weather conditions are suitable, for at least 48 hours over the one-week sampling period.
    - Responsive Monitoring will be performed when conditions are representative of the conditions identified by the complainant at the earliest opportunity after the complaint is received. Conditions surrounding the complaint including wind speed, wind direction, wind shear (the difference between wind speeds at the nacelle and at ground level), temperature, atmospheric pressure, relative humidity, and time of day will be documented to ensure that monitoring is completed under similar conditions. The monitoring will be performed over a 4 to 24 hour period with at least 3 hours of representative data collected.
        - Results from the Responsive Monitoring will be compared with the predictive noise modeling. When the Responsive Monitoring exceeds the predictive noise modeling, but noise from the wind farm is not considered to be responsible for the exceedance, a further assessment using an appropriate background and ambient noise analysis

technique may be carried out to separate the facility noise contribution from the Responsive Noise Monitoring. This will, in effect, separate noises not related to the Project.

- Measurement Instruments used to conduct both the Scheduled Monitoring and the Responsive Monitoring surveys will meet the minimum technical specifications in the International Electro-technical Commission (IEC) publication 60804 or its latest revision for Type II sound level metres.
- Reporting will summarize the results of any noise complaints received, any on-site noise monitoring, additional mitigation recommended or implemented, and steps taken to resolve the complaints.

13.1.3.2 *Monitoring*

No noise level monitoring is currently proposed.

13.1.3.3 *Residual Effects and Significance*

Magnitude
The Project is predicted to have a **low** magnitude of impact as noise is predicted to remain less than maximum allowable noise limits (40 dBA) from WTGs at existing residential receptors.

Likelihood
It is **almost certain** that the Project will generate noise.

Duration
The Project will generate noise for a **long-term** as noise is produced from activities associated with all Project phases.

Frequency
The frequency of noise generated from the Project is dependent on the Project phase. During construction, decommissioning and reclamation, noise will be generated **regular** frequency. During operations, noise will be generated by WTGs **continuously** (except for periods with no/low wind speeds).

Significance

The Project is predicted to have a **not significant** effect on noise (Table 10-4) as all regulatory thresholds and requirements will be met during construction and operations, and if not, a procedure for mitigating effects may be implemented.

13.2 Geophysical

This section outlines the effects of the undertaking on the following geophysical VECs; geology and groundwater.

13.2.1 Surficial and Bedrock Geology

The construction of access roads and turbine foundations has the potential to affect the following topography, surficial geology, and bedrock geology variables (Table 13-1):

- Topography: Topography (land elevations) will be altered by levelling for turbine foundations, access roads, laydown areas, and the substation location.
- Soil Destabilization: Clearing and disturbance of lands has the potential to cause soil erosion.
- Rock Mineralization: Upon exposure to oxygen and water, blasted or otherwise disturbed rock has potential to mineralize and leach soluble metals into surface and groundwater systems. The production of ARD is also a possibility in areas which comprise rock containing high levels of iron-sulphides. As discussed in Section 12.2.2.2.1, the potential for ARD at the Project is considered low. These activities also have the potential for naturally occurring uranium to enter groundwater. Uranium potential in groundwater in the area is listed as medium-risk (Section 12.2.2.2.2).

Project development will minimally alter site topography as the access roads and turbines are constructed. Potential minor impacts to receiving surface water systems (e.g., watercourses and wetlands) are possible from ground disturbances associated with earthwork related to turbine foundation and access road construction. Ground disturbances may cause a temporary increase in sediment loads that can degrade water quality conditions. Effects related to wetlands are assessed in Section 13.4.1 and potential effects on surface water, fish and fish habitat are assessed in Section 13.4.2.

Erosion potential of the overlying soil is anticipated to be moderate where exposed to physical weathering. Due to the limited footprint of the initial ground-level construction works and support infrastructure within the Project Area, associated erosion concerns are considered to be minor, centered around access roads, turbine foundations and power substations where the majority of soil disturbance will be undertaken.

Reclamation will be employed to stabilize and revegetate slopes and exposed surfaces.

13.2.1.1 *Mitigation*

The following erosion control and mitigation measures will be enacted during the construction, operation and decommissioning phases of the Project. These mitigation measures are aimed to minimize impacts to topography, surficial geology, and bedrock geology and resulting potential effects to air quality, groundwater or surface water conditions:

- Construction of sediment control measures (e.g., sediment fencing) and erosion control (e.g., mulching/revegetation) will be implemented.
- Reclamation of the site will be completed to stabilize and revegetate slopes and exposed surfaces.
- Topsoil and organic soil material removed during construction will be saved and used during reclamation in order to restore the local seed bank.
- Soil material will be replaced during reclamation when weather is optimal (i.e., minimal precipitation), if possible.
- A Project Contingency Plan will be developed and will include site specific measures to prevent sedimentation and erosion and respond to spills.

13.2.1.2 *Monitoring*

Soil and bedrock materials testing will be completed, if deemed necessary based on the geotechnical assessment, to identify ARD potential and uranium concentrations. In the event that surface material to be used in construction is found to contain levels above the applicable threshold criteria, a management plan will be developed.

13.2.1.3 *Residual Effects and Significance*

Magnitude

There is no regulatory threshold for impacts to geology. Since disturbance to site geology can impact water quality (i.e., total suspended solids, metals, ARD, and sediments etc.) the magnitude is defined as is for surface water, a regular exceedance (i.e., >2 per year) of the standard parameters for total suspended solids[9]. These parameters are defined in the *Nova Scotia Watercourse Alteration Standard* (NSECC 2015).

[9] The turbidity and total suspended solid levels of runoff from a construction area must not exceed the levels immediately upstream by 25 mg/l unless levels immediately upstream are greater than 250 mg/l, in which case

The Project is predicted to have a **low** magnitude of impact as total suspended solids levels are anticipated to remain within acceptable limits.

Likelihood
It is **almost certain** that the Project will disturb site geology as groundwork is required to support the construction of access roads and turbine foundations.

Duration
The time period over which the effects are likely to persist are predicted to be **short-term**, as they are confined to the construction, decommissioning, and reclamation phases of the Project.

Frequency
Effects to site geology will occur at a **regular** interval during the construction, decommissioning and reclamation phases of the Project.

Significance
The Project is predicted to have a **not significant** effect on geology (Table 10-4).

13.2.2 Groundwater

Groundwater impacts as a result of wind farm development can be variable and depend on conditions such as underlying geological conditions, natural groundwater characteristics, and the construction activities taking place. These interactions (Table 13-1) are based upon a potential change in groundwater quantity and quality from baseline conditions as outlined below.

13.2.2.1 *Quantity*

Changes to the natural surface conditions within the Project footprint have the potential to alter groundwater recharge and could cause temporary lowering or rising of the water table relative to baseline conditions (BLM 2005). Clearing and grubbing can increase recharge and conversely, hardened surfaces (e.g., access roads and construction pads) have the potential to reduce recharge. Overall groundwater recharge and discharge is expected to remain unchanged from existing conditions.

Localized groundwater flow paths within the Project footprint may be disrupted from initial construction operations (e.g., blasting; BLM 2005). Blasting can increase bedrock fracture

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construction area runoff turbidity and total suspended solid levels must not exceed levels immediately upstream by more than 10% (NSECC 2015).

frequency and change the direction of groundwater interflow, potentially impacting flow to wells or surface water features. Blasting associated with turbine foundations, if required, is less likely to impact surrounding wells as turbines are situated >1,000 m from all existing residential receptors. If blasting is required to support access road construction, it may occur in closer proximity to residential receptors, which would result in a greater potential for impacts to residential water wells.

There is potential for the Project to affect groundwater quality and quantity during the construction and decommissioning phases. Operational effects are considered to be negligible.

Dewatering may be required if groundwater is encountered during construction of turbine foundations. The dewatering would create a local drawdown of the groundwater table that may alter normal groundwater flow directions. However, based on the minimal size of the excavation, the limited time it is left unfilled, and the distance to adjacent aquatic receptors and groundwater wells, a reduction to groundwater quantity to these features is not anticipated.

Possible chemical spills during the construction and decommission phases also has potential to affect groundwater quality. Well records indicate that groundwater is generally at greater depths than the typical excavation depth for foundation installation. Raft foundations, with typical excavation depth between 3 to 5 m below grade, are proposed for the majority of the turbines. Driven pile foundations may be included as a design contingency, if weak foundation conditions are encountered, which require excavation to 3 m below grade. A driven pile foundation is expected to have a negligible impact on groundwater quantity.

Due to the nature of the Project, local groundwater quantity is not expected to be impacted. It is also not expected that Project construction will adversely affect the supply of water via groundwater discharge to surrounding aquatic features. Groundwater flow may be irreversibly altered from blasting; however, the effect is anticipated to be limited in extent and unlikely to affect groundwater flow in a regional area related to surrounding receptors. Foundation construction can affect groundwater quantity if foundation excavation encounters a shallow water table and dewatering is required. This would temporarily affect the local groundwater elevation and may temporarily alter groundwater flow direction. Therefore, a foundation excavation may encounter shallow groundwater and require dewatering or pile foundations may encounter upward gradients near the bedrock surface (note: WTGs are typically situated on topographic ridges). No other well records in this vicinity reported depth to groundwater information; thus, the lateral extent of this shallow aquifer remains unclear. For context, it is noted that wind turbines are typically installed on topographic highs where groundwater elevation is typically deeper than surrounding areas, and therefore the groundwater elevation may be deeper than indicated by the surrounding well records.

13.2.2.2 *Quality*

Precipitation or surface water that comes into contact with rock could affect surface water runoff quality or leach into the groundwater, which could potentially make its way to water wells or surface water features. Effects to groundwater quality (and surrounding wells) from the Project is unlikely because of the Projects low potential for ARD and medium risk for uranium in groundwater. Refer to Section 13.4.2 for Project effects on surface water and Section 13.2.1 for a discussion of ARD and uranium potential.

Potential residual impacts on groundwater quality may be associated with contamination from hazardous material spills during all activity phases. It is expected, however, that potential spills will be mitigated during construction. It is also assumed that operations will not include hazardous material storage. It is anticipated that turbine foundations would be left in place during decommissioning and that Project construction, operation, and/or decommissioning will not result in increased aquifer vulnerability at foundation sites. The potential effects associated with decommissioning are considered to arise from potential spills and can be mitigated with best construction practices.

It should be noted that the volume of fuel and hydraulic oil on construction equipment is limited, these constituents are typically biodegradable, and surficial geologic units exhibit low permeability which limits the rate to which releases could infiltrate into the ground and migrate to and within the groundwater.

13.2.2.3 *Mitigation*

The following mitigation measures will be included in the design of the Project:

- Construction areas (e.g., laydown areas) will be graded in order to control runoff.
- Potential effects to groundwater quality as a result of blasting will be reduced by using an emulsion compound that is insoluble in water. This will prevent contaminants such as Ammonium Nitrate Fuel Oil entering surface water bodies and groundwater during blasting activities.
- Refueling will occur in designated areas, >30 m from a watercourse or wetland.
- The operator will remain with the equipment during refueling.
- Spill response equipment will be readily available.
- A Project Contingency Plan will be developed for the Project to outline the prevention and response methods regarding spills and/or substance loss.

13.2.2.4 *Monitoring*

No groundwater monitoring is proposed as part of the Project and currently no pre-blast surveys are proposed as known water wells are all in excess of 1,000 m from WTG locations.

13.2.2.5 *Residual Effects and Significance*

Magnitude
The Project is predicted to have a **low** magnitude of impact on groundwater. No regulatory threshold is available; therefore, the Project team has considered a change in the groundwater quantity such that it has a negative effect on a groundwater receptor such as drinking water wells as the threshold.

Likelihood
The likelihood of an effect to groundwater is largely dependent on the requirement to blast which is currently not known. Even if blasting does occur the potential for groundwater interactions is unknown as it is dependent on many unknown variables (e.g., rock type, blast charge, distance to nearest well etc.). Conservatively, the likelihood of an effect to groundwater was deemed as being **possible**.

Duration
Potential impacts to groundwater are anticipated to be **short-term**. Impacts are more likely to occur during the construction (2 years) and decommissioning/reclamation (2 years) phases of the Project. During these phases, Project related activities have the potential to interact with groundwater. During operations (35 years), there is no anticipated impact to groundwater.

Frequency
Potential impacts to groundwater are predicted to be **sporadic**, as the activities likely to interact with groundwater occur at irregular intervals through the construction phase of the Project.

Significance
The Project is predicted to have a **not significant** effect on groundwater (Table 10-4).

13.3 Terrestrial

This section outlines the effects of the undertaking on the following biophysical VECs; habitat, flora, and lichens, fauna, bats, and avifauna.

13.3.1 Habitat, Flora, and Lichens

The proposed Project will result in both indirect and direct impacts to habitat types (associated with wetland and upland habitats), flora (vascular and nonvascular plants), and lichens (Table 13-1).

13.3.1.1 *Direct Impacts*

The proposed Project will have direct impacts to habitat structure and to flora and lichens. Clearing and grubbing for road and pad construction account for the most notable impact but will be limited to the construction phase of the Project. Although Project activities will cause a direct loss of flora, lichens, and the habitats that support them, the site will be restored during the reclamation phase of the Project.

Direct impacts during the operations phase of the Project (35 years) is minimal but includes vegetation management (i.e., cutting and clearing) along the collector line corridor and roads rights-of-way. This localized impact is anticipated to occur approximately once every ten years, or as required locally in the interim. The vegetation (brush) clearing and maintenance activities, largely occurring within areas previously cleared or impacted during the construction phase are expected to have a negligible impact during the operations phase.

Table 13-6 displays the habitat types and areas overlapped by the Project footprint. These estimations were derived by the same tools used to estimate land types in the Project Area (Section 12.3.1).

Table 13-6. Habitat Types Affected

Habitat Type	Project Area		Project Footprint[1]	
	Total Area of Habitat Type (ha)	Percentage of Habitat Type (%)	Total Area of Habitat Type affected (ha)	Percentage of Habitat Type affected (%)
Alders	119	13	4	7
Barrens	280	30	19	33
Cutover	5	1	2	4
Hard wood	10	1	1	2
Mixed wood	122	13	8	14
Softwood	331	36	22	39
Urban Development	14	2	1	2
Waterbodies	2	0	0	0
Wetland[2]	36	4	0	0
TOTAL	919	100	57	100

Habitat Type	Project Area		Project Footprint[1]	
	Total Area of Habitat Type (ha)	Percentage of Habitat Type (%)	Total Area of Habitat Type affected (ha)	Percentage of Habitat Type affected (%)
[1]Total area cleared within the Project Area to support Project infrastructure. [2]Includes wetlands from provincial forestry layer (NSDNRR 2021) and does not include field delineated wetlands.				

Seven habitat types are overlapped by the Project footprint and include soft wood stands (22 ha; 39%), barrens (19 ha; 33%), mixed wood (8 ha; 14%), alders (4 ha; 7%), cutover (2 ha; 4%), hard wood (1 ha; 2 %), and urban development (1 ha; 2 %; Figure 19, Appendix A). Vegetation clearing and grubbing during the construction phase of the Project will results in the direct loss of habitat. The Project footprint will account for the loss of 57 ha of habitat, which is approximately 6.2% of the total Project Area.

No significant habitats (e.g., deer wintering areas) exist within the Project Area, therefore, none are directly impacted by the Project.

No SAR vascular plant species were identified within the Study Area, however, three SOCI plant species, highbush blueberry (n=12), skunk cabbage (n=12) and southern twayblade (n=4), were documented throughout the Project Area via field surveys and desktop review (Figure 19; Appendix A). All observations of skunk cabbage and southern twayblade will be avoided by the Project footprint (i.e., no direct impacts), however, six of the 12 observations (50%) of highbush blueberry are situated within the proposed Project footprint and are anticipated to be lost from Project development (i.e., clearing activities; Figure 19, Appendix A).

One SAR lichen, blue felt lichen, was observed on the northwestern portion of the Project Area, west of the Study Area. The *At-Risk Lichens – Special Management Practices* (NSDNRR 2018) considers blue felt lichen a rare and sensitive lichen and recommends a 100 m buffer with no forest harvesting or road construction to occur within the buffer area. **The proposed Project footprint is situated 195 m from the blue felt lichen observation, therefore, complying with the 100 m buffer** (Figure 19; Appendix A).

Five SOCI lichen were identified in 16 locations across the Project Area, *Usnea rubicunda* (n=2), *Fuscopannaria soredidata* (n=1), *Parmotrema perlatum* (n=11), *Coccocarpia palmicola* (n=1), *Heterodermia neglecta* (n=1). One observation of *Parmotrema perlatum* is situated within the proposed Project footprint.

No direct impacts are expected to occur outside the Project footprint.

13.3.1.2 *Indirect Effects*

Removal of vegetation and habitat loss during the construction phase of the Project can result in indirect effects through edge effects. The effects include changes in microclimate, increased light availability and changes in vegetation communities. Clearing of habitats could also result in the potential of invasive plant species to establish an area.

Lichens and nonvascular plants are notably sensitive to edge effects and air quality due to being poikilohydric organisms with an inability to regulate and maintain their water content (Nash III 2008). Forested communities adjacent to clearings often have a microclimate which varies from interior forests, which is a result of increased solar radiation, high wind velocity and lower humidity (Rheult et al. 2003). Edge effects can result in the desiccation and death of lichen species and is one of the biggest threats to SAR and SOCI lichens. The extent in which lichens and plants are impacted by edge effects (referred as depth of influence) have been well documented, however, the depth of influence is context-dependent (e.g., dependent on size of the clearings, substrate, type of climate etc.). For simplicity, and consideration that not all lichens, vascular and nonvascular plants respond the same to edge effects, a depth of influence of 100 m was selected as this is the required buffer for blue felt lichen (NSDNRR 2018) (Figure 19; Appendix A). Observed priority lichen and plant species within the depth of influence by edge effects, has potential for adverse effects from the Project.

In total, five locations of one priority plant species (high bush blueberry) and no priority lichens are located within the 100 m depth of influence (Figure 19; Appendix A).

Vascular plants could also be affected by dust deposition onto vegetation, which can cover the leaves, block stomata and cellular respiration and reduce the overall efficiency of photosynthesis (Farmer, 1993). Dust can be absorbed through the soil resulting in overall decline in plant health and even lead to necrosis (Hosker & Lindberg, 1982). Dust deposition would largely be associated with activities during the construction and decommissioning phases of the Project.

Should vegetated habitats be affected by altered surface water flows (as discussed in Section 13.4.2), it could lead to a plant community shift that could negatively affect flora individuals. This change in moisture regime could ultimately affect flora community structure and composition, and in particular, could negatively affect lichen species that require humid conditions wetlands provide. Project Activities have been demonstrated to not impact surface water flows and, thus, are not anticipated to impact vegetation communities or species changes resulting from changes in access to water.

The operations-related activities having a potential indirect impact upon habitat include those activities resulting in the potential introduction of invasive species. The introduction and spreading of invasive plants (i.e., weeds) is a risk in instances where the machinery, equipment or personnel has previously been working in areas with invasive plant species. The spread of seeds into areas of recent soil disturbance or where vegetation has been managed along the rights-of-way is a potential risk during the operations phase, albeit very small, and is expected to result in a negligible incremental impact upon adjacent habitats.

13.3.1.3 *Mitigation*

Due to clearing requirements associated with the infrastructure footprint of the Project, there is no mitigation to be implemented on those areas required for infrastructure, except to note that the infrastructure locations have been carefully planned to avoid all environmentally sensitive areas, unique habitats, wetlands and species at risk flora and lichens with established setbacks, to the greatest extent possible considering all the other constraints on the Project.

The following mitigation measures were included in the design of the Project to minimize indirect effects to habitat, vascular plants, and lichens:

- Maintain a 100 m buffer between the blue felt lichen observation and the Project footprint;
- Maintain surface water flow via cross drainage culverts on access roads;
- Monitor wetlands as directed in regulatory approvals;
- Develop and implement erosion and sediment control plan;
- Regularly inspect and repair erosion and sediment control devices;
- Avoid travel across erosion prone areas;
- Manage vegetation by cutting rather than the use of herbicides;
- Dust suppressants (e.g., water trucks) will be used, as required, to control dust;
- Equipment will be equipped with spill kits and site personnel will be instructed on their use;
- Employ measures to reduce the spread of invasive species (such as cleaning and inspecting vehicles);
- Reclaim site to re-establish native vegetation communities;
- Where vegetation restoration is required, natural regeneration of native species will be favored;
- Develop a Vegetation Management Plan; and,

- An EPP has been developed and includes site-specific measures to prevent sedimentation and erosion, dust level management, and spills (Appendix T).

