Appendix S

Bat and Avian Post-construction Monitoring Plan

Appendix S

Environmental Effects follow up and Monitoring Programs (EEMPs): Bat and Avian Post-construction Monitoring Plan (PCMP)

Argentia Renewables Project

Issued by: Argentia Renewables Wind LP

Project Facility: All Locations

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Document Maintenance and Control

Argentia Renewables Wind LP (Argentia Renewables), an affiliate of Pattern Energy Group LP (Pattern), is responsible for the distribution, maintenance and updating of Environmental Effects follow up and Monitoring Programs (EEMPs): Bat and Avian Post-construction Monitoring Plan (PCMP)for the Argentia Renewables Project (the "Project"). This PCMP will be updated when needed for reasons including but not limited to reflecting changes in site-specific implementation, updating contact information, changes to scientific methods and survey best practices, and adding results of post-construction monitoring.

Material updates to this PCMP will be distributed to the appropriate parties. Contact information is provided below in Section 1.3.

PCMP Document Version

Version #	Section(s) Revised	Prepared By	Approved By	Date Issued

Index of Major Changes/Modifications in Latest Version

Item #	Description of Change	Relevant Section

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1.0 Introduction

The Environmental Effects follow up and Monitoring Programs (EEMPs): Bat and Avian Post-construction Monitoring Plan (PCMP) has been prepared by Argentia Renewables Wind LP (Argentia Renewables), an affiliate of Pattern Energy Group LP (Pattern) for the Argentia Renewables Project (the Project), which involves the planning, construction, operation and maintenance, and eventual decommissioning and rehabilitation of an onshore wind energy generation facility (Argentia Wind Facility) and a green hydrogen and ammonia production, storage, and export facility (Argentia Green Fuels Facility). The Project is located on Port of Argentia (POA) property located within the Town of Placentia, Newfoundland and Labrador (NL).

As per the guidance of the Newfoundland and Labrador Department of Environment and Climate Change - Wildlife Division (Wildlife Division), this PCMP describes bat and avian monitoring and mitigation measures and associated methodologies, as well as the chain of communication required for reporting results.

Please note that this PCMP is a draft document. This PCMP will be finalized based on additional consultation with Wildlife Division.

1.1 Legal

This document has been developed in compliance with the requirements of the Government of Newfoundland and Labrador. As a component of a Project Registration under the **Environmental Protection Act (Environmental Assessment Regulations)**, the document is considered to reflect a commitment by Argentia Renewables to carry out the actions described and to report on results achieved.

1.2 Purpose and Scope

The purpose of this PCMP is to meet the requirements for the issuance of a Section 19 permit under the **Newfoundland and Labrador Endangered Species Act** (NL ESA). The Project Species at Risk (SAR) Impacts Mitigation and Monitoring Plan (IMMP) is inclusive of eight NL ESA-listed bat and avifauna species (*see* Section 1.4 below).

1.3 Company Information

Argentia Renewables is an affiliate of Pattern Energy Group LP (Pattern Energy) and is responsible for activities associated with the Project, including implementation and management of this PCMP. Contact information is provided below.

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1.4 Project Description

The Project will produce up to approximately 100,000 metric tonnes of green hydrogen, equivalent to approximately 1.17 mega tonnes of ammonia annually, via electrolysis. The Project will have an installed electrolyser capacity of approximately 300 megawatts. The hydrogen produced by the Project will be converted into ammonia (i.e., a hydrogen-ammonia facility) and exported to international markets by ship from an existing marine terminal in the Port of Argentia. The Project electricity generation will be provided by a network of approximately 46 wind turbines located on the Argentia Peninsula and adjacent Port of Argentia lands commonly referred to as the Argentia Backlands. Associated infrastructure includes, but is not necessarily limited to, an access road network and electricity collection and distribution lines. The Project will help development of the green hydrogen and ammonia industry in Newfoundland and Labrador, providing opportunities for workers and businesses within a sector that will support efforts to decarbonize energy production. The Project is expected to have an operational life of no less than 30 years.

