APPENDIX 6-2

BAT REPORT

Appendix 6-2 – Bat Survey Report

Proposed Seven Hills Wind Farm, Co. Roscommon - EIAR

DOCUMENT DETAILS

Client:	**Energia Renewables Ltd.**
Project Title:	**Proposed Seven Hills Wind Farm, Co. Roscommon - EIAR**
Project Number:	**190907**
Document Title:	**Bat Survey Report**
Document File Name:	**190907 – BR - F – 2022.05.26**
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Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	18/08/2021	AJ	JH
01	Final	26/05/2022	AJ	JH

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1. INTRODUCTION

MKO was commissioned to complete a comprehensive assessment of the potential effects on bats of a Proposed Development to be known as "Seven Hills Wind Farm", in the Brideswell, Dysert and Four Roads area, County Roscommon. This report provides details of the bat surveys undertaken, including survey design, methods and results, and the assessment of potential effects of the Proposed Development on bats. Where necessary, mitigation is prescribed to minimise the potential for likely significant effects.

Bat surveys were undertaken in 2020 in accordance with NatureScot (formerly Scottish Natural Heritage) Guidance 2019 [1], and are consistent with the amendments described in the NatureScot 2021[2] guidance. Bat surveys employed a combination of methods, including desktop study, habitat and landscape assessments, roost inspections, manual activity surveys and static detector surveys at ground level and at height (from existing on site met mast). Surveys in 2020 were based on an indicative turbine layout of 21 turbines. The final turbine layout includes 20 proposed turbines.

The assessment and mitigation provided in this report have been designed in accordance with NatureScot, 2021. Consideration was also given to the Northern Ireland Environment Agency (NIEA) Natural Environment Division (NED) Guidance [3], which was produced in August 2021, following the completion of the bat surveys at the Proposed Development site.

The EIAR Site Boundary encompasses an area of approximately 588 hectares. The permanent footprint of the Proposed Development measures approximately 29.8 hectares, which represents approximately 5% of the EIAR Site Boundary. The Proposed Development is described in detail in Chapter 4 of this EIAR.

1.1 Background

Wind energy provides a clean, sustainable alternative to fossil fuels in generating electricity. However, wind energy development can impact wildlife, directly through mortality and indirectly through disturbance and habitat loss. Bat fatalities have been reported at wind energy facilities around the world, raising concern about the cumulative impacts of such developments on bat populations (Arnett *et al.* 2016). No large-scale studies have been undertaken in Ireland to date. However, a study from the UK estimated bat fatalities at 0 – 5.25 bats per turbine per month (Mathews *et al.* 2016). While these results are not directly applicable to Ireland due to differences in bat species and behaviour, Ireland shares more similarities with bat assemblages of Great Britain, when compared to those of mainland Europe.

Investigative research in North America and mainland Europe have revealed the mechanisms for bat mortality at wind turbines. Fatalities arise from direct collision with moving turbine blades (Horn *et al.* 2008, Cryand *et al.* 2014) and barotrauma (Baer Wald *et al.* 2008), i.e. internal injuries caused by air pressure changes. Why bats fly in the vicinity of wind turbines has been attributed to several different behavioural and environmental factors, e.g. habitat associations, weather conditions and, species ecology.

Pre-construction bat surveys are undertaken to provide a baseline to gain an insight into bat activity in the absence of turbines and to predict and mitigate against any future risks identified. Survey design and analyses of results at the Proposed Development site were undertaken with reference to the latest

[1] *Scottish Natural Heritage published Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (SNH 2019).*
[2] *NatureScot published Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation. Version: August 2021 (NatureScot, 2021).*
[3] *Northern Ireland Environment Agency Natural Environment Division (NED) published Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland (NIEA, 2021).*

policy and legislation, scientific literature and industry guidelines. Any spatial, temporal or behavioural factors that may put bats at risk were fully considered.

1.2 Bat Survey and Assessment Guidance

Several guidelines for surveying bats at wind energy developments have been produced in Europe, the UK and Ireland.

At a European level, the Advisory Committee to the EUROBATS Agreement, to which Ireland is a signatory, have produced Guidelines for Consideration of Bats in Wind Farm Projects which outlines an approach for assessing the potential impacts of wind turbines on bats during planning, construction and operation phases (Rodrigues, 2015). However, these guidelines are based on continental scenarios and include more diverse species and behaviours than those typical of Ireland. As such, EUROBATS guidance may recommend a level of survey that may prove inappropriate in Irish scenarios. Nevertheless, the guidance is evidence-based and provides a useful European context, within which Member States are encouraged to produce specific national guidance, focusing on local circumstances.