13.3.1.4 *Monitoring*

No monitoring is proposed, with the exception of monitoring for weed species and overgrowth at infrastructure locations that may require clearing during operations. Refer to Section 13.4.1.4 for proposed monitoring of wetlands.

13.3.1.5 *Residual Effects and Significance*

Magnitude

The Project is predicted to have a **low** magnitude of impact on habitat, flora, and lichens. No regulatory threshold is available; therefore, the Project team has considered an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports flora/lichen, where similar habitat is not currently available at the local/regional level as the threshold.

Likelihood

It is **almost certain** that the Project will impact habitat, flora, and lichens as clearing and grubbing associated with the construction phase of the Project will directly impact this VEC.

Duration

The time over which the effects are likely to persist are predicted to be **short-term**, as they are confined to the construction phase of the Project.

Frequency

Effects to habitat, flora, and lichens will occur **once** during the construction phase of the Project.

Significance

The Project is predicted to have a **not significant** effect on habitat, flora, and lichen (Table 10-4).

13.3.2 **Fauna**

The following potential effects on fauna (excluding bats and birds – see following sections of this EARD) may occur from construction, operations, and decommissioning activities (Table 13-1) and will be a result of effects such as tree clearing, road building and infrastructure installation and maintenance, including:

- mortality;
- sensory disturbance; and,
- loss or alteration of habitat and habitat fragmentation.

13.3.2.1 *Mortality*

Direct mortality of fauna species could result from Project activities, particularly from wildlife vehicle collisions. The Project phase with the highest levels of truck traffic, and therefore the highest risk of wildlife vehicle collisions, are during construction and decommissioning. During operations, maintenance will require trucks to access the site periodically but at a much lower frequency than during the construction and decommissioning phases of the Project. Estimates of air emissions have used 60 trips per year during operations.

According to Fahrig and Rytwinski (2009), road construction can have greater impacts on amphibians and reptiles, and large mammals, compared with small mammals and birds. Road infrastructure and traffic have a negative impact on those species that are attracted to roads but lack the speed or reaction time to avoid traffic (e.g., turtles attracted to gravel roadsides for nesting). Ruts, caused by equipment and vehicles, may fill with water in the spring and attract breeding amphibians. Since these ruts would likely dry up in the summer, this presents a potential risk to species that hatch. Small mammals and birds are generally able to avoid collisions with vehicles. Amphibians can benefit from culvert installation where wetlands and watercourses intersect roads, as an alternative to crossing the roads, because this group can experience high mortality (Bouchard et al. 2009).

The risk of collisions with wildlife will vary depending on the season and the species. For instance, during winters with deep snow conditions, white-tailed deer are more likely to use roads and trails, putting them at an elevated risk of collisions. During spring and summer, porcupine, and skunk forage on roadside vegetation at dawn and dusk, increasing the risk of collisions with those species, and turtles are drawn to the roadside to nest in the gravelly shoulders in June. As such, the risk of wildlife collisions is present at any time of year.

Direct mortality may occur during clearing and grubbing activities for the construction of roads and turbine pads for low mobility species such as reptiles and amphibians. Operational activities are infrequent and limited mortality would be expected during operations.

Additionally, accidents such as fuel spills have the potential to cause indirect mortality to fauna due to exposure of contaminants.

13.3.2.2 *Sensory Disturbances*

Wildlife sensory disturbance may occur as a result of on-going human activity on-site as well as visual and auditory disturbance related to the operation of the turbines. Sensitivity of wildlife to disturbance varies by species and life-stage and noise type. For example, due to the extensive use of highways in North America, “the effects of highway noise have been studied in many animal groups including birds (Leonard and Horn 2005; Parris and Schneider 2009; Slabbekoorn and Ripmeester 2008; Nemeth and Brumm 2010; Halfwerk et al. 2011; McClure et al. 2013; Nemeth et al. 2013), mammals (Rasmussen et al. 2009; Benítez-López et al. 2010; Iglesias et al 2012), amphibians (Bee and Swanson 2007; Lengagne 2008; Sun and Narins 2005; Holderegger and Giulio 2010; Herrera- Montes and Aide 2011), and fish (Dooling et al. 2015; Radford et al. 2014). These studies clearly show that wildlife near highways respond, often negatively, to the presence of roads. However, because many factors other than noise can also potentially affect wildlife presence and activity near roads (e.g., moving cars, substrate vibrations, different microclimate, vegetation and food availability, pollution) it is often difficult, if not impossible, to differentiate among them and identify the principal causal factors" (California Department of Transportation, 2016).

Sensory disturbance to fauna is expected during all Project phases. During the initial construction phase of roads and turbine pads, noise will be generated from activities such as rock blasting (if required), clearing, and grubbing. During the operations phase noise will be generated from the WTGs. Heavy equipment use will generate noise during the construction and decommissioning and reclamation phase as well. These sensory disturbances may result in localized wildlife avoidance of the area surrounding the Project Area. Some species may avoid the area, while others may be attracted to the increased activity, including opportunistic species such as eastern coyote, northern raccoon, striped skunk, or American black bear.

Human presence and vehicles may disturb wildlife. During operation of the Project, Project-related vehicles and personnel will be in the vicinity of wind turbines on a regular basis for ongoing maintenance. It is likely that some disturbance of diurnal wildlife will occur during operation and maintenance of the Project.

Noise is the type of sensory disturbance that is most likely to affect fauna within the Project Area. Although the auditory capabilities of fauna species vary (Shannon et al., 2016) and fauna behavior in response to noise is largely related to perceived threats, not noise intensity (Bowles, 1995), changes to ambient noise levels have the potential to adversely affect fauna. Noise can affect behavioral patterns (Patthey et al., 2008), stress fauna (Knight and Swaddle, 2011), cause avoidance behavior (Ware et al., 2015), and reduce the ability for communication and hunting success (Barber et al., 2009). Combined, these effects can negatively impact the overall population health of a particular species (Ware et al., 2015).

Drolet et al. (2016) report no changes to density of white-tailed deer when a simulated drilling noise was played at 55 to 65 dBA. A literature review conducted by Shannon et al. (2016) found that an increase in stress and decrease in reproductive success in terrestrial mammals has the potential to occur at noise levels ranging from 52 to 68 dBA.

Blasting and heavy equipment use during both the construction and decommissioning phases of the Project will generate noise. According to Suter (2002); bulldozers, graders, and excavators generate noise of the following ranges 91-107 dBA, 88-91 dBA, and 70-108 dBA, respectively.

Blasting, if required, is expected to exceed these ranges. The levels of noise during construction and decommissioning will exceed the levels cited by Drolet et al. (2016) and Shannon et al. (2016) for indirect impacts to wildlife.

As indicated in Table 13-5, with the exception of intermittent blasting (if required) or intermittent truck horns, noise attenuation for all construction related equipment is expected to be at existing background levels at 135 m from the source.

During operations, noise will be more consistent, which has the potential to affect communication of wildlife (Lowry et al. 2013). Per the Noise Impact Assessment (Appendix K), operational noise will be generated from the WTGs (Table 13-7).

Table 13-7. Operational Noise from WTGs

Noise (dBA)	Approximate Distance from WTG
50-55	130 m
45-50	290 m
40-45	460 m

WTG generated noise will attenuate to 50 dBA or less approximately 130 m from the turbines, meeting the levels cited by Drolet et al. (2016) and Shannon et al. (2016) to not cause indirect impacts to wildlife. Operational noise will also be less sporadic than the noise generated during construction, decommissioning and reclamation (i.e., consistent noise levels generated from WTGs).

Additionally, studies in the western United States have shown that there has been no significant effect of the construction and operation of wind farms on big game (Strickland and Erickson 2003), indicating that species are either unaffected by these developments, given their small footprint and the preservation of existing land use, or that they can readily adapt to the presence of wind turbines. At this site, habitat avoidance will most likely occur during periods of construction, and may be more intermittent during periods of operation, when human presence on-site is less frequent and would occur on a short-term basis.

Light is another source of sensory disturbance that can impact fauna by potentially causing disorientation or by causing attraction or avoidance behaviour (Longcore and Rich, 2004). In turn, these behavioural changes can affect the success of foraging, reproduction, and communication of wildlife (Longcore and Rich, 2004) and can disrupt habitat connectivity (Bliss-Ketchum et al., 2019). During construction, decommissioning and reclamation, light will be sourced from heavy equipment and light plants. During operations mitigation will include installation of motion activated lights on site infrastructure to reduce sensory disturbance. Motion activated lighting is only applicable to the ground-based infrastructure (i.e., at doorways or at the substation) as turbine lighting at the top of individual turbines is regulated by Transport Canada.

13.3.2.3 *Habitat Loss*

Vegetation clearing of the proposed Project footprint will account for the loss of 57 ha of habitat, which is approximately 6.2% of the total Project Area.

There is little established literature pertaining to the response of wildlife to wind farm development. A wildlife monitoring report from the Searsburg wind project in Vermont reported that moose were using the area under a generating turbine (Multiple Resource Management Inc. 2006). A total of 23 images of moose were captured using a remote camera installed under the turbine, and of these, 61% occurred when the turbine was on and generating power. Observations of moose scat and of a single moose foraging were reported on the site of the Dokie Wind Energy Project in British Columbia (Jacques Whitford AXYS Ltd, UNBC 2008), meaning that moose continued to use the area after the wind farm was in operation.

While habitat preferences can change as the abundance of available habitat changes (Osko et al. 2004) and habitat selection shows a high degree of variability among individuals (McLaren, Taylor and Luke, 2009), mammals may require large areas with diverse habitat types (Snaith et al. 2002). Habitat preferences are correlated with forage and cover requirements, as well as breeding behaviours (Peek, Urich, and Mackie, 1976).

Vegetation clearing will occur during the construction phase of the project, specifically around turbine pads, new and upgraded access roads, along transmission line corridors, at the new substation, and at the potential concrete plant. If footprints overlap with suitable ungulate habitat, this vegetation removal could result in the loss or fragmentation of habitat for ungulates. This effect has potential for long-term impacts when mature forest (potentially suitable security or thermal habitat) is converted to early succession stages (less suitable security or thermal but potentially suitable food habitat).

Limited research on the effects of wind turbines on terrestrial mammals exists regarding the effect of infrastructure development (i.e., powerlines, ski trails, wind power) on ungulate behaviour, habitat use and movement. In a study conducted in at a wind energy facility in Oklahoma using telemetry data, Rocky Mountain Elk movement patterns prior to construction, during construction and operation did not vary and overall trends in home range size were not affected (Walter et al. 2006). Climatic variables and their effects on forage availability potentially have a greater influence on ungulate movement than the construction of wind-power facilities (Walter et al. 2006).

Any construction activities undertaken during fall could potentially affect the rutting behaviour of ungulates. It is assumed that construction activities undertaken in spring (May to June) will not affect ungulate calving areas. Most ungulates prefer riparian areas, typically with high shrub vegetation cover to give birth. As the turbines were sited away from riparian areas to the extent practicable, the noise associated with the construction and assembly of turbines is not likely to affect the selection of calving areas. Walter et al. (2006) observed that elk continued to use riparian habitats located within the project area during and after construction since this habitat was not altered by installation of the wind-power project.

Linear features such as roads, trails and transmission corridors have the potential to influence wildlife movement patterns. They create a barrier to movement for certain species, may act as a conduit to movement for other species and the types of human activity can influence wildlife movement. Bears are tolerant of some human activity but will avoid features when human frequency is high (Jalkotzky et al. 1997).

The impacts and effects on wildlife movement associated with linear features will vary depending on the feature type, frequency of human activity, season of use and width of the feature. The existing roads and ATV trails have already enabled access within the Project Area and it is anticipated that there will not be an appreciable increase in hunting activity due to construction activities.

Studies completed by Buckmaster et al. (1999) indicate that wildlife populations may be expected to disperse from the area during periods of construction. Based upon the vegetation characteristics in adjacent areas, and the conclusions of Buckmaster et al. (1999), it is expected that displacement of wildlife will be temporary. Development of the turbine sites and access roads is expected to increase forage potential as grass and forb species re-establish during interim reclamation. Loss of thermal and security cover is unavoidable, however, surrounding vegetation is expected to maintain these requirements.

The proposed Project footprint may also overlap with breeding sites for amphibians, such as wetlands. Refer to Section 13.4.1 for more detail.

Overall effects to fauna habitat as a result of the Project is limited due to the relatively small geographic extent of alteration (57 ha) when compared to the vast expanse of available habitat in the vicinity. The habitat present in the Study Area is common to the regional area and alternate habitat for wildlife exists on adjacent undeveloped lands, therefore, changes in abundance and distribution could be expected, but overall fauna population changes are not expected as a result of the Project.

13.3.2.4 *Mitigation*

The following mitigation measures will be included in the design of the Project to minimize effects to mammals:

- Gates will be used to restrict vehicle access for the life of the Project.
- On access roads to WTG1 and WTG13 and the above ground electrical collector line to WTG1 and WTG11, 'doglegs' were implemented to reduce line of sight for both the public and for predators from existing roads. This reduces the line of sight and is expected to reduce predation.
- Installation of motion activated lighting, which is only applicable to the ground-based infrastructure (i.e., at doorways and at the substation) as turbine lighting at the top of individual turbines is regulated by Transport Canada.

- Project staff will be made aware of wildlife potential on roads especially for Project traffic.
- Dust suppressants (e.g., water trucks) will be used, as required, to control dust.
- Equipment will be equipped with spill kits and site personnel will be instructed on their use.
- Implement reclamation program to re-establish habitat to support fauna habitat.
- Waste management to reduce attractants to opportunistic wildlife species, where applicable.
- Vegetation management will be conducted by cutting (i.e., no use of herbicides).
- Vehicle speeds on access roads will be limited.
- Install cross drainage culverts to maintain site surface water flow and allow passage for amphibians/reptiles.
- Avoid clearing around wetlands and riparian areas to the greatest extent possible. Avoidance of wetlands and watercourses in Project design was heavily weighted.
- Leave coarse woody debris in areas that would be re-vegetated after construction to provide alternative refugia and foraging areas for herpetofauna.
- Conduct regular road maintenance in the form of grading to prevent water pooling and to minimize deep ruts to prevent amphibians from laying eggs in pools.
- Develop a Wildlife Management Plan.

13.3.2.5 *Monitoring*

No monitoring is proposed for this VEC, with the exception of post-construction mortality monitoring for birds (Section 13.3.4.4) and bats (Section 13.3.3.5).

13.3.2.6 *Residual Effect and Significance*

Magnitude

The Project is predicted to have a **low** magnitude of impact on fauna. No regulatory threshold is available; therefore, the Project team has considered an effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports fauna, where similar habitat is not currently available at the local/regional level as the threshold.

Likelihood

It is **almost certain** that the Project will impact fauna as clearing and grubbing associated with the construction phase of the Project will directly impact habitat and activities associated with all Project phases will generate noise that may adversely affect fauna. The likelihood for the Project to cause direct mortality to fauna is less likely but still possible.

Duration

The time over which the effects are likely to persist are predicted to be **long-term**, as they there is potential for interaction during all Project phases.

Frequency

Potential effects to fauna will occur at varying frequencies. For example, loss of habitat will occur once construction phase of the Project, sensory disturbance will occur regularly during the construction phase but continuously during operations.

Overall, effects to fauna are anticipated to occur at **regular** intervals during the Project.

Significance

The Project is predicted to have a **not significant** effect on fauna (Table 10-4).

13.3.3 Bats

The following potential effects on bats may occur from construction, operations, and decommissioning activities (Table 13-1):

- Direct and indirect mortality;
- Sensory disturbance; and,
- Loss or alteration of habitat.

13.3.3.1 *Direct and Indirect Mortality*

Project construction is not expected to significantly impact bats present in the area, although it may result in some direct mortality as bat habitat is present within the Project Area and bats were identified during assessments.

All construction will occur during normal working hours (i.e., daylight) therefore collisions with flying bats are unlikely. No hibernacula were identified during baseline surveys; therefore, disturbances are not expected during the construction phase in areas of the project footprint.

There are low levels of bat activity across the Project Area with a total of 191 bat passes recorded via six bat acoustic detectors between May 10 and October 31, 2022. The majority (86%) of recorded bat passes were identified as migratory species and were predominantly determined to be silver-haired bats. Peak bat activity occurred in late September with a total of 20 bat passes recorded in a single night. On average 0.15 migratory passes per detector night occurred for the Project Area from May 10 to October 31.

Studies have shown that on average, greater than 80% of bat fatalities currently recorded at wind energy developments in North America, involve migratory species (Arnett *et al.*, 2008). Bat fatalities, primarily migratory species, occur through direct collision with blades or indirectly from rapid decompression (barotrauma) near turbines (Baerwald *et al.,* 2008). In Alberta, during fall migration (July 15 to September 30), bat fatalities consist mainly of hoary and silver-haired bats (Government of Alberta, 2013).

Due to the lack of readily available data in Nova Scotia to which the data collected for this EARD can be compared to[10], the Alberta model11 has been adopted for the purposes of analyzing potential impacts to bats. The Alberta Government's *Bat Mitigation Framework for Wind Power Development (Government of Alberta, 2013)* uses a Precautionary Principle whereby the following bat passes per night for migratory species is considered when determining project risk:

- Less than 1 migratory bat passes per detector night = potentially acceptable risk
- 1-2 migratory bat passes per detector night = potentially moderate risk
- Greater than 2 bat passes per detector night = potentially high risk of bat fatalities

Therefore, based on precautionary guidance from the Alberta Government (2013) the average of 0.15 migratory passes per detector night observed across the Project Area would be considered a potentially acceptable risk and is the lowest risk threshold for bats identified. The Alberta Government also states that **"**Pre-construction surveys indicating "less than 1 migratory-bat passes/detector-night" (equating to less than 4 mortalities per turbine) suggests that bat fatality issues are unlikely; however, post-construction monitoring is required."

Bat mortality is a known potential effect of wind energy projects' operational phases in Canada with the majority of mortalities associated with migratory bat species (Zimmerling and Francis 2016). Mortality potential is strongly impacted by region, habitat, and bat species in the vicinity of WTGs (Hein *et al.,* 2013). Siting turbine locations in areas that avoid bat migratory routes is the most significant step to decrease mortalities available (DNV GL, 2018).

"Bat mortality has been documented at wind power projects in a variety of habitats across North America. In Ontario, annual mortality estimates at wind power projects range from 4 to 14 bat

10 No post-construction mortality monitoring programs are available for public review in Nova Scotia except through Freedom of Information and Protection of Privacy (FOIPOP) application.

11 This model is also used by the Saskatchewan Ministry of Environment in its determination of project risk.

mortalities/turbine/year. Annual bat mortality estimates at wind power projects in North America vary from less than 1 to over 50 bat mortalities/turbine/year" (OMNR 2011).

The prominent causes of bat mortality at wind turbine sites are direct collision (i.e., direct blunt-force trauma) and barotrauma (indirect trauma) although it is difficult to attribute individual fatalities exclusively to either direct or indirect trauma (Grodsky *et al.,* 2011; Baerwald et al. 2008). It is difficult to attribute individual fatalities exclusively to either direct or indirect trauma (Grodsky *et al.,* 2011). Barotrauma involves tissue damage to air containing body structures (i.e., the lungs) caused by rapid or excessive air pressure changes. It is believed that air pressure changes in air space directly adjacent to moving turbine blades causes expansion of air in the lungs not accommodated by exhalation, therefore resulting in lung damage and internal hemorrhaging. Grodsky *et al.* used radiology to investigate causes of bat mortality and found that a majority of the bats examined (74%; 29 out of 39 individuals) had bone fractures that are likely to have occurred during direct turbine collisions (2011). Approximately half (52%; 12 out of 23 individuals) of the examined bats had mild to severe hemorrhaging in the middle or inner ears (or both) (Grodsky *et al.,* 2011).

13.3.3.2 *Sensory Disturbance*

Noise will be generated during all phases of the Project. During construction and decommissioning and reclamation, noise will be generated by heavy equipment. During operations, noise will be consistent and will be generated by WTGs. During construction and reclamation, noise will only occur during daylight hours (typically) and therefore sensory disturbance should be limited to roosting bats. Project related effects will be associated with noise conditions that exceed those levels whether they be cumulative or independent.