1.5 Site Description

The Project Area is defined as: “the immediate area within which Project activities and features will occur, and within which direct physical disturbance associated with the Project will occur.” The Project Area comprises the wind turbine pads, Argentia Green Fuels Facility, electrical substation, access roads, Collector Lines, Gen-Tie Line, Project Interconnect Line, and turbine staging areas. Two higher-level assessment areas were included in the Argentia Renewables Environmental Assessment Registration: the Local Assessment Area (LAA) defined as the Project Area plus a 1-km buffer and a 0.25-km buffer around the Project Interconnect Line, and the Regional Assessment Area (RAA) defined as the Census Division No. 1 (i.e., Avalon) subdivision B as the basis for the outer boundary in addition to the Placentia and Fox Harbour subdivisions (Figure S-1.5-1). While the RAA is based on the census subdivision, this area boundary aligns with regional drainage basins. The Project Area and LAA were used to assess the potential for direct and indirect impacts on target species and SAR; the RAA was used to assess the potential for regional and cumulative effects on target species and SAR.

The SAR IMMP (Appendix R) for the Project identifies eight NL ESA-listed species including two bats and five avian species. Relevant to this PCMP (i.e., bats and birds), these include two Schedule A-listed species (i.e., Endangered), the little brown myotis (*Myotis lucifugus*) and northern myotis (*Myotis septentrionalis*), four Schedule B-listed species (i.e., Threatened), the Red Crossbill (*Loxia curivorostra*), Short-eared Owl (*Asio flammeus*), Gray-cheeked Thrush (*Catharus minimus*), Olive-sided Flycatcher (*Contopus cooperi*), and one Schedule C-listed species (i.e., Vulnerable), the Rusty Blackbird (*Euphagus carolinus*). Three additional bat species are included due to anticipated NL ESA-listing: hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), and eastern red bat (*Lasiurus borealis*).



Pattern | Argentia Renewables	FIGURE NUMBER: S - 1.5 - 1	COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 22N	PREPARED BY: C. Burke	DATE: 24/07/25
	FIGURE TITLE: Study Area Boundaries Associated with the Project	NOTES:	REVIEWED BY:	
	PROJECT TITLE: Argentia Renewables		APPROVED BY:	sem

SEM MAP ID: 238-005-GIS-159-Rev0

2.0 Roles and Responsibilities

Argentia Renewables is accountable for activities associated with the Project and conducted within the Project Area, including implementation and management of the PCMP. Role-specific responsibilities are listed in the subsequent sections.

2.1 Managers and Supervisors

- Managers and supervisors are responsible for ensuring that staff, contractors, suppliers, and visitors have been properly trained in the PCMP expectations and procedures.
- Managers and Supervisors shall provide the necessary resources and appropriately trained personnel for executing the PCMP.

2.2 Wildlife Division

- The Project (or designate) will update Wildlife Division annually with recorded fatality numbers and adjusted fatality estimates.
- The Project (or designate) will update Wildlife Division if any adaptive management is required.
- This PCMP will be updated as necessary, following consultation with Wildlife Division.

2.3 Post-construction Monitoring Training Coordinator

- Responsible for developing, implementing, and updating the training plan related to post-construction monitoring for the Project.
- Provides technical support, auditing, tracking of equipment maintenance related to post-construction monitoring.
- Must ensure that the post-construction monitoring team is trained in accordance with this PCMP.
- Responsible for the documentation of training hours, certifications, and skills acquired by the post-construction monitoring team.
- Provides the opportunity for regular evaluations and feedback sessions, to identify areas for improvement and ensure compliance with Canadian regulations.

2.4 Staff, Contractors, Suppliers, and Visitors

All personnel conducting activities in the Project area, are required to complete wildlife awareness training and, where applicable, Project personnel should have a full understanding of the PCMP and how to respond and implement the PCMP as it pertains to their activities in the Project Area.

3.0 Post-Construction Monitoring

As per the recommendation of the Wildlife Division, post-construction monitoring (PCM) activities will be completed for at least the first year of Project operation (i.e., Year One). Following the completion of Year One, PCM activities and consultation with Wildlife Division, additional PCM activities may be requested. In addition to standard PCM, including carcass searches and bias trials (*see* Section 3.3 below), additional coincident studies will be conducted including avifauna surveys according to protocol currently in use at the Project, and bat acoustic and/or thermal camera surveys. Thus, PCM activities will include carcass searches and bias trials, avifauna surveys, and bat acoustic and/or thermal camera surveys.