Bat Conservation Ireland produced Wind Turbine/Wind Farm Development Bat Survey Guidelines (BCI, 2012a). This document provides advice to practitioners and decision makers in Ireland on necessary qualifications for surveyors, health and safety considerations, pre-construction and post-construction survey methodologies and information to be included in a report. In the absence of comprehensive Irish research, these guidelines provide generalised methodology rather than detailed technical advice.

The second edition of the UK Bat Conservation Trust Bat Survey Good Practice Guidelines (Hundt, 2012) includes a chapter (Chapter 10) on survey methodologies for assessing the potential impacts of wind turbines on bats. The document provides technical guidance for consultants carrying out impact assessments. However, the recommendations are not based on any research findings specific to the UK. A third edition to the guidelines, published in early 2016, removed the chapter on surveying wind turbine developments. Prior to the publication of the BCT guidelines, Natural England's *Bat and Onshore Wind Turbines: Interim Guidance* provided a pragmatic interpretation of the EUROBATS recommendations, as applied to onshore wind energy facilities in the UK (Natural England, 2014). In addition, the Chartered Institute of Ecology and Environmental Management (CIEEM) publishes advice on best practice as well as updates on the current state of knowledge in *the Technical Guidance Series* and in the quarterly publication *In Practice*.

In August 2021, NatureScot (formerly Scottish Natural Heritage), published *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (NatureScot, 2021). The 2021 version supersedes the 2019 version of the guidance. The purpose of the guidance is to help planners, developers and ecological consultants to consider the potential effects of onshore wind energy developments on bats. The emphasis is on direct impacts such as collision mortality, but there is reference throughout to the need for a full impact assessment requiring wider consideration of other (indirect) effects. The Guidance replaces previous guidance on the subject; notably that published by Natural England and Chapter 10 of the Bat Conservation Trust publication, *Bat Surveys: Good Practice Guidelines (2nd edition),* (Hundt, 2012) and tailors the generic EUROBATS guidance on assessing the impact of wind turbines on European bats (Rodrigues *et al.* (2014)). The document guides the user through the key elements of survey, impact assessment and mitigation.

The NIEA (NED) recently published *Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland*. This new guidance follows and builds upon the recently updated NatureScot 2021 guidance. The latter guidance has set the industry standard since its publication in 2019. The NED guidance does not aim to replace the NatureScot guidance, but it does provide additional clarifications and recommendations regarding survey requirements and impact assessment in an Irish context.

The survey scope, assessment and mitigation provided in this report are in accordance with NatureScot 2021 Guidance.

1.3 Statement of Authority

Scope development and project management was overseen by Aoife Joyce (BSc., MSc.) and John Hynes (BSc., MSc., MCIEEM). Aoife has three years' experience in ecological assessments and has completed CIEEM and BCI courses in Bat Impacts and Mitigation, Bat Tree Roost Identification and Endoscope training and Kaleidoscope Pro Analysis. John is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and has over 9 years' professional ecological consultancy experience. He is also a former member of the Bat Conservation Ireland management council.

Bat surveys were conducted by MKO ecologists Aoife Joyce (BSc., MSc.), Luke Dodebier (BSc.), Rachel Walsh (BSc.), Katie Pender (BSc.) and Neil Campbell (BSc.). All staff have relevant academic qualifications to complete the surveys and assessments that they were required to do.

Data analysis was undertaken, and results were compiled by Aoife Joyce and Luke Dodebier. Impact assessment, the design of mitigation and final reporting was completed by Aoife Joyce under the supervision of John Hynes (BSc., MSc.) and Pat Roberts (BSc., MCIEEM), who both reviewed and approved the final document. Pat has over 10 years' experience in management and ecological assessment.

1.4 Irish Bats: Legislation, Policy and Status

Ireland has nine resident bat species, comprising more than half of Ireland's native terrestrial mammals (Montgomery *et al.,* 2014).

All Irish bats are protected under European legislation, namely the Habitats Directive (92/43/EEC). All Irish species are listed under Annex IV of the Directive, requiring strict protection for individuals, their breeding sites and resting places. The lesser horseshoe bat (*Rhinolophus hipposideros*) is further listed under Annex II of the Directive, requiring the designation of conservation areas for the species. Under this Directive, Ireland is obliged to maintain the favourable conservation status of Annex-listed species. This Directive has been transposed into Irish law through the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011, as amended).