All noise attenuates (diminishes) with distance from the source (see California Department of Transportation, 2016). This occurs through geometric spreading and signal reduction from ground and atmospheric absorption. Noise from point sources (i.e., construction equipment) traveling through a soft site (e.g., a forest or meadow), are reduced by attenuation rates of 7.5 dBA for each doubling of distance (based on 50 feet) (California Department of Transportation, 2016). As indicated in *Table 13-5. Sound attenuation from construction through forested habitats,* with the exception of intermittent blasting (if required) or intermittent truck horns, sound attenuation for all construction related equipment is expected to be at existing background levels at 135 m from the source of the sound and less depending upon the equipment being used.

Anthropogenic noise can interact with an animal's ability to process information, in turn reducing survival and reproduction (Gomes et al. 2016). Anthropogenic noise can cause acoustic masking during foraging (Siemers and Schaub 2011). Jones (2008) found that traffic noise reduced foraging time and effort in mouse-eared bats (*Myotis myotis*). Anthropogenic noise can also cause an avoidance response which in turn reduced foraging efficiency (Luo et al. 2014). The effects of anthropogenic noise on bats is not well understood (Bunkley et al. 2015; California Department of Transportation, 2016).

Due to the extensive work on highway construction, a number of studies have been summarized by the California Department of Transportation (2016). Those studies assumed principal potential effects of traffic noise and highway construction on bats were thought to include acute acoustic trauma, disturbance and displacement from important food and shelter resources, and signal masking. However, because of the multiple behavioral and physiological defensive mechanisms they have developed to prevent noise overexposure, most bats are likely effectively shielded from most trauma events that would result from highway or construction noise (California Department of Transportation, 2016). Furthermore, masking can only occur if the noise spectrum overlaps with that of the bat echoes (California Department of Transportation, 2016).

For bat species, echolocation calls are in the ultrasonic range beyond the upper frequency limits of construction noise (California Department of Transportation, 2016). For these species, there is effectively no echolocation masking effect from construction noise. Additionally, the lack of construction activity during bat activity (30 minutes before sunset to 30 minutes after sunrise), further limits any potential masking effects in the ultrasonic ranges.

Disturbance is likely to be the most pervasive and significant effect associated with construction projects. Construction noise (e.g., heavy equipment, blasting, and pile-driving) could potentially affect bats, particularly those species that roost nearby. Sudden, loud noises can potentially disturb bats and cause abandonment of roosts (Pearson et al. 1952; Humphrey and Kunz 1976; Kunz 1982; Fenton 1997; Ferrara and Leberg 2005). If loud enough and sudden, such noise can also potentially cause temporary or permanent hearing loss in bats, but this has yet to be tested. Chronic disturbance may also alter important colony activity patterns, particularly during the breeding season (Shirley et al. 2001; Mann et al. 2002) and disrupt critical torpor cycles of hibernating/overwintering bats, forcing them to overuse critical energy resources (Speakman et al. 1991; Thomas 1995; Fenton 1997; Johnson et al. 1998). However, bats are well adapted morphologically, physiologically, and behaviorally to avoid acoustic trauma (California Department of Transportation, 2016). Because they are often aurally confronted with exceptionally loud sounds from their own and other bat echolocation signals (e.g., 110 dB) they have evolved very fast protective mechanisms to prevent sensory overload and damage to the auditory system (Wever and Vernon 1961; Henson 1965; Braun 1994). These mechanisms include behavioral avoidance, changing the shape and orientation of the pinnae (Wever and Vernon 1961), closing the cartilaginous fold in the outer ear canal (Wever and Vernon 1961), the tympanic reflex (Wever and Vernon 1961), and resonance absorption (Braun 1994). While these mechanisms are very effective in achieving the needed protection from constant noise exposure (i.e., in the case of WTGs), it is speculated that these mechanisms also can prevent over exposure from sudden, unexpected anthropogenic noise shocks (e.g., blasting). While it seems, likely bats have the capacity to do so (Henson (1965), found

Brazilian free-tailed bats could initiate the tympanic reflex very quickly (4-10 milliseconds) before echolocating. Additionally, because the spectra of construction noise do not appreciably overlap with most bat echolocation calls or their hearing of them, echolocation in most species of bats is likely not adversely affected by these noise types (California Department of Transportation, 2016).

13.3.3.3 *Loss or Alteration of Habitat*

No previously known hibernacula are within the Project Area, as confirmed by NSDNRR, nor were any potential bat hibernaculum identified during biophysical surveys. Potential roosting habitat (i.e., snags and mature stands) for bats was observed in select sites within the Study Area, predominantly in wetlands however these were not investigated for the presence of bats.

Habitat suitable for bat roosting and foraging was reviewed for all proposed WTG's. Observations at each WTG location indicates that for the most part, habitat to support these activities will continue to be present as only 6% of habitat within the Project Area will be affected by construction through direct loss. So similar to the effects on birds, the habitat present across the Study Area (and WTG locations specifically), is also present extensively in surrounding undeveloped forested lands. As such, removal of this habitat for the construction of WTG's and access roads associated with the Project is not expected to have an effect of bat populations in the region. Decommissioning of the Project will result in the return of potential bat habitat.

13.3.3.4 *Mitigation*

Bat mortality risk has been found to be greater during low wind speed conditions than during high-wind conditions with fewer bats observed at wind speeds greater than 6 m/s (21.6 km/hr; Arnett, et al., 2008). Baerwald et al. (2008), found that by increasing the low wind cut-in speed of a turbine from the rated 4 m/s (14.4 km/h) to 5.5 m/s (19.8 km/h), a reduction in turbine-caused bat fatalities occurred. It has been shown that increasing cut-in speeds to 5.5 metres per second, significantly reduced turbine-related bat fatality, as bat activity is reduced during higher wind speeds (Baerwald et al 2009, Arnett et al 2010).

Cut-in speeds can be managed remotely via turbine operators and can be implemented immediately (depending on the turbine and software used). As increases in cut-in speed have financial implications to the generation capacity of the Project, it is recommended that an iterative review and adjustment of cut-in speeds be developed with NSDNRR to ensure effective mitigation, while not excessively affecting energy production. As adjustments to cut-in speed can be implemented without delay, reaction to field results (e.g., high fatality numbers during post-construction fatality monitoring, wind speed or time of day) could be applied rapidly. Through continued carcass surveys and iterative adjustments in cut-in speed, the need for mitigation (if required) can be met while still allowing energy production by the Project during bat migratory periods.

Additional mitigations for bats include:

- Wedgeport Wind will complete clearing activities that may impact potential roosting habitat outside of the bat roosting period (May 15 to September 30).
- Installation of motion activated lights on site infrastructure to reduce insect attraction and subsequent attraction by bats. Motion activated lighting is only applicable to the ground based infrastructure (i.e., at doorways and the substation) as turbine lighting at the top of individual turbines is regulated by Transport Canada.
- Provide wildlife awareness training to site personnel.
- Develop a Wildlife Management Plan.

13.3.3.5 Monitoring

Carcass searches are an important monitoring process during the first two years of operation to evaluate the correctness of the predictions and to test the possibility of unexpected risk factors. Post-construction mortality monitoring for bats will be completed in conjunction with bird mortality surveys as described in the *Post-Construction Survey Protocols for Wind and Solar Energy Projects (Alberta Environment and Parks, 2020*). In past EARD applications protocols as listed in *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (CWS 2007a) were suggested for use, however, the Alberta Environment and Parks document, the protocols have been updated to reflect current information and knowledge around post-construction monitoring.

13.3.3.6 Residual Effects and Significance

Magnitude
The Project is predicted to have a **low** magnitude of impact on fauna. No regulatory threshold is available; therefore, the Project team has considered the Government of Alberta's (2013) Precautionary Principle of a potentially acceptable risk as the threshold.

Likelihood
It is **almost certain** that the Project will impact bats as clearing and grubbing associated with the construction phase of the Project will directly impact habitat and activities associated with all Project phases will generate noise that may adversely affect foraging success of bats. The likelihood for the Project to cause direct mortality to bats is likely.

Duration
The time over which the effects are likely to persist are predicted to be **long-term**, as they there is potential for interaction during all Project phases.

Frequency
Potential effects to bats will occur at varying frequencies. For example, loss of habitat will occur once during the construction phase of the Project, sensory disturbance will occur regularly during the construction phase but continuously during operations.

Potential for direct mortality is most likely during the operational phase of the Project, therefore, effects to bats are anticipated to occur at a **continuous** interval during the Project.

Significance
The Project is predicted to have a **not significant** effect on bats (Table 10-4).

13.3.4 Avifauna

Table 13-1 provides a summary of the potential Project interactions and environmental effects resulting from the Project. The table is divided according to each of the Project phases assessed (construction, operation and maintenance, decommissioning and reclamation) as well as accidents, malfunctions, and unplanned events.

Wind turbine effects of on birds and bird migrations have been studied in great detail over the past decades (Kern and Kerlinger, 2003; Drewitt and Langston, 2006; Smallwood, 2013). The impact that turbines may have on birds, and bird movements, depends largely on local topography, turbine design, and the particular bird communities inhabiting the Study Area. While birds may be affected during construction phase through displacement and habitat loss, they are most likely to interact with the Project during its operation in the form of direct mortality. This section will describe the potential Project interactions (including estimated mortality) and environmental effects associated with the various Project activities.

CWS stated that the Project Area is significant for waterfowl and shorebirds for breeding, migratory stop-overs, and overwintering sites (June 3, 2022, pers. comm. with MEL, Stephen Zwicker, Environmental Assessment Coordinator, CWS). Three important shorebird staging sites are nearby: Cook's Beach (approximately 4.3 km away), Melbourne Game Sanctuary (Melbourne Lake specifically; approximately 4.3 km away), and Pinkney's Point (approximately 3.4 km away). The ocean surrounding the peninsula on which the Project Area is located is within foraging range of the Roseate Tern (*Sterna dougallii*), which is listed as Endangered under Schedule 1 of SARA (June 3, 2022, pers. comm. with MEL, Stephen Zwicker, Environmental Assessment Coordinator, CWS).

The primary adverse impacts associated with any wind project are avian mortality through collision with moving rotor blades and the loss of habitat associated with infrastructure.

13.3.4.1 *Direct Mortality*

There is the potential for direct mortality, including direct mortality of eggs/unfledged nestlings, during site preparation when clearing and grubbing vegetation (construction phase = 2 years). Vehicle collisions is a potential activity that could cause birds to be struck or accidently killed. Vehicle collisions could occur during any Project phase but is more likely to occur during construction (2 years) or decommissioning/reclamation (2 years) as there will be an increase in truck traffic during these phases. Mortality associated with turbine collisions may occur during operations (35 years).

Birds may avoid a wind project; for example, some may be displaced from the area, while others may avoid turbines or take other evasive action to prevent a collision.

Band et al. (2007) stated that birds with flight heights coinciding with the rotor swept area (RSA) of turbines have a higher likelihood of collision[12]. However, it should be noted that having the highest collision exposure index, does not allow us to predict which species are most prone to collision, as species-specific behaviours may affect collision rates. Fatality rates do not depend on bird abundance alone, but on other factors, such as differential use of areas within a wind farm (Ferrer, et al., 2012). Collision mortality has been shown to not simply increase with abundance alone; factors such as frequency of passage, flight behaviour, weather, and topography influence collision risk (Lucas, Janss, Whitfield, & Ferrer, 2008). Verification of collision impacts can only be confirmed through post-construction mortality monitoring.

In Canada, 69% of bird fatalities recorded from wind power projects were passerines (Bird Studies Canada, 2016). It is likely that passerines make up an even larger percentage of fatalities than estimated, due to the difficulty in detection of individuals during surveys than larger birds (Erickson, Wolfe, Bay, Johnson, & Gehring, 2014), as well as rapid scavenger removal (70-80% within two days) (Lekuona & Ursua, 2007).

Avoidance behaviour varies between species (Whitfield, 2009), with raptors appearing to be more vulnerable to collision with turbines than most other avian groups [(Erickson W., et al., 2002) (Young, Erickson, Strickland, Good, & Sernka, 2003)]. Behaviour of diurnal migrants such as raptors makes them potentially more vulnerable to collisions with wind turbines, particularly during hunting (Higgins , Osborne, & Naugle, 2007), or while utilizing thermal updrafts to increase altitude and conserve energy. Barrios and Rodriguez (2004) reported increased mortality during fall/winter migration, with birds flying closer to turbines. Some studies have also correlated raptor

[12] The RSA for the SG 6.6-170 (WTG used as part of the effects assessment) is 22,698 m^2

abundance with a higher collision risk; breeding grounds and areas with foraging habitat have been identified as sites that increase high flight abundance [(Bevanger, et al., 2010) (Eichhorn, Johst, Seppelt, & Drechsler, 2012)]. Additionally, diurnal migrants (raptors, vultures, etc.) are more constrained by topographical features than nocturnal migrants – they tend to be concentrated along linear features such as rivers, ridges, and valleys (Richardson, 2000); resulting mitigation suggests turbine placement away from such features.

Ferrer et al. (2012) further suggests there is clear evidence that the likelihood of bird collisions with turbines depends critically on species behaviour and topographic factors, and not only 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 wind turbines could be harmful for birds even where there is a relatively low density of birds, whereas other locations would be relatively risk free even with higher densities of birds (Ferrer, et al., 2012).

The risk to avian species for collision with wind turbines is highest during migration periods (Alberta Environment and Parks, 2016), when the most fatalities tend to be reported. Fatalities can also occur from MET towers and guywires, or through nest mortality/disturbance from clearing of vegetation/loss of habitat (Band, Madders, & Whitfield, 2007). Bird fatalities due to turbine collision have been consistently identified as a leading ecological shortcoming to wind energy (Drewitt & Langston, 2006), however, mitigating for this consequence is not forthright, due to the complexity of factors influencing collisions (Marques, et al., 2014).

Bird collision likelihood depends on species, turbine height and elevation, implicating species-specific and topographic factors in collision mortality. There was no evidence of an association between collision likelihood and turbine type or the position of a turbine in a row (Lucas, Janss, Whitfield, & Ferrer, 2008).

Populations of several groups vulnerable to collisions are increasing across Canada (e.g., waterfowl, raptors). This suggests collision mortality at current levels does not limit population growth. The factors that contribute to a species' vulnerability to collisions include species that flock, have rapid flight, and are large with slow maneuverability (high wing loading and low wing aspect ratio) (Rioux, Savard, & Gerick, 2013).

13.3.4.1.1 National Averages

Direct mortality resulting from the collision with WTGs is the most apparent Project interaction.

While collision with WTG's causing direct mortality is an often a cited effect on birds, a study completed in 2013 found that after completing carcass searches at 43 wind farms across Canada, the average number of birds killed per turbine per year was 8.2 ± 1.4 (Zimmerling et al., 2013).

In Canada, the Wind Energy Bird and Bat Monitoring Database (WEBBMD) is a joint initiative among Bird Studies Canada, Canadian Wind Energy Association (CanWEA), ECCC and the

Ontario Ministry of Natural Resources (Bird Studies Canada, 2018). Data from Atlantic Canada available on the database come from only two sites from New Brunswick, three in Prince Edward Island, two in Newfoundland and Labrador and one in Nova Scotia. In Atlantic Canada, the estimated average mortality rate is 1.17 birds/turbine/year (WEBBMD 2016).

Another study completed in 2013 reviewed 22 wind projects in the eastern U.S. and found that after accounting for varying proportions of the year being sampled, annual per turbine mortality was modeled to be 6.86 birds/turbine/year; 95% CI=5.41 – 8.30) (Loss et al., 2013).

13.3.4.1.2 Wedgeport Wind Project Estimate[13]

Using the SNH Collision Risk Model (also known as the Band model), a method based on vantage point data to estimate the number of birds with the potential to collide with turbines at a proposed wind project (Scottish Natural Heritage, October 2016), MEL has estimated bird mortality resulting from the Project. To estimate bird mortality associated with this Project, a guidance document from Scottish Natural Heritage (2000) was followed. The guidance document from Scottish Natural Heritage (2000) provides guidance on calculating a theoretical collision risk for birds and wind power projects assuming there's no avoidance behaviour (Scottish Natural Heritage, 2000). However, in reality, most birds do use avoidance behaviours to avoid the turbine structures. Therefore, the results of the no avoidance calculations are moderated by an important factor that represents the proportion of birds often hit which are likely to take effective avoiding action. There are approaches that may be appropriate depending on the species and flight behaviour to determine the probability of birds flying through a RSA and using the guidance document the assumption is where a bird population makes regular flights through the wind farm in a reasonably defined direction (Scottish Natural Heritage, 2000).

This estimating method was previously used in the EA of the Stirling Wind Project, Alberta that was conducted by MEL. That project was subject to an Alberta Utility Commission (AUC) regulatory hearing and was subsequently approved. That project is currently under construction.

Avian species were surveyed at the Wedgeport Wind Farm Project using point count plots and radar tracking methods. The data sets generated by these surveys differ to a large degree in timing, area coverage, and resolution, among others, resulting in incompatibility when calculating mortality estimates. For this reason, estimates were made separately using each data set as a means

[13]Refer to Appendix C-4 – Avian Mortality Estimates for detailed discussion on methodologies.

to highlight information unique to those surveys. Multiple estimates also provide a measure by which we can scrutinize our outputs.

13.3.4.1.3 Total Mortality Estimates from point count data

The results of the Project specific bird mortality estimates are provided below in Table 13-8 and estimate that total mortality associated with the Project on an annual basis will be approximately 35.8 birds, or 2.8 birds/turbine/year.

Table 13-8. Summary of Collision and Mortality Estimates

Species Group	Total Collision Estimates (birds/year)	Estimated mortality (birds/turbine/year)
Waterfowl	1.0	0.1
Shorebirds	5.2	0.4
Passerines	26.7	2.1
Raptors	0.2	0.0
Other landbirds	2.7	0.2
Total	**35.8**	**2.8**

13.3.4.1.4 Total Mortality Estimates from radar data

As per the methods of analysis previously provided, the following mortality estimates were determined for all bird passes using radar tracking data only. The estimated mortality for all bird passes associated with the Project as detected from radar and using a 98% avoidance is 22.30 birds per year or approximately **1.72** birds/turbine/year[14].

The following summarizes the estimated mortality rates provided above as birds / turbine / year:

Table 13-9. Mortality Estimates Summary

Study	Estimated Bird Mortality per WTG (bird / turbine / year)	Estimated Project Bird Mortality (bird /year for Project [13 WTG])
Zimmerling et at. (2013)	8.2	106.6
Bird Studies Canada – Atlantic Provinces (2018)	1.2	15.6

[14] Due to radar limitations, radar captures 'target' signals. There is a broad assumption in the results that the targets are birds. In addition, targets (assuming they are birds), cannot be broken down easily by size, and also there is no method to determined species. Therefore, the estimate includes all radar targets and applies the 98% avoidance rate. The below estimate would then represent total estimated mortality and is not a cumulative mortality to be added with point count data.

Loss et al. (2013)	6.9	89.7
MEL Estimates – Point Count	2.8	36.4
MEL Estimates – Radar	1.72	22.4
AVERAGE	**4.2**	**54.1**

13.3.4.2 *Habitat Alteration*

Seven habitat types are overlapped by the Project footprint and include soft wood stands (22 ha; 39%), barrens (19 ha; 33%), mixed wood (8 ha; 14%), alders (4 ha; 7%), cutover (2 ha; 4%), hard wood (1 ha; 2 %), and urban development (1 ha; 2 %; Figure 19, Appendix A). Vegetation clearing and grubbing during the construction phase of the Project will results in the direct loss of habitat. The Project footprint will account for the loss of 57 ha of habitat, which is approximately 6.2% of the total Project Area.

Avian habitat directly within the footprint of proposed new access roads and turbine pad area construction will be eliminated. Clearing and grubbing for site preparation will remove vegetation, reducing the quantity of terrestrial habitat, and affecting the quality of already marginal habitat.

The Project will result in a slight increase in edge area, which may act as a barrier for some bird species, while presenting potential benefits to others. Some bird species benefit from forest edges and have shown to return in subsequent years after an area is cleared. A study in Alberta showed that the abundance of Alder Flycatchers increased in a previously cut area (Tittler et al. 2001).

Bird species that currently use the habitat within the Study Area will be displaced during the initial stages of construction, changes in habitat availability, and associated sensory disturbances. This could potentially cause direct mortality if individuals are unable to relocate to alternate suitable habitat. However, there are areas of suitable nesting habitat in adjacent lands and the regional area in general. The proposed Project is located in a rural, relatively untouched setting, surrounded by forested landscape that may provide alternative suitable habitat.