3.1 Avifauna Surveys

Extending the work of Dr. William Montevecchi, Memorial University of Newfoundland, traditional PCM will be supplemented by avifauna surveys. This will allow the Project to assist with local research initiatives whereby researchers are hoping to gain insight into how avifauna behaviour may change following construction and operation of the Project, and onshore wind energy facilities generally. Prior to commencement of operations, the Project will have two years of avifauna surveys at the Argentia Wind Facility portion of the Project Area. The Project will conduct avifauna surveys in Year One, Year Three, and Year Six of operations. Post-construction avifauna surveys will comprise avian use point count surveys and will follow the study design and survey protocols of pre-construction Project avifauna surveys.

3.2 Bat Acoustic and/or Thermal Camera Surveys

Bat acoustic detectors and/or thermal cameras will be used to collect information on bat activity at select Project sites. Bat acoustic detectors and/or thermal cameras will be used to gather information about bat activity in proximity to Project wind turbines and may be used to inform smart curtailment protocols (*see* Section 5.0 and 5.1.4 below).

Bat acoustic and/or thermal camera surveys will be conducted from approximately May 1 to September 30, which coincides with the anticipated summer active period for the three bat species known to be present in the Project Area. Prior to the commencement of the Construction Phase, bat acoustic surveys were conducted as part of the 2023 Terrestrial Baseline Study (Argentia Renewables EA Registration, Chapter 3.1.3). The Project will utilize bat acoustic and/or thermal cameras in Year One of operation. Bat acoustic and/or thermal camera survey findings will be analyzed alongside traditional PCM (*see* Section 3.3 below) and may be used to inform adjustments to Project smart curtailment protocols (*see* Section 5.1.3 below).

3.3 Bird and Bat Fatality Monitoring

The following sections summarize each of the surveys associated with documentation of bird and bat fatalities at the Project, with a focus on the detection of SAR fatalities and in particular, bats (see Table S-3.3-1). Survey types include standardized fatality searches and bias trials (collectively, the "PCM Surveys"). Bias trials include searcher efficiency (SEEF) trials and carcass persistence (CP) trials. PCM Surveys will be conducted in Year One of operation. PCM Surveys after Year One may be modified to evaluate smart curtailment protocols (*see* Section 5.1.4 below). Additional PCM Surveys may be conducted if a large mortality event of a SAR occurs or to test the efficacy of material changes to smart curtailment protocol implementation, in consultation with Wildlife Division. Specific survey methods will be refined in consultation with Wildlife Division prior to commencement of operations; preliminary PCM Survey protocols are described below. PCM Surveys will be conducted from spring until fall, approximately May 1 to September 30, as practicable.

Table S-3.3-1 Planned PCM Surveys and additional PCM activities for Year One.

Activity	Deliverable	Timing (approximate)
Avifauna Surveys	Field Surveys, Analyses, and Report	TBD
Bat Acoustic and/or Thermal Camera Surveys	Field Surveys, Analyses, and Report	May 1 - September 30
Standardized Fatality Searches	Field Surveys, Analyses, and Report	May 1 - September 30
Searcher Efficiency Trials	Field Surveys, Analyses, and Report	May 1 - September 30
Carcass Persistence Trials	Field Surveys, Analyses, and Report	May 1 - September 30

3.3.1 Standardized Fatality Searches

The Project will complete three seasons of standardized fatality searches at Project turbines to estimate bird and bat fatalities, including SAR. Standardized fatality searches will only be part of PCM Surveys in Year One.