In addition, Irish species are further protected by national legislation (Wildlife Acts 1976-2021). Under this legislation, it is an offence to intentionally disturb, injure or kill a bat, or disturb its roost. Any work at a roost site must be carried out with the agreement of the National Parks and Wildlife Service (NPWS).

The NPWS monitors the conservation status of European protected habitats and species and reports their findings to the European Commission every 6 years in the form of an Article 17 Report. The most recent report for the Republic of Ireland was submitted in 2019. Table 1-1 summarises the current conservation status of Irish bat species and identified threats to Irish bat populations.

Table 1-1 Irish Bat Species Conservation Status and Threats (NPWS, 2019)

Bat Species	Conservation Status	Principal Threats
Common pipistrelle *Pipistrellus pipistrellus*	Favourable	**A05** Removal of small landscape features for agricultural land parcel consolidation (M) **A14** Livestock farming (without grazing) [impact of anti-helminthic dosing on dung fauna] (M) **B09** Clear--cutting, removal of all trees (M) **F01** Conversion from other land uses to housing, settlement or recreational areas (M) **F02** Construction or modification (e.g. of housing and settlements) in existing urban or recreational areas (M) **F24** Residential or recreational activities and structures generating noise, light, heat or other forms of pollution (M) **H08** Other human intrusions and disturbance not mentioned above (Dumping, accidental and deliberate disturbance of bat roosts (e.g. caving) (M) **L06** Interspecific relations (competition, predation, parasitism, pathogens) (M) **M08** Flooding (natural processes) **D01** Wind, wave and tidal power, including infrastructure (M)
Soprano pipistrelle *Pipistrellus pygmaeus*	Favourable	
Nathusius' pipistrelle *Pipistrellus nathusii*	Unknown	
Leisler's bat *Nyctalus leisleri*	Favourable	
Daubenton's bat *Myotis daubentoni*	Favourable	
Natterer's bat *Myotis nattereri*	Favourable	
Whiskered bat *Myotis mystacinus*	Favourable	
Brown long-eared bat *Plecotus auritus*	Favourable	
Lesser horseshoe bat *Rhinolophus hipposideros*	Inadequate	