The Project is likely to result in an increase in habitat fragmentation and an increased amount of forest edge. This could lead to decreased forest quality for species that rely on interior forest conditions (i.e., areas within a forest sheltered from edge effects), although such habitat is already limited due to historical human disturbance. These effects have both positive and negative outcomes depending on the bird species using the habitat. Habitat fragmentation and increased edge areas may lead to increased predation on birds, a study by Manolis, Andersen, and Cuthbert (2002) found that distance to nearest clear-cut was the best predictor of nest predation in multiple ground laying birds. However, some bird species benefit from forest edge habitat and have shown to return in subsequent years after an area is cleared due to the availability of foraging opportunities and other niche habitats. A study in Alberta showed that the abundance of alder flycatchers increased in a previously cut area (Tittler et al., 2001). Additionally, rusty blackbirds can also tolerate forestry activities as long has their habitat of coniferous dominant trees of varied heights near waterbodies is maintained (C. Stacier, Personal Communications, 2018).

The Project will alter habitat within the Study Area; alterations will have both negative and positive effects depending on the bird species. Not all alterations will be permanent, and these alterations will not have a significantly negative impact on core habitat and similar habitat for avifauna is present in the surrounding landscape.

13.3.4.3 *Sensory Disturbances*

Sensory disturbance refers to changes in ambient noise levels caused by Project activities. It has the potential to impact avifauna, either negatively through disruption to migration and behavioural patterns or positively by attracting some species with the increased activity levels. Noise and vibrations are provincially regulated under the *Workplace Health and Safety Regulations* to protect the health and safety of site workers and the general public, which will help mitigate any negative impacts to bird species.

Sensory disturbance may occur during construction, in particular during site preparation. Activities during the avian breeding season have the potential to cause direct mortality, abandonment of nests, and the destruction of nest contents, all of which could include species designated as SAR or SOCI. If adjacent suitable habitat is not available, birds that have been displaced will not likely nest until habitat becomes available. This may result in a higher non-breeding population. 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 (see California Department of Transportation, 2016). This occurs through geometric spreading and signal reduction from ground and atmospheric absorption. Noise from point sources (i.e., construction equipment) traveling through a soft site (e.g., a forest or meadow), are reduced by attenuation rates of 7.5 dBA for each doubling of distance (based on 50 feet) (California Department of Transportation, 2016). As indicated in *Table 13-5. Sound attenuation from construction through forested habitats,* with the exception of intermittent blasting (if required) or intermittent truck horns, sound attenuation for all construction related equipment is expected to be at existing background levels at 135 m from the source of the sound and less depending upon the equipment being used.

Sensory disturbance from noise can impact birds in a number of ways. Birds can exhibit greater susceptibility to noise impacts as many species rely on vocal communication (Bickley and Patricelli 2010). Avifauna may be displaced from areas adjacent to the Project as a result of 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, and orientation (Shannon et al, 2016; Bickley and Patricelli, 2010; Marler et al, 1973). 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 125-140 dBA (Bickley and Patricelli, 2010).

Some bird species may not be impacted by sensory disturbances. A study of the impact of logging truck traffic on bird reports no observed effects on nesting at noise levels of 53 dBA (Grubb et al., 1998). It was also found that noise tolerant species had increased nest success through decreasing nest predation (Francis et al., 2009).

Light is a source of sensory disturbance that can impact birds by potentially causing disorientation, avoidance, or attraction (Longcore and Rich, 2004). In turn, these behavioural changes can affect the success of foraging, reproduction, and communication of wildlife (Longcore and Rich, 2004) and can disrupt habitat connectivity (Bliss-Ketchum et al., 2019). It has been known that exterior structures such as substations, buildings and other floodlit structures can attract birds during the night and lead to mortality events. In addition, migratory birds during fall and spring are especially attracted to lighting on tall structures. Modifications and timing of use for lighting can be managed to limit impacts on birds and, therefore, no effects to avifauna are expected related to light pollution.

13.3.4.4 Mitigation

13.3.4.4.1 Avoidance of Habitat and Habitat Features

Pre-construction wildlife and habitat surveys were completed with micro-siting (defined as assessment of each turbine, access road, collector line, collector substation. O&M building and laydown areas in the field to ensure compliance with setbacks).

Based on these surveys and other factors, such as landowner considerations, regulatory setbacks, and public/municipal consultation, a constraints analysis was used to develop the current Project layout by identifying appropriate lands for Project infrastructure.

Setback requirements provided initial guidance on how to best design the Project. Field surveys were then used to identify environmental features (i.e., wetlands, nests) and key habitat within or near the Project. Project design and siting was optimized to avoid wildlife features and habitat using the Requirements and the field survey results.

Wedgeport Wind will develop a Wildlife Management Plan that will specify best management practices associated with bird species utilizing the Study Area, mitigation methods, and contingency plans associated with vegetation removal, turbine operation, progressive reclamation, and re-vegetation of the Project footprint. Additional mitigations include:

- The Project Infrastructure footprint will be cleared of vegetation and timber outside of the breeding season between April 15 – August 30. If during construction, additional areas need to be cleared, a nest sweep will be completed by a biologist no more than 7 days prior to construction start and repeated as necessary prior to any disturbance.
- Should any ground- or burrow-nesting species initiate breeding activities within stockpiles or exposed areas during construction or operations, the Proponent will avoid disturbance to these areas until chicks can fly and the nesting areas are no longer being utilized.
- Grubbings and topsoil will be salvaged and stored for use in site restoration.
- Implement an erosion and sediment control plan.
- Regularly inspect and repair erosion and sediment control devices.
- Equipment will be equipped with spill kits and site personnel will be instructed on their use.
- Implement reclamation program to re-establish similar habitat to support reintroduction of birds post turbine life.
- Use movement detection lighting on office structures, doors to turbines, gates, etc. which turn off when not in use, instead of permanent lighting.

13.3.4.4.2 Adaptive Management

Should post-construction monitoring identify significant mortality events to a particular species of bird, at a particular time of the year, or during specific weather conditions, the Proponent will implement an adaptive management protocol to monitor and mitigate future effects to the greatest extent possible.

Adaptive management is an iterative learning process producing better understanding and improved management over time (Kerlinger et al. 2010). An adaptive approach involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions (U.S. Department of the Interior, 2009).

Adaptive Management options will be discussed with NSDNRR and the literature notes that being coupled with an agreed-upon set of criteria that is consistent with the regulatory context is important for success.

The expectation is that Adaptive Management would be applied to: assess the effectiveness of the site-specific mitigation strategies devised during pre-project planning; identify appropriate management responses or adjustments of operations to address unforeseen impacts; and inform and improve longer term mitigation strategies going forward. The Adaptive Management will also include other measures deemed necessary by the proponent based on project-specific details, emerging technology or as a result of improved understanding of potential impacts.

13.3.4.5 *Monitoring*

Carcass searches are an important monitoring process during the first 2 years of operation to evaluate the correctness of the predictions and to test the possibility of unexpected risk factors. Post-construction mortality monitoring for birds will be completed in conjunction with bat mortality surveys as described in the Post-Construction Survey Protocols for Wind and Solar Energy Projects (Alberta Environment and Parks, 2020). In past EARD applications, protocols as listed in Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (CWS 2007a) were suggested for use, however, in the Alberta Environment and Parks document, the protocols have been updated to reflect current information and knowledge around post-construction monitoring.

13.3.4.6 *Residual Effect and Significance*

The predicted residual environmental effects of the Project on avifauna are assessed to be adverse, but not significant after the implementation of mitigation measures, monitoring, and further adaptive management, should it become necessary.

Literature reviews regarding mortality, in addition to literature on avoidance rates, and estimations of mortality using the SNH Collision Risk Model suggest that direct mortality will occur but is not related specifically to bird numbers. Additionally, studies of ~25,000 mortality assessments at wind projects in the U.S. did not indicate the presence of significant large scale mortality events. So, the predicted effects are not expected to be significant in the context of the direct mortality resulting in population level effects. While this conclusion notes that there will likely be some mortality, mortality will likely not be significant given the population numbers and the expected mortality from the Project. Scientific and regulatory literature notes that mortality risk does exist but is likely low. Kerlinger et al (2010) reviewed avian collision fatality data from "studies conducted at 30 wind farms across North America to estimate how many night migrants collide with turbines and towers, and how aviation obstruction lighting relates to collision fatalities. Fatality rates, adjusted for scavenging and searcher efficiency, of night migrants at turbines 54 to 125 m in height ranged from <1 bird/turbine/year to 7 birds/turbine/year. Multi-bird fatality events (defined as >3 birds killed in 1 night at 1 turbine) were rare, recorded at <0.02% (n =4) of 25,000 turbine searches. Lighting and weather conditions may have been causative factors in the four documented multi-bird fatality events, but flashing red lights (L-864, recommended by the Federal Aviation Administration [FAA]) were not involved, which is the most common obstruction lighting used at wind farms. A Wilcoxon signed-rank analysis of unadjusted fatality rates revealed no significant differences between fatality rates at turbines with FAA lights as opposed to turbines without lighting at the same wind farm." Kerlinger et al. (2010) go on to state that "what is striking about the data from wind farms is the relative absence of large-scale fatality events." They further state that "only four incidents were reported of multi-bird fatality events at wind turbines during ~25,000 turbine searches in all studies combined. That so many studies and so many searches have been conducted at wind turbines without recording large-scale fatality events strongly suggests the probability of large-scale fatality events occurring is extremely low".

With respect to the degree of disturbance proposed to occur within the Study Area through the loss of habitat, vegetation clearing of the proposed Project footprint will account for the loss of 57 ha of habitat, which is approximately 6.2% of the total Project Area. Avian habitats present within the Study Area is not unique and is extensively present within the surrounding landscape and across large tracts of undeveloped land. It is expected that any birds utilizing habitat that will be disturbed by Project activities will move to similar habitats within and adjacent to the Study Area. Given that avian habitat within the Study Area is not unique as compared to surrounding habitats, displaced bird species will find similar habitat in nearby areas. This supports the conclusion that loss of habitat will not be significant.

Temporary sensory disturbance is expected during construction, and limited disturbance is expected through operations, no significant residual environmental effects on avifauna are expected. Temporary sensory disturbance will be limited to daylight hours during construction, and this will limit adverse effects to most bird species. It would be expected that displacement of nocturnal bird species nesting in the area would occur during daylight operations, but the abundance of habitat remaining would not be expected to limit nocturnal nesting success. This supports the conclusion that temporary sensory disturbance will be adverse but will not be significant.

Decommissioning of the turbines will result in a positive effect on the Project, involving the reclamation of land and re-establishment of vegetation and habitat for birds across the Study Area.

Magnitude

Biophysical surveys resulted in the observation of 16,020 individuals, representing 100 bird species within the Project Area. Estimated mortality of 53 birds / year is 0.33% of the total birds counted in aviafauna surveys. Therefore, population level impacts are likely **negligible** in magnitude.

Habitat loss for bird species is low in magnitude as only 6.2% of the current habitat will be directly lost due to project infrastructure. The potential effect of the loss of breeding bird habitat from clearing for the Project would be **negligible** in magnitude.

Sensory disturbance during operations from the constant sound of operating wind turbines would be low. Ambient wind noise is expected to be high in the vicinity of the turbines which would be expected to mask some of the WTG operating sound.

Consistent with the expectations, Wedgeport Wind commit to conducting post-construction monitoring to determine the magnitude of the impact of the Project on birds. Post-construction monitoring will provide project-specific baseline data on mortality (both avian and bat) to allow for determination of the magnitude of effects.

Likelihood

The likelihood of mortality from turbine operation is **almost certain** as no literature could be found that indicated that an operating wind project did not result in bird mortality. However, the estimate of collisions and mortality on populations of birds appears to be low.

The likelihood of habitat loss is **almost certain** because the Project layout requires clearing to support Project infrastructure.

Duration

The potential effect of collisions with turbines on birds would be **long-term** during the operation of the Project (35 years) with higher effects during migratory periods.

The potential effect on habitat is **short-term** during construction and sensory disturbance is **long-term** during the operation of the Project.

Overall, the duration of potential effects on avifauna is considered **long-term**.

Frequency

The frequency of all effects is considered **continuous**, as there is potential for the Project to interact with avifauna continuously during operations (except for periods with no/low wind speeds) .

Significance

The Project is predicted to have a **not significant** effect on birds (Table 10-4).

13.4 Aquatic

This section outlines the effects of the undertaking on the following aquatic VECs; wetlands and surface water and fish and fish habitat.

13.4.1 Wetlands

The Project has potential to interact with wetlands (directly and indirectly) through clearing and grubbing, new access road and turbine pad construction, turbine foundation installation, site reclamation, infrastructure removal and accidental erosion and sedimentation events, fuel spills and fire as summarized in Table 13-1.

These potential interactions could affect wetlands through direct alteration, or indirect impacts to wetland function (e.g., hydrology, habitat and vegetation integrity). Direct and potential indirect effects to wetlands are discussed in the following sections, along with avoidance and mitigation measures to eliminate or minimize the described potential Project interactions with wetlands. Figure 20 (Appendix A) provides an overview of delineated wetlands in relation to Project development.

13.4.1.1 *Direct and Potential Indirect Impacts*

Direct impacts are defined as the physical alteration (e.g., soil and/or hydrological disturbance) of wetland area as a result of Project infrastructure. Indirect impacts to wetlands are described as changes to baseline wetland condition and function where wetland habitat is not directly impacted but may be indirectly altered as the result of Project activities.

A total of 44 wetlands were identified within the Study Area. Over the temporal lifetime of the Project direct impacts are expected to only five wetlands: WL23, WL28, WL38, WL40 and WL42, totaling 0.314 ha (3,139 m^2) in disturbance, as a result of turbines WTG1, it's associated access road, and the access road to WTG13.

Alteration areas were assessed based on proposed turbine pad extents and access road designs as described in Section 0.

A collector line will cross WL41 and WL42, however poles are planned to span the wetlands (40-50 m) and no associated direct impacts are expected.

Three wetlands are proposed for partial alteration, while one (WL28) is conservatively proposed for complete alteration. WL28 is within 5 m of the WTG1 foundation and almost entirely within the turbine's clearing extent. As a result, WL28 has been conservatively assessed as complete altered herein due to the elevated risk of direct, and indirect, impacts. Expected direct wetland impacts are presented in Table 13-10 and Figure 20 (Appendix A). Predicted wetland alteration extents, and resultant wetland compensation requirements, will be refined at the permitting stage and during detailed Project design and engineering.

Wetlands within 30 m of Project infrastructure development (e.g., turbine pads, access roads, collector lines) were conservatively assessed to have reasonable potential for indirect effects (i.e., WL6, 7, 13, 23, 25, 28, 32, 38, 40, 41, 42, 43, and 44) and are further considered herein. Project-related potential indirect impacts to wetlands may occur as a result of:

- Construction resulting in changes to hydrological flow paths (groundwater and surface water) resulting in wetting or drying of wetlands (e.g., inadvertent drainage or impoundment).
- Potential sedimentation within wetlands as a result of up-gradient activities resulting in soil erosion (e.g., earth moving, removal of vegetation) during construction.
- The spread or introduction of invasive species into wetlands during the construction and operations.

While indirect impacts are not expected to the majority of the unimpacted portions of WL23 and WL28, unimpacted, isolated fragments of these wetland may not be able to be self-sufficient and maintain natural wetland function. As a result, the total direct impact area of WL23 and WL28 has been expanded to include wetland fragments which lie outside of proposed Project footprint (Table 13-10, Figure 20; Appendix A).

Changes to wetland hydrology is a common driver for further change to wetland function and habitat integrity. Indirect hydrological impacts to wetlands, specifically WL23, WL38, WL40 and WL42 (i.e., partially impacted), are not expected through new access road construction if proper cross-drainage is maintained.

WL38, WL41 and WL42 interact with existing roads (not Project-related). No upgrades or modifications to previously constructed local and development access roads (e.g., Black Pond Road, Comeaus Hill Road) are proposed for the purposes of this Project.

Vegetation clearing in unaltered portions of WL23, WL38, WL40, WL41 and WL42, as shown in Figure 20 (Appendix A), is not expected to result in wetland alteration or indirect impacts if best-practices and appropriate mitigations are applied (see Section 13.4.1.3).

While WL28 is conservatively proposed for complete alteration at this time, alteration extents, potential indirect impacts and monitoring may be further assessed at the permitting stage. Wetland monitoring is further described in Section 13.4.1.4.

No Project impacts are expected to the remaining 39 delineated wetlands within the Study Area (88% of wetlands), including WL2 (WSS), which have been avoided by Project infrastructure. All other delineated wetlands have been avoided and are located beyond the Project's proposed clearing area (Figure 20; Appendix A). Wetland avoidance and mitigations are further described in Section 13.4.1.3.

Project interactions with surface water features and fish and fish habitat are described further in Section 13.4.2.

Table 13-10. Expected Wetland Impacts within the Study Area

Wetland ID	Dominant Wetland Type	Wetland Size (ha/m^2)[1]	Expected Direct Impact Area (m^2)	% Impact Area	Alteration Type
23	Swamp	0.080 ha / 800 m^2	0.014 ha / 135 m^2	17%	Partial
28	Swamp	0.265 ha / 2,650 m^2	0.265 ha / 2,650 m^2	100%	Complete[2]

Wetland ID	Dominant Wetland Type	Wetland Size (ha/m^2)[1]	Expected Direct Impact Area (m^2)	% Impact Area	Alteration Type
38	Swamp	0.146 ha / 1,460 m^2	0.007 ha / 74 m^2	5%	Partial
40	Swamp	0.034 ha / 340 m^2	0.000 ha / 1 m^2	< 1%	Partial
42	Swamp	0.869 ha / 8,690 m^2	0.028 ha / 279 m^2	3%	Partial
Total Impact Area: 0.314 ha (3,139 m^2)					

[1] Wetland area within the Study Area

[2] Conservatively proposed for complete alteration due to proximity to infrastructure footprint and clearing extent. Wetland alteration extents will be refined at the permitting stage.

13.4.1.2 *Wetlands of Special Significance*

There are no direct or potential indirect Project-related impacts expected to WL2, a WSS. WL2 is a salt marsh, which are hydrologically driven by lateral tidal water fluctuations and have minimal subsurface/groundwater inputs (Price, 1990). Localized clearing of vegetation and road, turbine pad and collector line construction upgradient of WL2 is not expected to result in indirect hydrological impacts.

13.4.1.3 *Mitigation*

The Project team utilized avoidance as the first step in the hierarchical process for wetland conservation, as described in the *Wetland Conservation Policy* (NSE 2019). Avoidance of wetland alteration was achieved during the initial design of the Project, where micro-siting was used to minimize wetland direct and potential indirect impacts whenever practicable. Specifically, the Project Infrastructure was able to avoid direct impacts to 39 of 44 wetlands (88%), or 98% of delineated wetland area, including WSS WL2.

With the exception of WL23, WL28, WL38, WL40, and WL42 as presented in Table 13-10, turbine infrastructure has been sited to avoid construction and clearing within 30 m of wetlands. Proposed clearing around new access roads is at minimum 15 m from wetland boundaries. The collector lines which run through WL41 and WL42 are planned to span the wetlands (40-50 m) with no support pole placement in the wetlands and therefore no associated direct or indirect impacts are expected if proper mitigations are applied (e.g., swamp mats, limited equipment access). WL40 is assessed as partially altered at this time, however, due to the small impact extent (<1 m^2), there may be opportunity for avoidance through detailed project design. Generally, the

Project footprint was minimized as best possible while still meeting engineering and design constraints.

Where wetland avoidance was not possible, Wedgeport Wind will apply for wetland alteration approvals, implement mitigation measures during construction, conduct wetland monitoring during and following construction, and support wetland compensation plan(s) as required by approvals.

A preliminary wetland monitoring approach is discussed in Section 13.4.1.4. A detailed wetland compensation and monitoring plan will be prepared through the wetland permitting process, as is necessary.

The following mitigation measures will be included in the design of the Project in order to maintain natural function of unimpacted wetland and reduce loss of function in wetlands proposed for partial alteration.