Standardized fatality searches will be conducted twice monthly from approximately May 1 through September 30, within cleared portions of the Project Area up to an 80-metre (m) radius of each turbine on the turbine pads and access roads. Standardized fatality searches will be conducted utilizing circular transects spaced 20 m apart in cleared areas, with surveyors searching the area out to 10 m on either side of the transect. All carcasses or carcass evidence will be photographed in the position found, geolocated using a hand-held GPS, collected if appropriate and according to approved collection permits, and recorded on a plot-specific fatality search datasheet. For each carcass found, the following data will be recorded:

- Fatality search turbine/plot number;
- Observer name;

- Unique carcass identification number (carcass ID);
- Date and time recorded and/or collected;
- Species (when possible);
- Sex (when possible);
- Age or age class (when possible);
- Nearest turbine;
- Distance and azimuth to nearest turbine;
- Visibility class of where each carcass was found, if found outside of cleared survey plot; and
- Condition class of carcass (e.g., intact, scavenged, feather spot).

All carcasses will be collected in accordance with required collection permits, stored in plastic bags, labelled, frozen for future use during SEEF and/or CP trials, or delivered to an appropriate agency for necropsy, as dictated by approved collection permits. Fatality estimator software will be employed for determining fatality estimates for the Project. Search frequency may be adjusted depending on the results of bias trials described below.

3.3.2 Searcher Efficiency Trials

Detections of fatalities at wind turbines can be biased due to several factors including the distance of the carcass from the searcher, visual obstructions such as dense vegetation or snow, and level of decay and/or effects of scavenging. SEEF trials will be conducted regularly throughout the three seasons of fatality monitoring to correct for detection bias when searching for carcasses in Year One. SEEF will be tested for each individual searcher responsible for conducting standardized fatality searches.

SEEF trials will be conducted using trial carcasses (e.g., pre-marked carcasses found during standardized fatality searches, surrogates such as rodents or game birds, appropriately sized feathered decoys) placed the morning of a standardized fatality search at random locations with the search plots, by personnel not part of the survey team, prior to the arrival of searchers,; the timing and locations of SEEF trials will be unknown to standardized fatality searchers (Strickland et al. 2011). The locations of SEEF trial carcasses will be recorded by individuals deploying trial carcasses. Approximately 18 SEEF trials will be conducted across the three seasons of standardized fatality searches (i.e., six SEEF trials each in spring, summer, and fall) and will be distributed to account for different visibility classes among cleared search plots, if necessary. SEEF trial carcasses will comprise different sizes intended to represent different detectability among large birds, small birds, and bats. Data collected for each SEEF trial will include the following standardized information:

- Name of the individual conducting the standardized carcass search;
- Date, time, and location the trial carcass was placed;

- Trial carcass type (e.g., surrogate type, decoy size) or species;
- Vegetation height and visibility class, if necessary, and outside cleared search plot;
- Site conditions (i.e., weather); and
- Date and time of standardized carcass search and whether SEEF trial carcass was found.

Following the completion of each SEEF trial, as with the concurrent standardized carcass search, all trial carcasses may be collected in accordance with required collection permits and frozen for future use during subsequent SEEF or CP trials (non-decoy trial carcasses can be reused several times), as dictated by the approved collection permits. The results of SEEF trials may be used to adjust search frequency.

3.3.3 Carcass Persistence Trials

To account for the proportion of carcasses removed by scavengers prior to detection during standardized fatality searches, which can impact fatality estimates, CP trials will be undertaken in Year One. CP trials will be conducted in non-search locations within the Project Area using game cameras and actual avian or bat carcasses, over a 90-day period.

If possible, CP trial carcasses will comprise carcasses collected during standardized fatality searches, pending permit approval; surrogate rodent or game bird carcasses available from commercial vendors may be used as necessary (Hallingstad et al. 2018). CP trial locations will be outside search plots but in areas generally representative of search plot conditions (i.e., cleared areas where carcasses are similarly detectable by, and available to, scavengers). Cameras will be mounted on and locked to temporary t-posts, placed low to the ground but not obscured by vegetation, approximately 3 m from the carcass, as per Hallingstad et al. (2023). PCM Survey personnel will check CP trial carcasses on a weekly basis to ensure the carcass has not been moved from the camera frame by scavengers and cameras remain functional. Photographs will be reviewed on days 5, 10, 15, 30, 45, 60, 75, and 90, to document trial carcass status.

The results of CP trials may be used to adjust search frequency. Should regional carcass persistence rates become available, these rates may be used in concert with site-specific data to adjust fatality estimates.