2. PROJECT DESCRIPTION

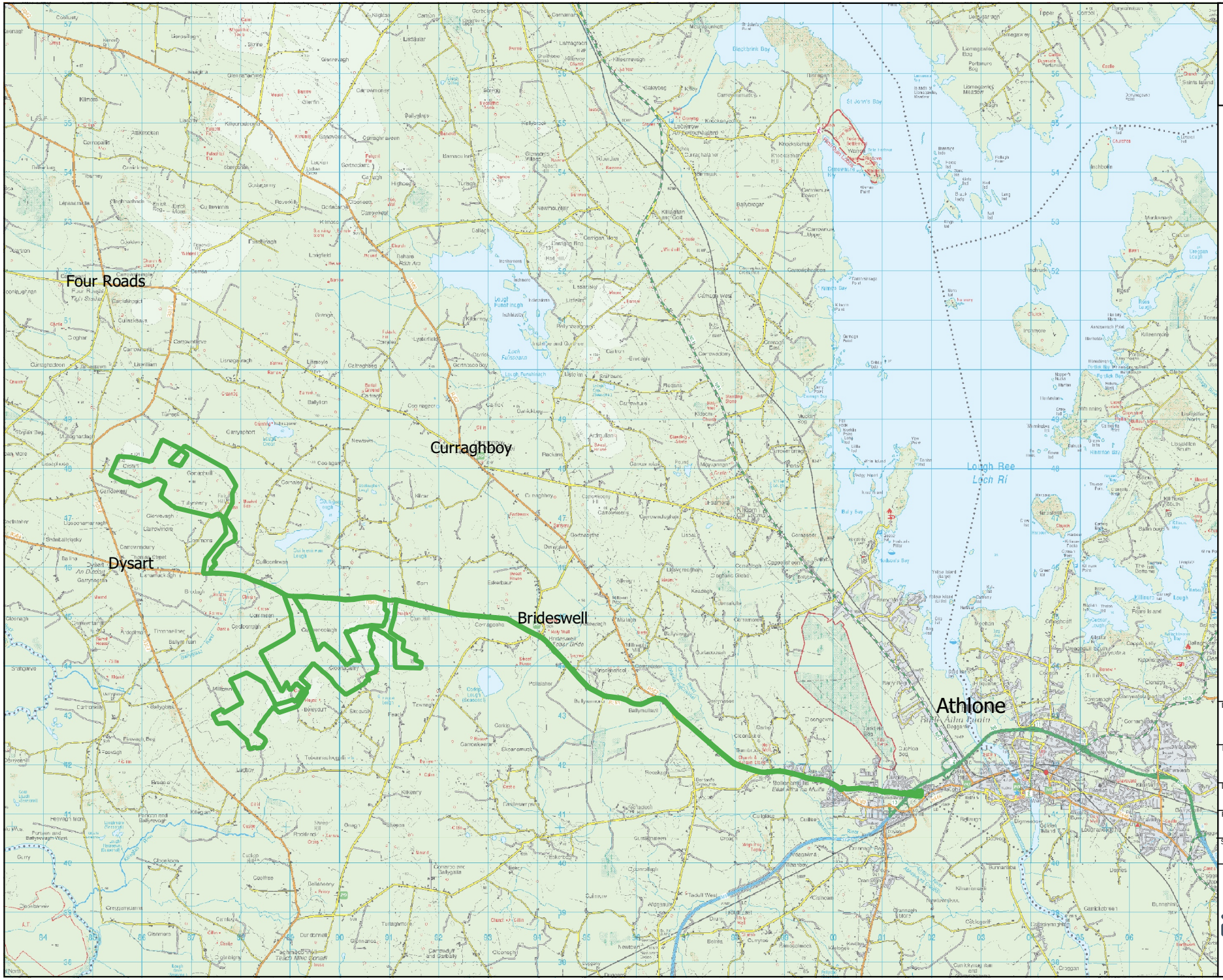
The Proposed Development site is located northeast and southeast of the village of Dysart, approximately 1.5 kilometres away at its closest point and approximately 11 kilometres northwest/west of the town of Athlone, Co. Roscommon. The proposed site covers an area of approximately 588 hectares, in total, and it is divided into two clusters (Figure 2-1).

A total of three site entrances are proposed for the construction stage of the Proposed Development in order to transport turbine components, materials and equipment to the site. The locations of the access junctions are shown in Figure 4-19, Chapter 4, and are described as follows:

- Access A on the R363 Regional Road into northern cluster of turbines (T1 to T7).
- Access B on the L7535 Local Road at the junction with R363, into the southwest cluster of turbines (T8 to T18), and
- Access C on the R363 Regional Road, into the southeast turbines (T19 and T20) and proposed onsite electrical substation

The land-use/activities within the Proposed Development site are almost entirely agricultural grasslands which are used for grazing and pasture farming in its current land use, with some small areas of scrub. Other land types within the surrounding area consist of small areas of non-commercial forestry, scrub, peat-cutting and low-density residential areas in nearby villages. There are a number of small lakes, turloughs and seasonal lakes are located within proximity of the site, which drain into the river suck, a tributary of the River Shannon, approximately 3km west of the Proposed Development site at its nearest point.

The project allows for the construction of 20 turbines with a ground to blade tip height of 180m. Further detail on the project description can be found in Chapter 4 of this EIAR.



Map Legend

EIAR Site Boundary

N

Drawing Title

Site Location

Project Title

Seven Hills Wind Farm, Co. Roscommon

Drawn By	Checked By
DN	ÓM
Project No.	Drawing No.
190907	Figure 2-1
Scale	Date
1:100000	30.05.2021

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3. METHODS

3.1 Consultation

A scoping exercise was undertaken as part of the EIAR for the Proposed Development. A Scoping Document, providing details of the application site and the Proposed Development, was prepared by MKO and circulated to consultees in March 2020. As part of this exercise, prominent Irish conservation groups were contacted, and Bat Conservation Ireland (BCI) and National Parks and Wildlife Service (NPWS) were specifically invited to comment on the potential of the Proposed Development to affect bats.

Details of consultation responses specifically related to bats are provided in Section 4.1 below.

3.2 Desk Study

A desk study of published material was undertaken prior to conducting field surveys. The aim was to provide context to the site in order to assist bat survey planning and assessment. This included the identification of designated sites, species of interest or any other potential risk factors within the EIAR Study Area and the surrounding region. The results of the desk study including sources of information utilised are provided below.