- Acquire and adhere to wetland alteration permits, as required, and implement wetland monitoring as directed by permits and in consolation with NSECC.
- Engage in wetland compensation activities for the wetland loss associated with the Project as required by the provincial wetland alteration process and in consultation with NSECC.
- Complete pre-construction site meetings for all relevant staff/contractors related to working in and around wetlands and watercourses to mitigate unauthorized disturbance.
- Ensure all wetlands are visually delineated (i.e., flagged).
- Conduct vegetation management (cutting and clearing) in or near wetlands in accordance with applicable guidelines and in consideration of breeding bird windows and maintain wetland vegetation wherever practicable.
- Mitigate risk of soil disturbance (e.g., rutting) by using mitigations such as swamp mats, limiting the use of machinery within wetlands, and avoiding work in wetlands in highly saturated conditions (e.g., consider seasonality), as is practicable.
- Implementation of erosion and sediment control measures (e.g., sediment fence, rip rap, check dams, revegetate exposed soil, etc.) as needed to minimize the potential

for sediment release into surface water and wetlands. All erosion and sediment control structures will be regularly inspected and repaired.

- Direct construction and/or operational runoff through natural upland vegetation, wherever possible.
- Maintain or construct appropriate cross-drainage on existing and new access roads.
- Employ measures to reduce the risk of spread of invasive species (particularly by vehicles) into wetlands and retain habitat integrity (e.g., revegetate exposed soil surfaces with native vegetation, include invasive species monitoring tin the wetland monitoring program).
- No fuel will be stored on site and refueling will occur in designated areas, >30 m from wetlands and watercourses. Spill response equipment will be readily available.

13.4.1.4 *Monitoring*

Wetlands are protected under the provincial *Environment Act* and Wetland Conservation Policy (NSE 2019) to mitigate net loss of habitat and function. The wetland alteration permitting process will be completed as required and in consultation with NSECC.

As is required through the wetland alteration permitting process, wetland monitoring will be completed to verify the accuracy of the predicted environmental effects, the effectiveness of the mitigation measures outlined in Section 13.4.1.3 and signal the potential need for additional mitigation measures or compensation. A preliminary proposed monitoring approach is proposed herein. A detailed wetland monitoring plan will be prepared through the wetland permitting process in consultation with NSECC.

Generally, wetland monitoring is proposed based on the expected impact assessments described above. This includes the remaining unaltered portions of WL23, WL38, WL40 and WL42 (e.g., on either side of the access roads). WL28 may be included in the monitoring program if complete alteration is not expected at the permitting stage.

Wetland monitoring typical methods include hydrological and vegetative approaches to assess potential shifts in wetland characteristics and function over time. Visual observations of wetland conditions are also used to supplement this information. A hierarchy of monitoring approaches will be applied in consideration of the magnitude and type of individual wetland impacts (e.g., direct vs. potential indirect). Generally, baseline monitoring (pre-construction) will take place before construction commences to acquire baseline conditions from which to compare post-construction monitoring results. Comparison methods and indicators of change will be detailed in the wetland monitoring plan.

Should post-construction wetland monitoring indicate a potential shift above natural variation, Wedgeport Wind will consult with NSECC to identify whether corrective actions or compensation will be required.

Annual monitoring results, as well as any changes to the program, will be provided to NSECC, as per wetland alteration permit conditions. NSECC will be contacted and consulted in the instance of an unintended direct and/or indirect impact to a wetland.

13.4.1.5 *Residual Effects and Significance*

Magnitude

Expected Project wetland impacts are confined to four wetlands (WL23, WL28, WL38, and WL42). The directly impact area totals 0.314 ha (3,139 m^2) or 2% of delineated wetland area (16.505 ha) over the lifetime of the Project. The impacted wetlands are all treed swamps, which comprised 98% of the wetland area identified in the Study Area. Wetland alteration approvals (including appropriate compensation and monitoring) will be obtained prior to completing wetland alterations and any compensation effectively follows the NSE Policy of No Net Loss. The Project will have a **low** magnitude of impact on wetlands.

Likelihood

It is **almost certain** that the Project will impact wetlands as road and pad construction is proposed to directly impact four wetlands (WL23, WL28, WL38, and WL42).

Duration

The time over which the effects are likely to persist are predicted to be **short-term**, as they are confined to the construction phase of the Project and impacts will be compensated for as required.

Frequency

Effects to wetlands will occur **once** during the construction phase of the Project.

Significance

The Project is predicted to have a **not significant** effect on wetlands (Table 10-4).

13.4.2 Surface Water, Fish and Fish Habitat

The Project has potential interactions with the aquatic environment and associated fish habitat (directly and indirectly) through clearing and grubbing; access road and turbine pad construction; turbine foundation installation (through dewatering); site reclamation; infrastructure removal; as well as from accidents and malfunctions (Table 13-1).

These potential interactions could affect fish habitat and surface water features through direct alteration, or changes to water quality or quantity.

These effects are discussed below. The Project interactions described relate to the potential effects to fish and fish habitat as a result of direct Project development and/or indirect changes to fish habitat quality.

13.4.2.1 *Direct and Indirect Impacts*

Eight watercourses were identified within the Study Area, along with two open water features present within WL18 and WL42, respectively. To be conservatively inclusive, all watercourses and open water features identified within the Study Area are presumed to be accessible to fish, even though there are considerable restrictions on some of the watercourses.

Surface water features were identified as a constraint to be avoided in the planning process for the Project layout. As a result, potential interactions with surface water features and associated fish habitat were avoided to the greatest extent practicable. Therefore, the only predicted direct impact to fish habitat involves a standard road crossing which will be required to provide access across WC8.

While the detailed road design and culvert sizing has not yet been finalized, it is estimated that the road width will be 17 m. Given that WC8 is; on average; 1.0 m wide, the maximum anticipated impact to WC8 is 17 m^2. An open water section was identified associated with WC8 and WL42; this open water feature has been avoided and the watercourse crossing is proposed on a straight, linear section of WC8. Wedgeport Wind will proceed through NSECC permitting under the watercourse alteration process (NSE, 2015). Fisheries and Oceans Canada (DFO) will review the watercourse alteration application to determine whether this road crossing will result in Harmful Alteration, Disruption or Destruction (HADD) of fish habitat. However, MEL is experienced in the process of culvert design, crossing characteristics, construction and construction monitoring, and implementation of mitigation measures to limit effects during construction, and based upon that experience, is of the professional opinion that the crossing can be designed and constructed using standard methods and there will be no HADD determination. This will of course be confirmed. No additional direct impacts are expected to watercourses, waterbodies, or wetlands which support fish habitat.

Project interactions with wetlands are described further in Section 13.4.1.

Turbine pads have all been placed to respect a 30 m buffer on all fish habitat, and site access roads have all been designed to avoid direct impacts to fish habitat except as noted. Two watercourses with potential fish habitat are present within 30 m of planned site access roads (WC5 and WC7). Indirect impacts to these watercourses are not expected, provided mitigation measures are implemented to control erosion and sedimentation in proximity to these features, and provided appropriate cross-drainage is provided by road construction.

13.4.2.1.1 Blasting

Blasting may result in sensory disturbance to fish, impacting fish behaviour, spawning grounds and migration patterns. The detonation of explosives near watercourses can produce post-detonation shock waves which involves a rise to a high peak pressure and then a subsequent fall to below ambient hydrostatic pressure. This pressure deficit can cause impacts in fish (Wright and Hopky, 1998). An overpressure in excess of 100 kPa can result in effects to fish including damage to the swim bladder in finfish, and potential rupture and hemorrhage to the kidney, liver, spleen and sinus venous. It is also possible that fish eggs and larvae can be damaged (Wright and Hopky, 1998). The degree of damage is related to the type of explosive, size and pattern of the charges and the distance to the watercourse, depth of water within the watercourse, and species, size and life stage of the fish.

Sublethal effects have also been observed including changes in fish behavior as a result of noise produced during blasting (Wright and Hopky, 1998). While blasting is not anticipated to be required to support Project construction activities on roads or collector lines or laydown yards, a 30 m setbacks from turbine foundations has been implemented.

13.4.2.1.2 Water Quality and Quantity

Indirect impacts to fish and fish habitat may be possible as a result of water quality changes sourced from upgradient development activities, including unplanned events and release of deleterious substances, spills and erosion and sediment control failure (and associated siltation). Impacts to water quality are not expected, provided mitigation measures related to erosion and sediment control and spill prevention are implemented.

Acid generating rock, if exposed, can result in changes in water quality and impacts to fish health and fish habitat. NSDNRR has developed an ARD Risk Map (Trudell and White, 2013) and Nova Scotia Department of Energy and Mines provide an Interactive Map for Viewing the Bedrock Drainage Potential for Southwestern Nova Scotia (NSDEM, 2022) which were reviewed. This review found that the Project Area is located in an area with low bedrock ARD potential (NSDEM, 2022). As a result, impacts to water quality and indirect effects to fish habitat are not expected.

Indirect effects to fish habitat may occur through movement of water across a landscape, and resultant changes in catchment areas and instream flows. The Project will not require alteration of catchment areas or changes in instream flows in any site watercourses. Access roads will be constructed to allow cross drainage if and as required.

13.4.2.2 *Summary of Impacts*

The Project is predicted to result in a direct impact to 17 m^2 of fish habitat in WC8 through installation of a culvert to support construction of an access road.

The Project is not predicted to result in indirect effects to surface water features or associated fish habitat. This is based primarily on proactive Project planning and implementation of a mitigation sequence which prioritizes avoidance of impacts, and implementation of 30-m buffers on watercourses wherever practicable. Additionally:

- Wetlands expected to be directly impacted by Project development do not provide habitat for fish.
- With the exception of WC8, site access roads have been planned to avoid direct impacts to all fish habitat.
- Roads will be built to allow cross-drainage if and as required and adhere to provincial standards for culvert sizing in WC8.

The protective avoidance and mitigation measures (Section 13.4.2.3) will ensure impacts to fish and fish habitat do not occur as a result of Project development. Mitigation will employ an adaptive management approach. If required, existing mitigation measures will be adjusted or additional measures will be implemented in response to construction monitoring.

13.4.2.3 *Mitigation*

The Project team followed a mitigation sequence to reduce impacts to fish and fish habitat. This was accomplished primarily by avoidance of direct impacts to fish habitat throughout the Study Area.

The following mitigation measures will be included in the design of the Project:

- Road crossings will be installed in compliance with Nova Scotia Guide to Altering Watercourses (NSE, 2015) and fish rescue will be completed during crossing construction, if required.
- Implementation of erosion and sediment control structures (e.g., sediment fence, rip rap, check dams etc.) as needed to minimize the potential for sediment release into surface water. All erosion and sediment control structures will be regularly inspected and repaired.
- Minimize use of equipment within the 30 m watercourse buffer.
- No watercourse crossings or impacts to fish habitat are permitted without approval from DFO/NSECC.
- Spill prevention, response and management will be designed in the EPP and implemented across the Project.

13.4.2.4 *Monitoring*

No monitoring is proposed for this VEC, unless required by regulatory approvals for WC8.

13.4.2.5 *Residual Effects and Significance*

Magnitude

As only one watercourse is crossed, and the crossing will be designed in accordance with regulatory requirements, and mitigation measures are proposed to limit other effects, the Project is predicted to have a **low** magnitude of impact to surface water, fish and fish habitat.

Likelihood

It is **almost certain** that the Project will impact surface water, fish and fish habitat as a culvert is required to be installed on WC8 to allow for access to WTG13. But this is the only location of likely effects.

Duration

The time over which the effects are likely to persist are predicted to be **short-term**, as they are confined to the construction phase of the Project. Culvert installation will occur during construction and the highest potential for sediment related issues will also occur during this phase of the Project.

Frequency
Effects to surface water, fish and fish habitat will occur **once** during the construction phase of the Project. Frequency of impacts includes the culvert installation in WC8 and excludes potential sediment related issues which may occur sporadically but are not anticipated after mitigation measures have been implemented.

Significance
The Project is predicted to have a **not significant** effect on surface water, fish and fish habitat (Table 10-4).

13.5 Technical Components

This section outlines the effects of the undertaking on the following technical VECs; visual aesthetics, shadow flicker, and electromagnetic interference.

13.5.1 Visual Aesthetics

The visual representation of the Project was completed to demonstrate to stakeholders and the public at large where the Project will be visible and to what extent it will be visible in the surrounding area (Appendix U). The visual representation includes a Zone of Visual Influence (ZVI) and visual simulations.

Zone of Visual Influence
The ZVI is a graphical way to describe where the proposed Project can be seen. To make the resulting viewshed as accurate as possible, the existing structures and forests have been incorporated into the analysis. The digital surface model (DSM) developed by the Province of Nova Scotia from aerial Lidar data was used. The DSM data is available at a spatial resolution of 1.0 m and represents the heights (in relation to the GRS80 ellipsiod) of the upper surface of trees, buildings, anthropogenic structures, etc. A Canopy Height Model (CHM) which represents the height of objects above the ground was also used in the analysis.

The hub heights of the proposed turbines were reduced by the height of the vegetative canopy over the underlying ground at the 13 WTG sites. A GIS based viewshed analysis was completed for an area within 4 km of the proposed turbines for the revised hub heights using the DSM surface with an observer height of 1.6 m. The results indicate areas where the proposed WTGs can be viewed, however, this includes the top of forests and buildings. The resultant viewshed shown in Appendix U, represents areas where people have a line-of-sight view of the proposed WTGs.

Visual Simulations
The visual simulations were created using WindPRO 3.5.584 which is software developed by RISO which is the National Laboratory for Sustainable Energy in Denmark. WindPRO provides a comprehensive suite of wind farm design and modeling software that has become the industry standard.

Visual simulations allow users to superimpose WTGs on landscape photographs to provide the pubic and regulators with a sense of what the resultant turbines will look like once installed. The ZVI analysis results were used to select sites for the visual simulations. A variety of public, well know sites were selected and photographs were obtained with the camera oriented along a predefined compass azimuth to ensure the proposed WTGs where within the images.

The images were imported into WindPRO and the camera position, time of image capture, camera heading, tilt and pan angles as well as the camera sensor and lens data were input into the software. Turbine specific 3D models were then generated from the input data and superimposed over the original photographs. In all images, the rotor disks were oriented perpendicular to the camera to ensure the most prominent 3D model was generated.

Refer to Appendix U for the ZVI and visual simulation.

The turbines will also possess obstruction marking and lighting as required by Transport Canada. Lighting will be primarily visible at night and will be minimized as much as allowable. Lighting will also be used during the construction, maintenance, and decommissioning phases of the Project, but will be limited in use whenever possible.

13.5.1.1 *Mitigation*

Visual representation provides only a model of how the Project will look. There are no specific impacts associated with visual models, and therefore no mitigation is proposed.

13.5.1.2 *Monitoring*

No monitoring is proposed for this VEC.

13.5.1.3 *Residual Effects and Significance*

Magnitude
There is no defined threshold as visual aesthetic is subjective to the observer. The Project is therefore predicted to have a **low** magnitude of effect on visual aesthetics as three COMFIT turbines currently exist in proximity to the proposed turbine locations and there were no concerns expressed during public consultation.

Likelihood
It is **almost certain** that the Project will have an effect on the visual aesthetics as 13 WTGs are proposed as part of the Project.

Duration
The duration of the Projects effect on visual aesthetics is **long-term** as the WTGs are proposed to be in operations for 35 years.

Frequency
The effects on the visual aesthetics will occur **continuously** throughout the life of the Project.

Significance
The Project is predicted to have a **not significant** effect on the visual aesthetic (Table 10-4).

13.5.2 Shadow Flicker

Shadow flicker is caused by sunlight passing through the rotating wind turbine blades casting moving shadows on nearby residences. There is potential for shadow flicker to occur during the operations phase of the Project (Table 13-1).

Shadow Flicker Modeling (SFM) for the Project was completed by Nortek. The purpose of SFM is to determine the extent of the impacts that shadow flicker will have on the surrounding community and residences. The SFM was completed using WindPro 3.5.584 and includes the three existing COMFIT turbines. The SFM was based on developing theoretical (i.e., worst case) and actual (i.e., realistic) case scenarios. Theoretical case provides the maximum amount of shadow flicker expected to be experienced at the modeled receptors under the following conditions:

- The sun shines 100% of the time when it is above the horizon;
- The turbine rotor is always perpendicular to the sun;
- Shadow flicker starts as the sun moves above 3 degrees from the horizon;
- The shadows dissipate at a maximum distance from the blade as a result of atmospheric conditions;
- and light diffusion, and;
- The rotor blades are always spinning.

Theoretical case was calculated for shadow hours per year and shadow minutes per day. Actual case was modeled by incorporating site specific wind conditions and monthly sunshine probabilities. Actual case was calculated for shadow hours per year.

The analysis of the theoretical case indicates that modelled shadow flicker exceeds the 30 hours per year threshold at 10 of 32 receptors and exceeds the 30 mins per day threshold at 4 of 32 receptors. The actual case scenario is believed to provide a more realistic result as the assumptions in the theoretical case are very conservative. The actual case scenario shows that all receptors are below the 30 hours per year threshold.

Further detailed methodology and results are available in Appendix V.

Potential impacts to humans associated with shadow flicker is minimal. Refer to Section 13.6.5 for more details on potential Project related effects on human health.

13.5.2.1 *Mitigation*

Wedgeport Wind is committed to operating the Project to be in compliance with the NSECC guidelines for shadow flicker (30 hours/year and/or 30 mins/day).

A Complaints Resolution Plan and CLC will be developed for the Project. Upon notice of a landowner issue with shadow flicker, Wedgeport Wind will request as much detail as possible to assist with prompt resolution of the issue, including the dates that shadow flicker occurred and the start and end time and a short video of the shadow flicker, if possible. Wedgeport Wind will send a representative to the Project site to investigate the issue, including to determine the time of day that the issue is occurring and the turbines that are causing the shadow flicker for the landowner. Wedgeport Wind will propose and offer to implement appropriate mitigation measures to limit the amount of shadow flicker from the Project to a maximum of 30 hours per year and/or 30 minutes per day at the residence. Mitigation measures may include the installation of blinds, curtains, or other screening devices. In extreme situations where other mitigation measures do not mitigate shadow flicker concerns at a receptor location (permanent dwelling), and there is a confirmed exceedance to the NSECC guidelines, Wedgeport Wind will investigate changes to turbine operations, such as turbine curtailment to ensure compliance with NSECC guidelines.

13.5.2.2 *Monitoring*

No monitoring is proposed for this VEC.

13.5.2.3 *Residual Effects and Significance*

Magnitude

The Project is anticipated to have a **low** magnitude of effect on shadow flicker as actual case modelling (Appendix V) predicts the Project will meet the guideline for shadow flicker as defined by NSECC within the *Guide to preparing an EA Registration Document for Wind Projects in Nova Scotia* (NSECC 2021): an exceedance of 30 hours of shadow flicker per year and/or 30 mins of shadow flicker per day at an existing residential receptor.

Likelihood

It is **likely** that the Project will have an effect on the shadow flicker as 13 WTGs are proposed and during certain conditions there is potential for shadow flicker to occur.

Duration

The duration of the Projects effect on shadow flicker is **long-term** as the WTGs are proposed to be in operations for 35 years.

Frequency

The effects on the visual aesthetics will occur **sporadically** throughout the operations phase of the Project.

Significance

The Project will have a **not significant** effect on the visual aesthetic (Table 10-4).

13.5.3 Electromagnetic Interference

The Project has the potential to effect electromagnetic interference during Project operations (Table 13-1).

Nortek Resource Solutions Inc initiated the EMI Study (Appendix W) including consultation with required contacts as specified by the Radio Advisory Board of Canada (RABC). The Project area and systems were assessed for interference with point-to-point systems, broadcast transmitters, over-the-air television reception, cellular networks, land mobile radio networks, satellite systems, radar systems, and VHF omnidirectional range systems.

The results of the EMI Study show that the turbines are not expected to pose any serious interference with existing radio, telecommunication, or radar systems in the area. There are two communications towers within or near 1 km of the proposed turbines and the operators of these towers include the Municipality of the District of Argyle, Bell Mobility Inc. (Bell), and Bragg

Communications Inc (Bragg), and Orion Wireless Partnership (Orion). Wedgeport Wind has engaged with Municipality of the District of Argyle, Bell, and Bragg and no issues with the proposed Project layout were noted by these licensees. Wedgeport Wind reached out to the fourth licensee, Orion, but has not yet received a response.

DND and Nav Canada have provided letters of non-objection to the Project (Appendix X).

Electromagnetic Fields (EMF) are expected to have insignificant effects on human health (see section 13.6.5 for more human health impacts of EMF).

13.5.3.1 *Mitigation*

Due to lack of known EMI effects, no mitigation is proposed.

13.5.3.2 *Monitoring*

No monitoring is proposed for this VEC.