3.3.4 Search Area Adjustment

A search area adjustment may be used to account for unsearched and/or unsearchable areas within search plots. Several analytical methods exist to calculate search area adjustment. If a sufficient number of carcasses (e.g., more than 30) for a particular size group are found, an empirical distribution can be used to generate a search area adjustment.

3.3.5 Fatality Estimates

Fatality estimator software will be used to complete statistical analyses and generate fatality estimates for the Project. Fatality estimates will be calculated using the Generalized Fatality Estimator (GenEst; Dalthorp *et al*., 2018, Simonis *et al*., 2018). To calculate fatality estimates, GenEst adjusts each fatality included in an estimate for SEEF, CP, a detection reduction factor referred to as "k", and a search area adjustment. GenEst uses a parametric bootstrap to estimate associated confidence intervals and is considered to be the least biased fatality estimator available (Rabie et al. 2021). The Project will consult with the Wildlife Division to determine which fatality estimates will be generated (e.g., species specific).

3.3.6 Permitting

Permits required to handle or collect any bird or bat carcasses discovered during PCM activities (e.g., Species at Risk Act, Migratory Birds Convention Act), or during operation of the Project, will be obtained from the appropriate government agency prior to initiating work described in this PCMP.

4.0 Reporting

For each year PCM activities are conducted at the Project, an Annual PCM Report will be generated. Annual PCM Reports will document the methods and results of PCM activities described in this PCMP and implemented at the Project and will be submitted to Wildlife Division. Annual reports will be made available to the Qalipu First Nation and Miawpukek First Nation, as needed.

Annual PCM Reports will include data summaries and analyses, as appropriate, of all PCM activities conducted at the Project, including avifauna surveys and bat acoustic and/or thermal camera surveys. Any SAR carcasses discovered during PCM activities or incidentally at the Project will be reported to Wildlife Division and other government agencies, as appropriate, within 48 hours of discovery and confirmation. Annual PCM Reports will also include recommendations for additional mitigation and/or adaptive management, as appropriate (s*ee* Section 5.0 below).

5.0 Mitigation

The Project is committed to avoiding and/or minimizing direct and indirect impacts to wildlife, including SAR, which may occur during Project Construction Phase or Operation and Maintenance Phase.

5.1.1 Pre-construction and Construction Mitigation

Prior to and/or during construction of the Project, the Project (or designate) will:

- Undertake an avian collision risk assessment of Project transmission infrastructure prior to construction; install bird flight diverters in areas of relative high risk;
- Engage a wildlife-friendly Project lighting plan
    - Minimize pilot warning and obstruction lighting on all tall structures as feasible;
    - Utilize flashing warning lights that turn off completely between flashes;
    - Install the fewest number of site-illuminating lights feasible in the Project Area; and
    - Use only flashing lights at night at the lowest intensity and fewest number of flashes per minute as required by Transport Canada.
- Minimize scheduling disturbance-causing activities, such as vegetation clearing, during the regional avian nesting period of approximately April through August, to the extent practicable
    - Conduct avian nest clearance surveys if vegetation clearing occurs during the regional avian nesting period to avoid and/or minimize incidental take of birds, nests, and eggs;
    - Take the following steps immediately if an active nest is discovered, defined by the presence of eggs or young dependent on the nest (Government of Canada 2019):
        - Halt all disruptive activities in the nesting area;
        - Move construction equipment and personnel away as quickly and quietly as possible and avoid disturbing the surrounding vegetation or making a trail to and from the nest;
        - Protect the nest with a vegetated buffer zone;
        - Establish a setback distance for activities; and
        - Maintain mitigation measures and avoid the immediate area until the young have naturally left the vicinity of the nest.

5.1.2 Post-construction Mitigation

During the Operation and Maintenance Phase of the Project, the Project (or designate) will:

- Feather (i.e., curtail) turbine blades below a cut-in speed of 3.5 metres per second (m/s) during the autumnal bat migration period;
- Curtail turbines during Year One at wind speeds below 6 m/s, from dusk to dawn (i.e., civil twilight), when ambient air temperatures are above six degrees (º) Celsius (C), between July 1 and September 30 (i.e., Year One Smart Curtailment);
- Extend the Year One Smart Curtailment program beyond Year One unless low SAR bat fatalities and use are observed, in which case the Year One Smart Curtailment program may be updated to consider additional factors (e.g., relative use within the Project Area, weather conditions);
- Implement the PCM activities described in this PCMP;
- Update Wildlife Division annually with the results of PCM activities at the Project through Annual PCM Reports; and
- Update Wildlife Division on any implemented adaptive management measures (e.g., refinement of and/or reversion to Smart Curtailment protocols).