3.2.1 Bat Records

The National Bat Database of Ireland holds records of bat observations received and maintained by BCI. These records include results of national monitoring schemes, roost records as well as ad-hoc observations. A search of the National Bat Database of Ireland was last carried out on the 01/03/2022 and examined bat presence and roost records within a 10 km radius of a central point in Northern and Southern Study Areas (Grid Ref: E186656 N247682 and E189455 N244200) (BCI 2012, Hundt 2012, NatureScot 2021). Available bat records were provided by Bat Conservation Ireland on 04/03/2022. Results from the National Biodiversity Data Centre were also reviewed on 01/03/2022, for bat species present within the relevant 10km grid squares of the Proposed Development.

In addition, information on species' range and distribution, available in the 2019 Article 17 Reports (NPWS, 2019), was reviewed in relation to the location of the Proposed Development. The aim was to identify any high-risk species at the edge of their range.

3.2.2 Bat Species' Range

EU member states are obliged to monitor the conservation status of natural habitats and species listed in the Annexes of the Habitats Directive. Under Article 17, they are required to report to the European Commission every six years. In April 2019, Ireland submitted the third assessment of conservation status for Annex-listed habitats and species, including all species of bats (NPWS, 2019).

The 2019 Article 17 Reports were reviewed for information on bat species' range and distribution in relation to the location of the Proposed Development. The aim was to identify any high-risk species at the edge of their range (NatureScot, 2021).

3.2.3 Designated Sites

The National Parks and Wildlife Service (NPWS) map viewer and website provides information on rare and protected species, sites designated for nature conservation and their conservation objectives. A search was undertaken of sites designated for the conservation of bats within a 10 km radius of the

Study Area (BCI 2012, Hundt, 2012, NatureScot 2021). This included European designated sites, i.e. SACs, and nationally designated sites, i.e. NHAs and pNHAs.

3.2.4 Landscape Features

3.2.4.1 Ordnance Survey Mapping

Ordnance survey maps (OSI 1:5,000 and 1:50,000) and aerial photographs were reviewed to identify any habitats and features likely to be used by bats. Maps and images of the Study Area and general landscape were examined for suitable foraging or commuting habitats including woodlands and forestry, hedgerows, treelines and watercourses. In addition, any potential roost sites, such as buildings and bridges, were noted for further investigation.

3.2.4.2 Geological Survey Ireland and National Monuments Service

The Geological Survey Ireland (GSI) online mapping tool and University of Bristol Speleological Society (UBSS) Cave Database for the Republic of Ireland were consulted for any indication of natural subterranean bat sites, such as caves, within 10 km of the proposed site (BCI, 2012) (last searched on the 6th May 2022). Furthermore, the archaeological database of national monuments was reviewed for any evidence of manmade underground structures, e.g. souterrains, that may be used by bats (last searched on the 6th May 2022).

3.2.4.3 National Biodiversity Data Centre Bat Landscape Mapping

The National Biodiversity Data Centre (NBDC) map viewer presents “Bat Landscape” maps for individual species and for all species combined. Lundy et al. (2011) used Maximum Entropy Models to examine the relative importance of bat landscape and habitat associations in Ireland. The resulting map provides a 5-point scale, ranging from highest habitat suitability index (presented in red) to lowest suitability index (presented in green). However, squares highlighted as less favourable may still have local areas of abundance.

The location of the Proposed Development was reviewed in relation to bat habitat suitability indices. The aim of this was to assess habitat suitability for all bat species within the EIAR Study Area. It is worth noting that these results are based on a modelling exercise and not confirmed bat species records. Regardless, they may provide a useful indication of potential favourable bat associations within the proposed site.

3.2.4.4 Additional Wind Energy Projects in the Wider Landscape

A search for existing and permitted wind energy developments within 10km of the Proposed Development site was undertaken (NatureScot, 2021). The Wind Energy Ireland (WEI) interactive wind map (windenergyireland.com) was reviewed in conjunction with wind farm planning applications from Roscommon County Council. Other infrastructure developments and proposals (e.g. roads) were also noted. Information on the location and scale of these developments was gathered to inform cumulative effects. Further details on infrastructure developments within the vicinity of the Proposed Development can be found in Chapter 2 of the EIAR.