13.5.3.3 *Residual Effects and Significance*

Magnitude
The Project is anticipated to have a **low** magnitude of effect on EMI as the EMI Report (Appendix W) meets all applicable consultation requirements within the Radio Advisory Board of Canada (RABC) and Canadian Wind Energy Association (CanWEA) *Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems* (RABC & CanWEA 2020) and/or additional proponent led consultation with potentially impacted licensees indicates no concerns.

Likelihood
It is **unlikely** that the Project will generate an electromagnetic interference.

Duration
The duration of the Projects potential generation of EMI is **long-term** as the WTGs are proposed to be in operations for 35 years.

Frequency
The effects of EMI will occur **sporadically** throughout the operations phase of the Project, if they occur at all.

Significance

The Project will have a **not significant** effect on EMI (Table 10-4).

13.6 Socioeconomic

This section outlines the effects of the undertaking on the following socioeconomic VECs; economy, land use and value, transportation, recreation and tourism, human health, cultural and heritage resources, and other undertakings in the area.

Refer to Table 13-1 for potential Project interactions with each socioeconomic VEC.

13.6.1 Economy

The proposed Project is predicted to be an important part of Nova Scotia's renewable energy initiative. The Project will provide a low-cost, fixed price clean electricity for the Province of Nova Scotia. Additionally, a tax revenue of $650,000 per year will go to the municipality in property tax.

The following expected economic outcomes are based on the actuals which occurred from the existing Glen Dhu Wind Power Project (GDWPP), in Antigonish, Nova Scotia. The reader should note that the GDWPP is 62.1 MW in size with 27 turbines and these results were provided in 2011. Variations in the proposed Project size may see an increase in the values presented. However, as the following values are confirmed amounts they are provided for use. The GDWPP represented an investment of approximately $150 million, which is similar to the Wedgeport Wind Farm Project. This included:

- 175,000 person – hours of work during the permitting, construction and operation phases;
- 70-80% Nova Scotia labour content;
- Estimates of $2,000,000 in direct worker spending in the local area;
- $38,000,000 in construction spending with Nova Scotia companies; and,
- 55 companies from Nova Scotia were be employed on the Project.

Wedgeport Wind's intent is to fulfill construction and operations contracts/positions with local personnel wherever possible. However, due to the specialized nature of wind turbine delivery, erection, and energization, if local personnel cannot be found, personnel may be required from other municipal, provincial, national, or international firms.

13.6.1.1 *Mitigation*

Wedgeport Wind will employ local contractors to complete Project tasks, whenever possible.

13.6.1.2 *Monitoring*

No monitoring is proposed for this VEC.

13.6.1.3 *Residual Effects and Significance*

Magnitude
The Project is anticipated to have a **high** magnitude of effect on the local economy, as the Project is predicted to contribute revenue to the local economy and be an important part of Nova Scotia's natural resource sector.

Likelihood
It is **almost certain** that the Project will interact with the local economy. The Project will directly cause an increase in local jobs and provide a stimulus to other local businesses (e.g., restaurants and hotels).

Duration
The duration of the Projects potential interaction with the local economy is **long-term** as it will occur during all Project phases.

Frequency
The effects of Project on the local economy will occur **regularly** throughout the life of the Project.

Significance
The Project will have a **significant** positive effect on economy (Table 10-4).

13.6.2 Land Use and Value

13.6.2.1 *Land Use*

The Project Area consists of predominately private land and some Crown land (Figure 4; Appendix A). Informal recreational activities including ATV trails, hunting (several tree stands observed), and possible berry harvesting evidence was observed within the Project Area during field surveys (Figure 18; Appendix A).

Once the Project is developed, access to the private lands will be restricted for 35 years during operations (via gates), as per Wedgeport Winds agreements with landowners (with the exception of those people having permission from the landowners). For portions of the Crown land that are being used for the Project, Wedgeport Wind will work with the Province of Nova Scotia to determine appropriate access to Crown land as well as safety measures to protect the Mi'kmaq of Nova Scotia and members of the public.

Although road access to the site for hunting and recreation may be restricted to the public, land use change within the Project Area is anticipated to be positive as it is adding a renewable energy resource to the area.

Following the operations period, the Project will be decommissioned, and the site will be reclaimed which will aim to revert land back to existing conditions and allow for the recreational activities and hunting conducted prior to Project development.

13.6.2.1.1 Tusket Islands Wilderness Area

The Tusket Islands Wilderness Area borders the eastern extent of the Project Area (Refer to Section 6.2.5 for more details on the Wilderness Area) and all Project infrastructure is setback from this boundary. The development of the Project will not directly impact the Wilderness Area as the Project footprint maintains a 20 m setback and the WTGs will maintain a minimum setback of 100 m (WTG blades will remain within the Project Area boundaries).

No impacts to water quality (i.e., sediment and erosion) are anticipated within the Wilderness Area from Project development. Please refer to Section 13.4.2 which discusses the Projects potential effects to surface water, fish and fish habitat. Only one watercourse is anticipated to be crossed by the Project and this watercourse does not drain into the Tusket Islands Wilderness Area.

The Wilderness Area contains saltmarshes that support rare vascular plants (NSECC 2022). One saltmarsh was identified within the Study Area (WL2). This saltmarsh continues beyond the Project Area and into the Wilderness Area. WL2 will not be directly impacted by Project infrastructure and is not anticipated to be indirectly impacted by the Project. Refer to Section 13.4.1 for more details related to the assessment of effects on wetlands.

The Wilderness Area provides important habitat year-round for waterfowl and shorebirds, and provides breeding habitat for colonial seabirds (e.g., terns and eiders; NSECC 2022). Noise generated by the Project during the construction, operations, and decommissioning/reclamation phases may displace wildlife, bats, and birds. Refer to Section 13.3.2.2, Section 13.3.3.2 and, Section 13.3.4 for more details related to the effects of sensory disturbance on wildlife, bats, and birds, respectively. The determination of effects indicates temporary displacement of wildlife during the construction and decommissioning/reclamation phases. However, these effects are likely temporary and long-term effects into the Wilderness Area are not expected. The results of the bird studies (migration, breeding bird, radar), indicated limited flyover to the Wilderness Area (Appendix C-1 and Appendix C-3) and the setbacks of Project infrastructure to these shoreline features (>100 m) suggest that there will be no direct effects to these areas.

During a meeting held on February 28, 2023, between Wedgeport Wind, MEL, and the NSECC Protected Areas Branch (Table 9-1), it was suggested that the construction of roads to WTG2, WTG7, and WTG10 will allow for new public access just outside the Tusket Islands Wilderness Area. It was suggested that there would be potential for public users to access the Wilderness Area from these new roads. However, access to the Project will be restricted via gates and the portion of the Project Area that borders the protected area is private land. As such, there will be public access restrictions in place. The NSECC Protected Areas Branch indicated they would be willing to work with Wedgeport Wind to generate signs for placement along these roads identifying the Wilderness Area and deterring the public from disturbing these lands. Wedgeport Wind is committed to working with NSECC to install signage at the WTGs nearest the Wilderness Area (P. Labor, NSECC, Personal Communications, February 28, 2023).

As no direct disturbance will be occurring within Wilderness Area, and potential mitigations as proposed throughout this EA will be implemented, no significant effects to the Wilderness Area are anticipated.

13.6.2.2 *Property Value*

The concern that property values will be adversely affected by the Project is a concern raised at other wind power projects throughout North America. In 2009, a study by Hoen et al. (2009) was commissioned by the U.S. Department of Energy to determine if this impact does in fact exist. The study collected data on almost 7,500 sales of single-family homes situated within 10 miles of 24 existing wind facilities in nine different U.S. states (Hoen et al., 2009). In addition, the study reviewed a number of data sources and published material. Although the reviewed information addressed concerns about the possible impact of wind energy facilities on the property values of nearby homes, Hoen et al. (2009) found that "the available literature that has sought to quantify the impacts of wind projects on residential property values has a number of shortcomings". The list of shortcomings identified in that study (Hoen et al., 2009) are as follows:

- Studies relied on surveys of homeowners or real estate professionals, rather than trying to quantify real price impacts based on market data;

- Studies relied on simple statistical techniques that have limitations and that can be dramatically influenced by small numbers of sales transactions or survey respondents;
- Studies used small datasets that are concentrated in only one wind project study area, making it difficult to reliably identify impacts that might apply in a variety of areas;
- Many studies had no reported measurements of the statistical significance of their results;
- Many studies have concentrated on an investigation of the existence of Area Stigma, and have ignored Scenic Vista and/or Nuisance Stigma;
- Only a few studies included field visits to homes to determine wind turbine visibility and collect other important information about the home (e.g., the quality of the scenic vista); and,
- Only two studies have been published in peer-reviewed academic journals.

Ultimately, the Hoen et al. (2009) study indicated that "none of the models uncovers conclusive evidence of the existence of any widespread property value impacts that might be present in communities surrounding wind energy facilities. Specifically, neither the view of the wind facilities nor the distance of the home to those facilities is found to have any consistent, measurable, and statistically significant effect on home sales prices. Although the analysis cannot dismiss the possibility that individual homes or small numbers of homes have been or could be negatively impacted, it finds that if these impacts do exist, "they are either too small and/or too infrequent to result in any widespread, statistically observable impact." (Hoen et al., 2009)

Critiques have been developed in response to the Hoen et al. (2009) report, notably by Gulden (2010) and Wilson (2010). These both outline concerns with methodology in the Hoen et al. (2009) report including the conclusion that the analytical methods cannot be shown to be reliable or accurate (Gulden 2010 and Wilson 2010). Another study completed by Gardner (2009) in Texas, USA states that "market data and common sense tell us property values are negatively impacted by the presence of wind turbines." Heintzelman and Tuttle (2012) found that properties within 1 km of a wind farm have the potential to lose value of 8.8% to 15.8%.

As a follow up to the 2009 study, Hoen et al. (2013) conducted another study to address these apparent gaps in data. Hoen et al. (2013) collected data from 51,276 homes across 27 counties and nine states in the USA relating to 67 different wind facilities. All homes included in the study were within a 10-mile (16 km) radius of a wind power project and 1,198 homes were within a one-mile

(1.6 km) radius of a wind power project. The study results revealed no statistical evidence that residential property values near turbines were affected in the post-construction or post-announcement/pre-construction periods. Therefore, the authors conclude that if effects do exist, either the impacts are sporadic and impact only a small subset of homes or are relatively small and are present within the margin of error in the models (Hoen et al. 2013).

Brinkley and Leach (2019) completed a review of seven studies on the impact of wind farms (various scales) on property values. Their review found that "wind power studies overwhelming indicate no significant impact on nearby property values" (Brinkley and Leach 2019).

13.6.2.3 *Mitigation*

Local residents were notified of the Project and an information session was held. Ongoing consultation will occur during construction and operations.

Wedgeport Wind is committed to working with NSECC to install signage at WTGs in proximity to the Tusket Islands Wilderness Area.

13.6.2.4 *Monitoring*

No monitoring is proposed for this VEC.

13.6.2.5 *Residual Effects and Significance*

Magnitude

The Project is anticipated to have a **low** magnitude of effect on the land use and value, as three COMFIT turbines are located within or immediately adjacent the Project Area and have been in place since 2012. Based on a literature review on the effects of property values in proximity to wind power projects, there is no anticipated decrease in property values. Additionally, the change in land use is anticipated to be positive as it is adding a renewable energy resource to the area.

Likelihood

It is **almost certain** that the Project will interact with land use. The Projects interaction with land value is **unlikely**.

Duration

The duration of the Projects potential interaction with land use and value is **long-term** as it may occur during all Project phases.

Frequency
The effects of Project on land use and value may occur **continuously** throughout the life of the Project.

Significance
The Project will have a **not significant** effect on land use and value (Table 10-4).

13.6.3 Transportation

An increase in truck traffic will occur during the construction (2 years) and decommissioning phases (2 years) of the Project. No change to local transportation is anticipated during operations, the Project phase with the longest duration (35 years). The increase in transportation during decommissioning will also recover to baseline levels after the completion of the Project.

Access to the Project site during the construction period will be via Black Pond Road and Comeaus Hill Road (Figure 6; Appendix A). All construction equipment and vehicles will access Black Pond Road from Highway 334 (to the east) or Comeaus Hill Road (to the west). Turbine component delivery will be via Highway 103 & Highway 334 which may cause delays in traffic. Transportation routes are subject to Nova Scotia Department of Public Works (NSDPW) approval.

Nav Canada and the DND have provided letters of non-objection indicating that there are no impacts on the air navigation system and specifically on civil and military air traffic control radars, navigation aids, and airports in the vicinity of the Project. Please refer to Appendix X for the letters of non-objection.

13.6.3.1 *Mitigation*

Transportation routes, delivery, and construction travel are subject to Nova Scotia Department of Public Works (NSDPW) approval and requirements. No additional mitigation is proposed.

13.6.3.2 *Monitoring*

No monitoring is proposed for this VEC.

13.6.3.3 *Residual Effects and Significance*

Magnitude
The Project is anticipated to have a **low** magnitude of effect on transportation, as there will only be an increase in truck traffic during the construction and decommissioning phases of the Project.

Likelihood

It is **almost certain** that the Project will have an effect on transportation as heavy equipment and turbine components will need to be mobilized to the site to support construction of the Project.

Duration

The duration of the Projects potential interaction with transportation routes is **short-term** as it will only occur within the construction (2 years) and decommissioning (2 years) phases of the Project.

Frequency

The effects of Project on the transportation will occur **sporadically** during the construction and decommissioning phases of the Project.

Significance

The Project will have a **not significant** effect on transportation (Table 10-4).

13.6.4 Recreation and Tourism

13.6.4.1 *Recreation*

Local residents and tourists do make use of the watershed for fishing, swimming, recreation and as a water source. The Project Area also borders the Tusket Islands Wilderness Area.

There is some opportunity within the Project Area for public access for hiking and walking, however, there are no designated public recreational trails present inside the Project Area. Berry picking may also occur.

All-Terrain Vehicles (ATV) use is widespread within the Project Area and there are interconnected trails, and tracks suggesting intermittent use. All trails appear to be informally used by public riders, although these trails are on private and Crown land. No trail signs are present.

No other public recreational lands exist within the Project boundaries.

The construction and operation of the Project will result in modified use by ATVs, hunters, general users or landowners. Once the Project is developed, access to the private lands will be restricted for 35 years during operations (via gates), as per Wedgeport Winds agreements with landowners (with the exception of those people having permission from the landowners). For portions of the Crown land that are being used for the Project, Wedgeport Wind will work with the Province of Nova Scotia to determine appropriate access to Crown land as well as safety measures to protect the Mi'kmaq of Nova Scotia and members of the public.

13.6.4.2 *Tourism*

From a literature review of nine papers, Atchison (2012) found that the percentage of tourists not discouraged from visiting an area with a wind farm averaged 91.3%. Virtually all visitors to Sortelha, Portugal, where two wind farms (39MW and 18MW) were constructed in 2010-2011, stated that the wind farms did not impact their selection of destination (Silva and Delicado 2017). Wind farms are unlikely to impact tourist volume, expenditure, or the experience of a tourist (Glasgow Caledonian University 2008; Atchison 2004). The "clear consensus is that there has been no measurable economic impact, either positively or negatively, of wind farms on tourism" (Atchison 2012).

In 2002, Market & Opinion Research International (MORI 2008) completed an independent research study on the "Economic Impacts of wind farms on Scottish tourism" for the British Wind Energy Association (BWEA) and the Scottish Renewables Forum. (Market & Opinion Research International, March 2008) MORI interviewed 400 tourists visiting Argyll and Bute, Scotland, an area chosen because, at the time, had the greatest concentration of wind farms in Scotland. In addition, the tourism industry in the region has a strong reliance on the area's high landscape value (the study indicates that 48% of the respondents who came to the area reporting doing so for the scenery).

The MORI (2008) study indicates that 40% of tourists interviewed were aware of the existence of wind farms in the area and when asked whether this presence had a positive or negative effect, 43% indicated that it had a positive effect, while a similar proportion (43%) felt it made no difference, and 8% felt that it had a negative effect.

In comparison, a 2003 study was completed for the Wales Tourist Board (NFO World Group, 2003) in response to an inquiry from the Welsh Assembly to "assess the effects of renewable energy, and particularly wind farms, on tourism." (NFO World Group, 2003). This study used a 266 person sample size and found that overall 78% of respondents were positive or neutral towards wind farms, with 21% negative, and 1% with no opinion.

Although the effects of the Project on local tourism and tourist perceptions cannot definitively be known until the Project is implemented, past research in the Scottish and Wales examples indicates that the dominant perceptions of the Project will likely either positive or neutral. Additionally, the Municipality of the District of Argyle released a video on the Pubnico Wind Project (https://www.youtube.com/watch?v=-eBZKBA4_AU) which provides details on how that community perceives the wind farm and notes that the wind farm is a draw for tourism.

An increase in construction personnel (e.g., equipment operators) are required during the construction (2 years) and decommissioning (2 years) phases of the Project. The influx of workers (~ 100+ people) during these phases will require hotel rooms in Yarmouth for extended periods. This may reduce the availability of rooms for tourists to the area.

13.6.4.3 *Mitigation*

No mitigations are proposed for this VEC.

13.6.4.4 *Monitoring*

No monitoring is proposed for this VEC.

13.6.4.5 *Residual Effects and Significance*

Magnitude
The Project is anticipated to have a **low** magnitude of effect on recreation or tourism.

Likelihood
It is **possible** that the Project will have an effect on recreation and tourism but only in very limited use of the existing lands, and during construction resulting from the use of hotel rooms in the area.

Duration
The duration of the Projects potential interaction with recreation or tourism is **long-term** as there is potential for it to occur for the life of the Project.

Frequency
The effects of Project on recreation or tourism will occur **sporadically**, if they occur at all.

Significance
The Project will have a **not significant** effect on recreation or tourism (Table 10-4).

13.6.5 **Human Health**

The Project has the potential to interact with human health during all Project phases. During construction and decommissioning, there will be an increase in traffic and heavy equipment will be in operation. These activities may also affect air quality (Section 13.1.2; and in turn country foods) and noise (Section 13.1.3).

13.6.5.1 *Country Foods*

No known country foods are harvested on a commercial scale within the Project boundaries. A determination of the exact nature and extent of private gardens was not undertaken for this Project as all residences with permanent and sustained gardens appear to be located at least 1,000 m from any single turbine.

During operations, there is potential for Project to result in ice throw and fire hazards which may affect human health.

13.6.5.2 *Ice Throw*

Under certain meteorological conditions, ice can form on the blades, tower, or any surface of the WTG. Ice formation on the blades can lead to vibrations and imbalances in the wind turbine, often resulting in the need to temporarily shut down the WTG. As the ice melts or is shaken loose by vibrations, it is possible for chunks of ice to fall from the structure or be thrown by the rotating blades. Ice throw causes a potential hazard to anyone in the vicinity of the WTG. The maximum ice throw distance is calculated using the following formula:

$$d_t = 1.5 \times (D + H)$$

Where: d_t = Maximum throwing distance (m)
D = Rotor diameter (m)
H = Hub height (m)

The above formula is in accordance with the Canadian Wind Energy Association (CanWEA 2017) *Best Practices for Wind Farm Icing and Cold Climate Health and Safety*.

The WTGs assumed for the Project (Siemens Gamesa SG 6.6-170) have a rotor diameter of 170 m and a hub height of 110.5 m which equates to a maximum throw distance of d_t = 420.75 m. Due to certification requirements which outline load cases which must be used in the design of wind turbines (including iced blades) manufacturers incorporate ice build-up on the blades as a load resulting in additional vibration caused by both mass and aerodynamic imbalance (LeBlanc, 2007).

A number of factors such as wind speed, rotational speed, size of the ice chunk, and position of the ice on the structure affect how far it may be thrown. It is widely accepted that the formula above generates a conservative ice throw distance and in practice this distance may be much smaller. The Projects WTGs are setback by a minimum of 1,000 m from existing residential receptors, well beyond the maximum ice throw distance.

The calculated strike risk does not factor in the following characteristics at the Project:

1. The presence of forest vegetation providing additional shelter;

2. Topographic variations, and;
3. The distance to nearby residences or habitable buildings exceeds the known maximum throw distance.

All commercial wind turbines include vibration monitors, which will automatically shut the turbine down when vibrations exceed a pre-set level. This vibration safety shutdown feature is also effective when excessive ice builds up on the turbine blades thus further limiting the risk of ice throw.