The following sections describe post-construction mitigation measures in greater detail.

5.1.3 Cut-in Speed Curtailment

Cut-in speeds are the minimum wind speed required for turbine blades to start moving to generate electricity. Research has shown that increasing cut-in speeds and feathering (i.e., curtailing), or preventing turbine blades from rotating below certain wind speeds, can reduce bat fatality rates, since bat activity is generally highest at low wind speeds (Arnett et al. 2006, Environment Canada 2014). Changes to wind turbine cut-in speeds in some locations have been found to reduce bat mortality by 50-90% (Environment Canada 2014; Environment and Climate Change Canada 2018). The fall migration season is when bats are most likely to be directly impacted by wind turbines (Environment Canada 2014). At operating wind energy facilities, most bat fatalities occur over a 6-8-week period during nights in the late summer or early fall, especially when wind speed is low (Environment Canada 2014).

The Project commits to feathering (i.e., curtailing), or preventing turbine blades from rotating, below a cut-in speed of 3.5 m/s during the autumnal bat migration period. Additionally, the Project commits to curtailing turbine blades at wind speeds below 6 m/s from dusk to dawn (i.e., civil twilight) in Year One between July 1 and September 30. This curtailment will occur only when temperatures are above 6º C (i.e., when bats are likely to be active) and is described in greater detail below.

Curtailment programs in future years will be dependent on data collected during PCM activities including bat fatality estimates and consultation with Wildlife Division. Any adjustments to this or future curtailment programs will consider additional smart curtailment variables (*see* Section 5.1.4 below) and not necessarily a change from the Year One Smart Curtailment program.

5.1.4 Bat Smart Curtailment

Wildlife Division was consulted regarding guidelines and best practices for avoiding and/or minimizing bat fatalities at operating wind turbines, including the implementation of a smart curtailment program. Smart curtailment programs targeted at avoiding and/or minimizing bat fatalities use site-specific information (e.g., bat activity, meteorological data), often real-time, to refine and implement turbine curtailment parameters. Studies have shown material results in reducing both bat fatalities and curtailment time at wind energy facilities using smart curtailment programs. For example, Hayes et al. (2019) demonstrated reductions in fatality estimates of 91.4% for little brown myotis, 90.9% for silver-haired bat, 82.5% for eastern red bat, and 81.4% for hoary bat using a smart curtailment program at a wind energy facility on the U.S. mainland.

The Project Smart Curtailment Protocol consists of the following:

- All wind turbines at the Project will be equipped with software to allow for smart curtailment (e.g., the VestasOnline Business and VestasOnline Compact Supervisory Control and Data Acquisition [SCADA]), allowing automatic curtailment of wind turbines when certain conditions are met (e.g., time of day, time of year, wind speed, temperature, precipitation);
- On commencement of Operation and Maintenance Phase, the Project will implement blade feathering/curtailment below the operational turbine cut-in speed (i.e., 3.5 m/s) during the autumnal bat migration period;
- During Year One turbines will be curtailed at wind speeds below 6 m/s, from dusk to dawn (i.e., civil twilight), when ambient air temperatures are above six degrees (º) Celsius (C), between July 1 and September 30 (i.e., Year One Smart Curtailment); and
- The Project will extend the Year One Smart Curtailment program beyond Year One unless low SAR bat fatalities and use are observed, in which case the Year One Smart Curtailment program may be updated to consider additional factors (e.g., relative use within the Project Area, weather conditions).

Bat fatality estimates for the Project will be calculated in accordance with this PCMP and provided to Wildlife Division via Annual PCM Reports. The Project will consult with Wildlife Division to determine whether the Year One Smart Curtailment program warrants extension in the context of additional site-specific data, including the results of bat acoustic and/or thermal camera surveys.

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