13.6.5.3 *Fire Hazard*

Numerous fire prevention systems are in place to prevent such an occurrence. A robust lightning protection system is implemented in order to efficiently ground lightning strikes anywhere on the WTG. In direct drive turbines there is no gearbox or gearbox lubricants, eliminating the risk of fire from overheating mechanical parts. There are many sensors throughout the WTG continuously monitoring temperatures and will send alerts or shut down the turbine if temperature limits are exceeded. Fire extinguishers are located throughout the tower and nacelle.

Wedgeport Wind will engage local fire departments to discuss fire safety related to the Project and address any concerns presented by the fire department. The Wedgeport & District Fire Department is located at 90 Black Pond Road, 300 m and 1,700 m east of the two respective entrances to the Project.

13.6.5.4 *Mitigation*

- WTGs have been setback a minimum of 1,000 m from all existing residential receptors.
- Access to the Project will be gated.
- Fencing will be installed surrounding the substation.
- Warning signs will be posted at site entrance(s).
- If turbine icing causes the blades to become off balance an automated control system would shut down the WTG to mitigate for ice throw.
- A robust lightning protection system is implemented in order to efficiently ground lightning strikes anywhere on the WTG.
- Fire extinguishers are located throughout the tower and nacelle of each WTG.
- Letter of non-objection provided by Nav Canada.
- Trucks will abide by posted speed limits.
- Trucks will cover loads.
- Apply water on access roads to control dust, as necessary.

13.6.5.5 *Monitoring*

No monitoring is proposed for this VEC.

13.6.5.6 *Residual Effects and Significance*

Magnitude
The Project is anticipated to have a **low** magnitude of effect on human health. No regulatory threshold is available; therefore, the Project team has considered a proven adverse effect on human health as the threshold.

Likelihood
It is **unlikely** that the Project will have an effect on human health due to the mitigations proposed and the setback distance to existing residential receptors (1,000 m).

Duration
The duration of the Projects potential interaction with human health is **long-term** as it may occur during all Project phases.

Frequency
The effects of Project on human health will occur **sporadically**, if it occurs at all.

Significance
The Project will have a **not significant** effect on human health (Table 10-4).

13.6.6 Cultural and Heritage Resources

Construction of the Project has the potential to interact with cultural and heritage resources, however, both the 2022 and the 2012 ARIA concluded that the Study Area is of low archaeological resource potential.

13.6.6.1 *Mitigation*

Wedgeport Wind will follow recommendations within the 2012 and 2022 ARIA including:

- If adjustments to the Project footprint are required, an ARIA will be completed.
- Stop work and notify the Coordinator of Special Places (CCTH) if an archaeological resource is identified during Project construction.

13.6.6.2 *Monitoring*

No monitoring is proposed for this VEC.

13.6.6.3 *Residual Effects and Significance*

Magnitude

The Project is anticipated to have a **low** magnitude of effect on cultural and heritage resources. No regulatory threshold is available; therefore, the Project team has considered this magnitude based on the 2022 and 2012 ARIA indicating a low potential for archaeological resources, of either First Nations or European-descended origin within the Study Area.

Likelihood

It is **unlikely** that the Project will have an effect on cultural and heritage resources due to the low potential for resources to be located within the Project footprint.

Duration

The duration of the Projects potential interaction with cultural and heritage resources is **short-term** as it would occur during the construction phase of the Project, if it were to occur at all.

Frequency

The effects of Project on cultural and heritage resources will occur **once**, if it occurs at all.

Significance

The Project will have a **not significant** effect on cultural and heritage resources (Table 10-4).

13.6.7 Other Undertakings in the Area

Three COMFIT turbines exist in proximity to the Project, the Little River Harbour Community Wind Project, Black Pond Community Wind Project, and Wedgeport Wind Power Project (
Table 13-11).

Table 13-11. Project Setbacks to Existing COMFIT Turbines

Project Name	Number of Turbines	MW	Nearest WTG	Distance from Nearest WTG (m)	Direction from Nearest WTG
Wedgeport Wind Power Project	1	1.8	WTG3	590	SW
Black Pond Community Wind Project	1	1.99	WTG3	498	S
Little River Harbour Community Wind Project	1	1.99	WTG3	1,205	SE

13.6.7.1 *Cumulative Impacts*

Cumulative impacts are defined as the combined impacts that may occur when wind power projects or other types of projects are located in the same region (NSECC 2021). As described above, the Project is located in close proximity to three existing COMFIT turbines (currently in operation). Based on the proximity of the COMFIT turbines to the Project, the potential interaction of residual effects between the projects is high.

The total linear length of access roads for the COMFIT turbines is approximately 2.4 km. The Project will require the construction of 8.48 km of new access roads which will increase local habitat fragmentation in a predominately undisturbed Project Area and the number of direct impacts to habitat and vascular plants. Refer to Section 13.3.2 for more details on the effects of habitat fragmentation on fauna and to Sections 13.3.1 for more details on the Projects effects on habitat and vascular plants.

The Project has avoided direct impacts to SAR (e.g., blue felt lichen), and minimized impacts to fish and fish habitat and wetlands, therefore, cumulative impacts on these VECs are not anticipated.

The three COMFIT projects are all <2 MW, therefore, did not undergo an EA and to the Project Teams awareness, have not completed bird and bat mortality monitoring. Regardless, it is assumed that the COMFIT turbines have caused direct mortality to birds and bats from collisions with the WTG blades but the number of mortalities is unknown. Per Section 0 and 13.3.4, this Project is predicted to cause bird and bat mortalities during operations and the cumulative impact on birds and bats is elevated due to the three existing turbines being present within 1,205 m of a proposed WTG location (WTG3).

The cumulative impact of the operational noise generated by the Project and the existing COMFIT turbines was captured in the predictive noise model (Appendix K). The cumulative noise generated by the Project and COMFIT turbines maintains the 40 dBA threshold is met at all existing residential receptors. Therefore, no cumulative impacts are anticipated on the noise VEC.

The development of the Project will benefit Nova Scotia by providing an additional renewable source of energy and contribute to the reduction of GHG emissions. The Project was awarded the government of Nova Scotia's RBP for renewable energy. There is a positive cumulative impact between the Project and the COMFIT turbines related to the climate change VEC.

13.6.7.2 *Mitigation*

No mitigation is available for cumulative effects expect for those already provided within this EARD.

13.6.7.3 *Monitoring*

No monitoring is proposed for this VEC.

13.6.7.4 *Residual Effects and Significance*

Effects of this Project on existing conditions have already been discussed in this document.

13.7 Summary

Refer to Table 13-12 for an effects assessment summary.

Table 13-12. Effects Assessment Summary

Group	VEC	Project Phase Interactions	Characterization[1]				Significance
			Magnitude	Likelihood	Duration	Frequency	
Atmospheric	Climate Change	All	H	AC	LT	C	Significant (positive)
	Air Quality	All	L	P	ST	S	Not Significant
	Noise	All	L	AC	LT	C	Not Significant
Geophysical	Geology	Construction	L	AC	ST	R	Not Significant
	Groundwater	Construction	L	P	ST	S	Not Significant
Terrestrial	Habitat, Vascular Plants, and Lichens	Construction	L	AC	ST	O	Not Significant
	Fauna	All	L	AC	LT	R	Not Significant
	Bats	All	L	AC	LT	C	Not Significant
	Avifauna	All	N	AC	LT	C	Not Significant
Aquatic	Wetlands	Construction	L	AC	ST	O	Not Significant
	Surface Water, Fish and Fish Habitat	Construction	L	AC	ST	O	Not Significant
Technical	Visual Aesthetics	Operations	L	AC	LT	C	Not Significant
	Shadow Flicker	Operations	L	L	LT	S	Not Significant
	Electromagnetic Interference	Operations	L	U	L	S	Not Significant
Socioeconomic	Economy	All	H	AC	LT	R	Significant (positive)
	Land Use and Value	All	L	AC/U	LT	C	Not Significant
	Transportation	Construction and Decommissioning	L	AC	ST	S	Not Significant
	Recreation and Tourism	All	L	P	LT	S	Not Significant
	Human Health	All	L	U	LT	S	Not Significant
	Cultural and Heritage Resources	Construction	L	U	ST	O	Not Significant
	Other Undertakings in the Area	All	L	U	LT	S	Not Significant

Group	VEC	Project Phase Interactions	Characterization[1]				Significance
			Magnitude	Likelihood	Duration	Frequency	
Magnitude – Negligible (N), Low (L), Moderate (M), High (H) **Likelihood** – Unlikely (UL), Possible (P), Likely (L), Almost Certain (AC) **Duration** – Short-Term (ST), Long-Term (LT), Permanent (P) **Frequency** – Once (O), Sporadic (S), Regular (R), Continuous (C)							

14 EFFECTS OF THE ENVIRONMENT ON THE UNDERTAKING

Effects of the environment on the undertaking considers local conditions or natural hazards that can affect the Project's operations and may contribute to further environmental impacts. Extreme storms and forest fires are natural hazards that have the potential to affect the Project. These hazards are described in more detail in the following subsections.

14.1 Extreme Storms

Climate change is increasing the frequency, strength, and intensity of storms (USEPA 2022) and extreme storms have the potential to affect Project infrastructure.

14.1.1 Extreme Wind

Although WTGs are designed to harness the kinetic energy of the wind in a wide range of wind speeds, including gusts and sustained high winds, extreme wind (e.g., hurricanes) can damage WTG blades.

WTG control systems are designed to protect the WTG in high wind conditions. The WTG will pitch the blades to catch less in higher winds and will continuously yaw into the wind in order to efficiently manage the wind loads.

WTG's have a 'cut in speed' (wind speed at which the WTG is able to start producing energy) of approximately 3 m/s or 11 km/h, and a 'cut out speed' (wind speed at which the WTG shuts down or limits energy production for safety reasons) of approximately 28 m/s or 100 km/h. Modern turbines are equipped with storm control technology that allows the WTG blades to 'feather' or 'spill' wind in higher wind speeds, reducing the load on the blades and WTG as a whole, while still producing energy.

Control and condition monitoring systems shut down the wind turbines during high and extreme wind conditions and move the blades in vane position, to reduce risk of turbine failure and risk to nearby pedestrians or drivers.

14.1.2 Lightning

Lightning strikes have the potential to damage WTG components. A robust lightning protection system is implemented in order to efficiently ground lightning strikes anywhere on the WTG. Fire extinguishers are located throughout the tower and nacelle.

14.1.3 Snow and Ice Storms

Heavy snow, freezing rain, and ice pellets have the potential to damage WTGs. Ice buildup on turbine blades can cause ice throw. If turbine icing causes the blades to become off balance an automated control system would shut down the WTG. The WTG would remain shut down until the ice has melted. Regular maintenance will also be implemented to mitigate the potential impacts of a snow and ice storm.

14.1.4 Flooding

Flooding has the potential to impact Project access roads and other infrastructure. The Project Area is located on a peninsula surrounded by the Atlantic Ocean where storm surges from extreme weather events could encroach within the Study Area. The Maritime Coastal Flood Risk Map (NSCC, 2022) was reviewed and it provides coverage of the town of Yarmouth, but no mapping is provided for the Study Area. Refer to Table 14-1 for the ground elevations and distances to the Atlantic Ocean from each of the proposed WTG locations.

Table 14-1. WTG Ground Elevations and Distances to the Atlantic Ocean

WTG ID	Ground elevation (mASL)	Approximate Distance to the Atlantic Ocean (m)
1	36	1,635
2	15	1,630
3	35	1,600
4	29	1,300
5	28	1,200
6	40	955
7	30	945
8	37	1,100
9	38	915
10	16	210
11	27	815
12	15	395
13	6	290

The WTGs positioned in the southern portion of the Study Area are at lower ground elevations and in closer proximity to the Atlantic Ocean. The risk of flooding to these WTGs is the greatest.

Access roads will be constructed to maintain natural drainage patterns (e.g., cross drainage culverts) to prevent washout.

Overall, the risk of flooding has been considered low based on the distances from the Atlantic Ocean and the WTGs respective elevations above sea level (6-38 mASL).

14.2 Forest Fires

Forest fires have the potential to damage Project infrastructure such as collector lines. The risk of a forest fire is dependent on several weather conditions such as extended periods without precipitation and high temperatures. Forest fire risk is also dependent on potential ignition sources such as lightening or human-caused fires (campfires, cigarettes etc.). Climate change is causing an increase in the frequency and strength of heatwaves (USEPA 2022). Forest fires are impossible to predict, however, the Study Area is situated in an area with the lowest likelihood (0-5) according to the fire weather index[15] (Natural Resources Canada 2022).

[15] Fire weather index is based on means measured from April to September from 1981 to 2010

15 OTHER APPROVALS REQUIRED

In addition to approval of the EA, the Project requires additional federal, provincial, and municipal permits/approvals (Table 15-1).

Table 15-1. Other Approvals Required

Approval / Permit Required	Responsible Department	Timeline to Obtain Approval	Description	Anticipated Submission
Federal Approvals				
Aeronautical Lighting Permit	Transport Canada (TC)	No sooner than 90 days prior to construction	The Civil Aviation Directorate within TC is responsible for the review of wind projects to assess the potential for the facility to interfere with navigation safety. Wind turbines and MET towers must have markings and lighting installed according to Transport Canada's *Standard 621 - Obstruction Marking and Lighting - Canadian Aviation Regulations (CARs)*. Under Standard 621 wind turbines of total height exceeding 150 m must adhere to additional lighting requirements (i.e., mid-tower lights). MET towers which exceed 60 m require specific markings.	To be submitted minimum 90 days prior to proposed construction start date.
Aeronautical Obstruction Clearance		No sooner than 90 days prior to construction	Required for all turbines and MET towers that exceed 90 m above ground level (AGL).	To be submitted minimum 90 days prior to proposed construction start date.
Letter of Non-Objection	NAV Canada	12 weeks	Consultation with NAV Canada is required as NAV Canada assesses all land use proposals near airports and air navigation infrastructure before construction.	Complete (Received November 4, 2022).

Approval / Permit Required	Responsible Department	Timeline to Obtain Approval	Description	Anticipated Submission
Notification	Department of National Defence (DND)	At least 90 days before construction	DND will review the wind farm to determine if a proposed project may create an unacceptable level of interference to military operations, safety, readiness or training of the Canadian Armed Forces (CAF).	Complete (Received November 4, 2022).
Provincial Approvals				
Crown land Disposition Lease or Permit	Nova Scotia Department of Natural Resources and Renewables – Lands Services Branch	9 to 12 months for any permanent lease agreement	Application occurs early in the permitting process and requires a development plan (e.g., Project Description Document). Integrated Resource Management process (4 to 6 months) will be initiated for permit activities. Disposition approval is not issued until the EA has been approved.	Completed – applications, including associated Development Plans were submitted on April 5, 2022. Disposition not anticipated until after EA Approval.
Heritage Approval	Nova Scotia Communities, Culture, Tourism, and Heritage (CCTH)	3 months	Following the completion of an ARIA, approval from CCTH is required before construction.	ARIA approved by CCTH on January 6, 2023.
Wetland Alteration Permit	Nova Scotia Environment and Climate Change (NSECC)	90 days	Nova Scotia Wetland Alteration Application is required when alterations to wetlands are required.	Application to be submitted after EA approval.
Water Withdrawal Permit		3 months	Required if surface water withdrawal is required and exceeds 23,000L/day subject to exemptions outlined in the Activities Designation Regulations under the *Environment Act*.	Application to be submitted after EA approval, however, this volume of water use is not currently anticipated.

Approval / Permit Required	Responsible Department	Timeline to Obtain Approval	Description	Anticipated Submission
Blasting Permit	Department of Labour and Advanced Education	-	Blasting permit is required under the General Blasting Regulations made under Section 82 of the *Occupational Health and Safety Act*	Application to be submitted after EA approval.
Special Move Permit	Access Nova Scotia	At least 7 days before work	A special move permit is required for movement along the highway of a vehicle which exceeds the legal weight limits or the legal dimensions limits set out in the Weights and Dimensions of Vehicles Regulations made pursuant to Section 191 of Chapter 293 of the *Motor Vehicle Act*.	Application to be submitted after EA approval.
Municipal Approvals				
Municipal Development	Municipality of Argyle	At least 60 days	Per Section 8.1 of the Municipality of the District o Argyle Land Use By-Law, a Development Agreement is required for a large-scale Wind Turbine Generator	Application to be submitted after EA approval.

16 FUNDING

The Project has applied for funding under Natural Resource Canada's Smart Renewables and Electrification Pathways Program (SREP) under the Established Renewables stream.

No provincial funding is anticipated or expected.

No municipal funding is anticipated or expected.

17 ADDITIONAL INFORMATION

All applicable information has been included above.

18 CONCLUSION

The EARD has been prepared to evaluate the effect of the Project on selected VECs, which includes a detailed assessment of baseline conditions and predicted impacts to each VEC. The VECs selected include:

- Climate Change
- Air Quality
- Noise
- Surficial and bedrock geology
- Groundwater
- Habitat, Flora, and Lichens
- Fauna
- Bats
- Avifauna
- Wetlands
- Surface Water, Fish, and Fish Habitat
- Visual Aesthetics
- Shadow Flicker
- Electromagnetic Interference
- Local Economy
- Land Use and Value
- Transportation
- Recreation and Tourism
- Human Health
- Cultural and Heritage Resources
- Other Undertakings in the Area

A summary of each VEC and Project interactions are outlined below.

Climate Change

GHGs will be emitted during all phases of the Project, which includes construction, turbine maintenance, and decommissioning and reclamation. During operations, WTGs produce emission free electricity.

The total amount of ROG, CO, NO_X, PM10, PM2.5 and CO_2 emissions generated by the Project are estimated to be 128 kg, 2,202 kg, 1,624 kg, 1,482 kg, 336 kg, and 796,386 kg, respectively. The primary source of GHG emissions per day from the Project is during the construction phase due to the use of heavy equipment for the installation and construction of site facilities.

In a single year during the operational phase, the Project will reduce overall provincial GHG emissions as WTGs provide emission free electricity. Available information (turbine size, wind generating potential, project lifespan, etc.) estimates that emissions reductions from the renewable energy provided by the Project will be the equivalent of offsetting approximately 65,862.5 tonnes of CO_2 per year. The amount of power generation would have an estimated 2,305,187.5 tonnes of CO_2 offset potential over a 35-year lifespan.

Based on the available GHG emissions calculations, including the production of roughly 796.4 metric tonnes of CO_2 during construction, operations and decommissioning, the offset potential for the Project is anticipated to be 2,304,391.1 metric tonnes of CO_2 over the Project's 35-year lifespan.

The Project is predicted to have a significant positive effect on climate change.

Air Quality

Air quality (dust) during construction has the potential to cause a nuisance to local residents and can affect the health of flora. Wind Farm operation has very limited potential to have an effect to air quality by changing particulate levels. After mitigation measures are implemented the predicted residual environmental effects for air quality are assessed not to be significant.

Noise

The Projects WTGs are setback by a minimum of 1,000 m from existing residential receptors. Construction generated noise is anticipated to attenuate to background conditions within 165 m of the source. Noise modelling was completed for the operational phase of the Project, and it predicts that turbine generated noise levels will not exceed 40 dBA at any existing residential receptor. After commitments and mitigation measures are implemented the predicted residual environmental effects for noise are assessed not to be significant.

Surficial and Bedrock Geology

Surficial geology within the Project Area is characterized by thin deposits of sandy glacial till, with exposed bedrock, and in local depressions a combination of organic and alluvial deposits. The bedrock geology of the Project Area, is comprised of Monzogranite, intruded into the surrounding Goldenville Formation.

The construction of access roads and turbine foundations has the potential to alter surficial and bedrock geology. The potential for ARD within the Project Area is considered low. These activities also have the potential for naturally occurring uranium to enter groundwater. Uranium potential in groundwater in the area is listed as medium-risk. The predicted residual effects are assessed not to be significant.

Groundwater

Hydrogeologic characterization of Nova Scotia's Groundwater Regions indicates that the Project Area is located on an area of igneous (monzogranite) rock. There is potential for the Project to affect groundwater quality and quantity during the construction and decommissioning phases of the Project. Changes to the natural surface conditions within the Project footprint has the potential to alter groundwater recharge. Localized groundwater flow paths within the Project footprint may be disrupted from initial construction operations. However, due to the nature of the Project, local groundwater quantity is not expected to be impacted. Groundwater quality could also be affected from blasting (if required) or rock-water interaction. Operational effects are considered to be negligible. However, after mitigation, no significant residual environmental effects to groundwater are anticipated.

Habitat, Flora, and Lichens

Habitat in the Project Area consist mainly of softwood stands (331 ha, 36% of the Project Area) followed by barrens (280 ha, 30 %). Alder (119 ha) and mixed wood (122 ha) stands are the third most dominant habitat types and both comprise 13% of the Project Area. The majority of the Project Area is intact forest (97%). Only 2% (14 ha) and 1 % (5 ha) of the Project Area is classified as disturbed (urban and cutover, respectively).

A total of 171 vascular plant species and 11 bryophyte species were identified within the Study Area. Three species of conservation interest (SOCI) vascular plant species were documented throughout the Project Area. No Species at Risk (SAR) vascular plants were identified.

Fourteen lichen species were observed within the Project Area. One was determined to be a SAR, blue felt lichen and five were determined to be a SOCI.

The proposed Project will have direct impacts to habitat structure and to flora and lichens. Clearing and grubbing for road and pad construction account for the most notable impact but will be limited to the construction phase of the Project. Six observations of one SOCI vascular plant is situated within the proposed Project footprint.

One observation of a SOCI lichen, is situated within the proposed Project footprint. The proposed Project footprint is situated 195 m from the blue felt lichen observation, therefore, complying with the 100 m setback.

The predicted residual environmental effects are assessed to be not significant. No SAR vascular plants or lichen will be lost as a result of Project development.

Fauna

Terrestrial fauna species, including mammal, herpetofauna and insect species, were observed incidentally within the Project Area during the biophysical surveys. One species, monarch is a SAR (note: no swamp milkweed was identified within the Study Area during vascular plant surveys or incidentally).

The Project Area is outside of mainland moose core habitat and concentration areas and no mainland moose sign was identified incidentally during field surveys.

No turtles were identified incidentally or during wetland and watercourse delineation and assessment. No nest beaches or suitable overwintering habitat were identified within the Study Area for snapping turtle. The known distribution for wood turtle and Blanding's turtle does not exist in proximity to the Project Area.

Habitat will be lost as a result of the Project, but the habitat present in the Project footprint is common to the regional area and available in the surrounding landscape. The geographic extent of disturbance footprint is small (57 ha). The activities likely to create the greatest indirect impact to fauna are sensory disturbances during all Project phases. Project development has the potential to have an effect on fauna from the loss or alteration of habitat and habitat fragmentation, sensory disturbance, and mortality.

After mitigation measures are implemented, no significant residual effects of the Project on fauna are anticipated.

Bats

Acoustic monitoring surveys for bats identified 191 total bat passes, 86% of which were from migratory species. The most common species groups recorded during the monitoring period (May 10 to October 31, 2022) were the silver-haired bat (58%) followed by eastern red bat (13%), high frequency bats (12%), and little brown myotis (11%). Hoary bat, the myotis species group, and tricolored bat were also recorded comprising the remaining 6% of bat passes. The average total passes per detector night for the Project Area over the entire survey period for all species was 0.18. The average migratory passes per detector night for the Project Area over the entire survey period was observed to be 0.15.

Bats may be affected by loss of alteration of habitat, sensory disturbance, and direct (e.g., collision with turbine blade) or indirect mortality (barotrauma). The loss of habitat from clearing and grubbing may impact roosting habitat, however, no previously known hibernacula are within the Project Area nor were any potential bat hibernaculum identified during biophysical surveys.

Construction noise (e.g., heavy equipment, blasting, and pile-driving) could potentially affect bats, particularly those species that roost nearby. Sudden, loud noises can potentially disturb bats and cause abandonment of roosts.

Based on precautionary guidance from the Alberta Government (no guidance currently exists in Nova Scotia), the average of 0.15 migratory passes per detector night observed across the Project Area would be considered a potentially acceptable risk and is the lowest risk threshold for bats identified. Therefore, no significant residual effects of the Project on bats are anticipated.

Avifauna

Avifauna surveys included spring and fall migration surveys, breeding bird surveys, waterfowl surveys, nocturnal owl surveys, and nightjar surveys. Additionally, radar and acoustic monitoring was completed.

Field surveys resulted in the observation of 16,020 individuals, representing 100 bird species within and outside the Project Area. The most abundant bird group observed (by total number of individuals) was shorebirds accounting for 61% of total individuals, followed by passerines (29%), waterfowl (5.6%), other landbirds (2.1%), diurnal raptors (1.3%), other waterbirds (0.94%), and nocturnal raptors (0.07%).

Across all survey seasons, a total of 16 avian SOCI and one SAR were identified, barn swallow. The barn swallow was observed outside of the Project Area on the coastline, close to a fish processing facility. Although there is foraging habitat for this species within the Project Area, such as swamps and open barrens/heathlands, there is no suitable breeding habitat for the barn swallow within the Project Area.

During the acoustic monitoring period a total of 821 detector-nights were monitored out of a possible 852 (i.e., 96%). A total of 28,853 nocturnal flight calls (NFCs) were recorded, averaging approximately 35 NFCs per detector-night. The majority of NFCs detected were warblers (83%), then sparrows (17%), followed by thrushes (<1%). The bulk of the detections (42%) were made across just seven nights: August 12, 25, 27, 28, and September 6, 28, and 29, 2022.

Nightly migration tracks throughout the radar recording period totaled 165,862, for all heights. During this time the tracks considered most at risk (<225 m) numbered 76,552.

Physical loss of bird habitat within the Project footprint will occur during the construction phase of the Project. Sensory disturbance from Project generated noise can impact birds in a number of ways. Avifauna may also be displaced from areas adjacent to the Project as a result of construction related noise.

There is potential for direct mortality during all Project phases and direct mortality resulting from the collision with WTGs is the most apparent Project interaction. McCallum Environmental Ltd. has conducted an analysis for estimated mortality using prescribed methods out of Scotland, and the results estimate that during operations, mortality is estimated between 1.7 to 2.8 birds/turbine/year.

After standard industry mitigation measures have been implemented, the predicted residual environmental effects are assessed to be not significant.

Wetlands

A total of 44 wetlands were delineated within the Study Area (16.5 ha in total or 4.7% of the Study Area), consisting of 43 freshwater wetlands and one tidal wetland. Swamp represents the most abundant wetland class in the Study Area, accounting for 91% of all wetlands and 98% of total wetland area. Two bogs, one fen, and one tidal salt marsh were also identified. Most individual wetlands are hydrological isolated in the sense that they do not have defined surface water connections (i.e., inlets, outlets, throughflow).

Thirteen wetlands are located within 30 m of Project infrastructure and were assessed to have potential for indirect impacts. Direct impacts are only anticipated at five wetlands, resulting in 0.314 ha in disturbance (1.9% of the total area of all wetlands identified).

No impacts (direct or indirect) are anticipated to any Wetlands of Special Significance (WSS).

Wetland alteration approvals will be obtained for wetlands proposed for alteration, wetlands altered will be appropriately compensated for, and a wetland monitoring program will be implemented for wetlands partially altered or with potential to be indirectly affected by the Project. As a result, the predicted residual environmental effects to wetlands are assessed to be not significant.

Surface Water, Fish and Fish Habitat

Fish habitat within the Fish Study Area is generally limited by dry conditions and extensive sections of subterranean flow. As first order streams, watercourses within the Study Area do not provide passage to any upgradient aquatic features. Watercourses are largely seasonal, low-gradient, soft-bottomed watercourses with little to no visible flow and moderate cover.

Eight field identified watercourses were delineated within the Fish Study Area. One watercourse, is a historically excavated channel, as determined from its straightened banks and machine tracks throughout this portion of the Fish Study Area. The remaining seven watercourses flow intermittently (i.e., seasonally). Another common characteristic of watercourses within the Study Area is a discontinuous channel. The channels of six watercourses were all noted to sporadically disappear, up to 50% of the length of the delineated flow line. When this occurred, surface flow water was observed to infiltrate underground or flow between vegetated boulders, with flow being more often heard than seen. Channels with surface flow would often reappear at a natural topographic low.

Electrofishing and trapping surveys in Black Brook and Black Brook Pond resulted in the capture of a single species, American eel (*Anguilla rostrat)*, in low abundance.

Surface water features within the Study Area provide poor quality habitat for other fish species identified through desktop review due to the inconsistent flow and subterranean sections acting as impediments to fish passage.

The Project is predicted to result in a direct impact to 17 m^2 of fish habitat in at a single watercourse resulting from the installation of a culvert to support construction of an access road. Watercourse alteration approvals will be obtained prior to construction. The Project is not predicted to result in indirect effects to surface water features or associated fish habitat. This is based primarily on proactive Project planning and implementation of a mitigation sequence which prioritizes avoidance of impacts, and implementation of 30-m buffers on watercourses wherever practicable.

The predicted residual environmental effects of the Project on surface water, fish, and fish habitat are assessed to be not significant.

Visual Aesthetics

The visual representation of the Project was completed to demonstrate to stakeholders and the public at large where the Project will be visible and to what extent it will be visible in the surrounding area. The visual representation includes a Zone of Visual Influence (ZVI) and visual simulations.

The predicted residual environmental effects of the Project on the visual aesthetics are assessed to be not significant.

Shadow Flicker

Shadow flicker modelling was completed for the Project. The model was based on developing theoretical (i.e., worst case) and actual (i.e., realistic) case scenarios. Theoretical case provides the maximum amount of shadow flicker expected to be experienced at the modeled receptors and was calculated for shadow hours per year and shadow minutes per day. Actual case was modeled by incorporating site specific wind conditions and monthly sunshine probabilities. Actual case was calculated for shadow hours per year.

The actual case scenario is believed to provide a more realistic result as the assumptions in the theoretical case are very conservative. The actual case scenario shows that all receptors are below the 30 hours per year threshold. The analysis of the theoretical case indicates that modelled shadow flicker exceeds the 30 hours per year threshold at 10 of 32 receptors and exceeds the 30 mins per day threshold at 4 of 32 receptors.

Wedgeport Wind is committed to operating the Project to be in compliance with the NSECC guidelines for shadow flicker (30 hours/year and/or 30 mins/day). A Complaints Resolution Plan and Community Liaison Committee (CLC) will be developed for the Project. Mitigation measures may include the installation of blinds, curtains or other screening devices, or the implementation of an operational curtailment plan, if necessary.

After mitigation measures are implemented, the predicted residual environmental effects of the Project on shadow flicker are assessed to be not significant.

Electromagnetic Interference

An Electromagnetic Interference (EMI) Study was completed for the Project. The results of the EMI Study show that the turbines are not expected to pose any serious interference with existing radio, telecommunication, or radar systems in the area. Wedgeport Wind has engaged with Municipality of the District of Argyle, Bell, and Bragg and no issues with the proposed Project layout were noted by these licensees. Wedgeport Wind reached out to the fourth licensee, Orion, but has not yet received a response.

Nav Canada and the DND have provided letters of non-objection indicating that there are no impacts on the air navigation system and specifically on civil and military air traffic control radars, navigation aids, and airports in the vicinity of the Project.

After mitigation measures are implemented, the predicted residual environmental effects of the Project on electromagnetic interference are assessed to be not significant.

Local Economy
The Project will provide a low-cost, fixed price clean electricity for the Province of Nova Scotia. Additionally, a tax revenue of $650,000 per year will go to the municipality in property tax.

Wedgeport Wind's intent is to fulfill construction and operations contracts/positions with local personnel wherever possible. However, due to the specialized nature of wind turbine delivery, erection, and energization, if local personnel cannot be found, personnel may be required from other municipal, provincial, national, or international firms.

A significant positive effect on the economy is anticipated from the Project.

Land Use and Value
The Project is located on both private and Crown land. Informal recreational activities include ATV trails, hunting, and possible berry harvesting. Access to the Project will be gated to restrict public access. Although road access to the site for hunting and recreation will be restricted to the public (with the exception of those people having permission from the land-owners), land use change within the Project Area is anticipated to be positive as it is adding a renewable energy resource to the area.

Based on a literature review on the effects of property values in proximity to wind power projects, there is no anticipated decrease in property values.

The Project was predicted to not have a significant effect on land use and value.

Transportation
An increase in truck traffic will occur during the construction (2 years) and decommissioning phases (2 years) of the Project. No change to local transportation is anticipated during operations, the Project phase with the longest duration (35 years). The increase in transportation during decommissioning will also recover to baseline levels after the completion of the Project.

Transportation routes are subject to Nova Scotia Department of Public Works (NSDPW) approval.

The Project is predicted to not have a significant effect on transportation.

Recreation and Tourism
The Project Area also borders the Tusket Islands Wilderness Area. The construction and operation of the Project will result in modified use by ATVs, hunters, general users or landowners. Although some ATV trails will be lost due to access road construction, the access roads, by definition, will

continue to allow access by ATVs or other recreational users, but such access will still be subject to permission from the landowners.

The effects of the Project on local tourism and tourist perceptions cannot definitively be known until the Project is implemented, a literature review indicated that the dominant perceptions of wind farm projects are either positive or neutral. An increase in construction personnel (e.g., equipment operators) are required during the construction and decommissioning phases of the Project. The influx of workers (~ 100+ people) during these phases will require hotel rooms in Yarmouth for extended periods. This may reduce the availability of rooms for tourists to the area.

The Project is predicted to not have a significant effect on recreation or tourism.

Human Health

The Project has the potential to interact with human health during all Project phases. During construction and decommissioning, there will be an increase in traffic and heavy equipment will be in operation. These activities may also affect air quality and noise.

Ice throw is another potential risk to human health and the maximum ice throw distance for the Siemens Gamesa SG 6.6-170 turbine was calculated to be 420.75 m. All commercial wind turbines include vibration monitors, which will automatically shut the turbine down when vibrations exceed a pre-set level. This vibration safety shutdown feature is also effective when excessive ice builds up on the turbine blades thus further limiting the risk of ice throw.

After mitigation measures are implemented, no adverse effects to human health are predicted.

Cultural and Heritage Resources

Construction of the Project has the potential to interact with cultural and heritage resources, however, both the 2022 and the 2012 ARIA concluded that the Study Area is of low archaeological resource potential and no significant archaeological features were identified within the Study Area during the field reconnaissance study. Due to a low potential for archaeological resources, of either First Nations or European-descended origin within the Study Area, no direct or indirect impacts to cultural and heritage Resources are expected as a result of the Project, therefore, no adverse effects to cultural and heritage resources are predicted.

Other Undertakings in the Area

Three COMFIT turbines exist in proximity to the Project, the Little River Harbour Community Wind Project, Black Pond Community Wind Project, and Wedgeport Wind Power Project. The potential for cumulative impacts between the projects is high.

The total linear length of access roads for the COMFIT turbines is approximately 2.4 km. The Project will require the construction of 8.48 km of new access roads which will increase local habitat fragmentation.

The Project has avoided direct impacts to lichen SAR, and no impacts to fish and fish habitat and wetlands that are cumulative with the existing projects will occur, therefore, cumulative impacts on these VECs are not anticipated.

The three COMFIT projects are all <2 MW, therefore, did not undergo an EA and to the Project Teams awareness, have not completed bird and bat mortality monitoring. Regardless, it is assumed that the COMFIT turbines have caused direct mortality to birds and bats from collisions with the WTG blades but the number of mortalities is unknown. This Project is predicted to cause bird and bat mortalities during operations and the cumulative impact on birds and bats is elevated due to the three existing turbines being present in proximity to the Project.

The cumulative impact of the operational noise generated by the Project and the existing COMFIT turbines was captured in the predictive noise model. The cumulative noise generated by the Project and COMFIT turbines maintains the 40 dBA threshold is met at all existing residential receptors. Therefore, no cumulative impacts are anticipated on the noise VEC.

There is a positive cumulative impact between the Project and the COMFIT turbines related to the climate change VEC.

Monitoring

Wedgeport Wind commits to developing the following monitoring plans:

- Wetland Monitoring Plan
- Post Construction Bird and Bat Monitoring

These plans will be developed to meet EA approval terms and conditions.

Additional Commitments

Wedgeport Wind has developed the following plan:

- Environmental Protection Plan

The Environmental Protection Plan includes details on erosion and sediment control, vegetation management, and spill response.

Wedgeport Wind commits to the following additional commitments:

- Ongoing engagement with First Nation communities and organizations and the public throughout the life of the Project.
- Support Mi'kmaq review of the EARD by making the Project team available to provide additional information about the Project, answer questions or facilitate discussion with interested Mi'kmaq Nations, organizations or individuals;
- Provide the Mi'kmaq of Nova Scotia an opportunity to walk the Project Area with Wedgeport Wind to identify and document sensitive sites prior to construction;
- Allow the Mi'kmaq of Nova Scotia to harvest traditional plants prior to clearing the Project footprint;
- Provide a tour of the Project to the Mi'kmaq of Nova Scotia, once in operation;
- Ensure there are various opportunities for Mi'kmaq participation in the Project (e.g., opportunities to participate in environmental monitoring);
- Development of a Mi'kmaq Communication Plan;
- Development of a Complaint Resolution Plan;
- Development of a Community Liaison Committee;
- Development of a Wildlife Management Plan; and,
- Development of a Contingency Plan.

The plans noted above will be developed to meet EA approval terms and conditions.

Conclusion

The findings of this EARD indicate that residual environmental effects after mitigation is implemented will not be significant for identified VECs.

Monitoring will be completed to confirm the predicted effects and determine if additional mitigation measures need to be implemented utilizing an adaptive management approach.

Therefore, it is the opinion of McCallum Environmental Ltd. that the Project should be approved by the Minister with conditions as the environmental effects are within standard industry expectations and expected regulatory thresholds and requirements. McCallum Environmental Ltd. also concludes that given the extensive amount of work completed at the Project, further environmental assessment work will not provide additional information which may be relevant for reducing Project related effects.

19 LIMITATIONS

Constraints Analysis

- On some maps, land use or land cover is defined everywhere to form a complete mosaic of polygons. On topographic maps land use/landcover is depicted only in certain areas. The source data in some cases may need to be conditioned to allow the second type of depiction if it is a mosaic, and certain constraints will operate differently in each case.
- Conflicts that might exist between objects in a database are typically of a logical nature, such as topological inconsistencies or duplicate identifiers. We attempted to ensure that our database has addressed any potential inconsistencies, however inconsistencies may still occur. In map generalization, the vast majority of conflicts are physical, spatial consequences of reducing map scale. The greater the degree of scale change, the more cluttered an un-generalized map will be, and this signals the extents of potential conflicts in presentation of the data.
- Habitat survey methods and results are presented with the acknowledgment of two biases which have been built into the survey methods. These are as follows:
    - Bias towards upland habitat. This bias was purposefully built into the survey methods with the understanding that all wetlands within the Study Area were delineated and evaluated in detail through completion of the separate wetland study.
    - The third bias in this survey is that habitat surveys were completed at discrete points and limited effort was made to delineate the extent of that habitat type around those points. As such, the ability to extrapolate habitat survey results across the entire Project Area is limited. These habitat survey points are meant to describe habitat in 'snapshots' of specific locations and completed to provide a summary of habitats present within the Study Area and also to inform specific biophysical field surveys. The results of the habitat survey describe the diversity of habitat types present throughout the Project Area and the relative abundance thereof, rather than absolute percent cover of each habitat type throughout the Project Area.
- MEL has relied in good faith upon the evaluation and conclusions in all third-party assessments. MEL relies upon these representations and information provided but can make no warranty as to the accuracy of information provided.
- There are a potentially infinite number of methods in which human activity can influence wildlife behaviors and populations and merely demonstrating that one factor is not operative does not negate the influence of the remainder of possible factors.

- The EARD provides an inventory based on acceptable industry methodologies. A single assessment may not define the absolute status of site conditions.
- Effects of impacts separated in time and space that may affect the areas in question, have not been included in this assessment.
- The aerial photos used in the figures may not represent actual on the ground conditions due to the age of the aerial photo and changes in land use.
- Classification and identification of soils, vegetation, wildlife, and general environmental characteristics (i.e., vegetation concentrations, and wildlife usage) have been based upon commonly accepted practices in environmental consulting. Classification and identification of these factors are judgmental and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may not identify all factors.
- Different assessors may come to different results and conclusions and analysis based upon the collected information.
- All reasonable assessment programs will involve an inherent risk that some conditions will not be detected and all reports summarizing such investigations will be based on assumptions of what characteristics may exist between the sample points.

20 CERTIFICATION

This Report has considered relevant factors and influences pertinent within the scope of the assessment and has completed and provided relevant information in accordance with the methodologies described.

The undersigned have considered relevant factors and influences pertinent within the scope of the assessment and written, combined, and referenced the report accordingly.

McCallum Environmental Ltd. has no past, present, or contemplated interest in the assessed underlying property or investments in the proponent.

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