3.2.5 Multidisciplinary Surveys

Multidisciplinary walkover surveys were undertaken 2019, 2020 and 2021 (Table 3-1). The site was systematically and thoroughly walked in a ground-truthing exercise with the habitats on the proposed site assessed and classified. The Grid Connection route component of the Proposed Development was visited as part of the multidisciplinary surveys outlined in Chapter 6 of the main EIAR. The habitats (including any culverts/bridges) were assessed for bat commuting, foraging and roosting suitability.

During the static bat detector deployments and collections each season, any incidental records and bat habitat assessments were also carried out.

Multidisciplinary walkover surveys were undertaken within the site of the Proposed Development on the following dates:

Table 3-1 Multidisciplinary Survey Effort

Multidisciplinary Survey	Dedicated Bat Survey
25th October 2019	8th April 2020
17th December 2019	21st April 2020
8th May 2020	2nd June 2020
22nd May 2020	25th June 2020
22nd July 2020	18th August 2020
4th September 2020	1st September 2020
24th September 2020	
31st March 2021	

3.3 Field Surveys

3.3.1 Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out throughout 2020. During these surveys, habitats within the Study Area were assessed for their suitability to support roosting, foraging and commuting bats. Connectivity with the wider landscape was also considered. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories are divided into *High, Moderate, Low* and *Negligible*, and are described fully in **Appendix 1**.

3.3.2 Roost Surveys

A search for roosts was undertaken within 200m plus the rotor radius (i.e. 81m) of the Proposed Development footprint (NatureScot, 2021). The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. The site was visited in April, June, August and September 2020. A walkover was carried out and all structures and trees were assessed for their potential to support roosting bats (see **Appendix 1** for criteria in assessing roosting habitats).

Any potential roost sites were subject to a roost assessment. This comprised a detailed inspection of the exterior and interior (if accessible) to look for evidence of bat use, including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises.

Any potential tree roosts were examined for the presence of rot holes, hazard beams, cracks and splits, partially detached bark, knot holes, gaps between overlapping branches and any other potential roost features (i.e. PRFs) identified by Andrews (2018).

3.3.3 Manual Transects

Manual activity surveys comprised walked transects at dusk and dawn. A series of representative transect routes were selected throughout the Proposed Development site. The aim of these surveys was to identify bat species using the site and gather any information on bat behaviour and important features used by bats. Transect routes were prepared with reference to the proposed layout, desktop and walkover survey results as well as any health and safety considerations and access limitations. As

such, transect routes generally followed existing roads and tracks. Transect routes are presented in Figures 3-1 to 3-3.

Transects were walked by two surveyors, recording bats in real time. Dusk surveys commenced 30 minutes before sunset and were completed for 3 hours after sunset. Dawn surveys commenced 2 hours before sunrise until sunrise. Surveyors were equipped with active full spectrum bat detectors, the Batlogger M bat detector (Elekon AG, Lucerne, Switzerland), and all bat activity was recorded for subsequent analysis to confirm species identifications. Transects surveys were undertaken in Spring, Summer and Autumn 2020. Table 3-2 summarises survey effort in relation to walked transects.

Table 3-2 Survey Effort - Manual Transects

Date	Surveyors	Sunrise/ Sunset	Type	Weather	Walked (km)
8th April 2020	Aoife Joyce and Luke Dodebier	20:20	Dusk	10-15˚C, dry, calm	3.74
21st April 2020	Aoife Joyce and Luke Dodebier	06:22	Dawn	5-7˚C, dry, calm	1.97
2nd June 2020	Katie Pender and Claire Stephens	21:52	Dusk	12-15˚C, dry to light rain, calm	4.4
25th June 2020	Luke Dodebier and Rachel Walsh	05:04	Dawn – Roost only	15˚C, dry, calm	-
18th August 2020	Aoife Joyce and Rachel Walsh	20:53	Dusk	20˚C, dry, calm	3.6
1st September 2020	Rachel Walsh and Neil Campbell	06:43	Dawn – Roost only	14˚C, dry, calm	-
Total Survey Effort					**13.71km**

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Spring Transect Route

N

Drawing Title

Spring Transect Route

Project Title: Seven Hills Wind Farm, Co. Roscommon	
Drawn By: AJ	Checked By: AJ
Project No.: 190907	Drawing No.: 3-1
Scale: 1:16895	Date: 19.05.2022

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Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Summer Transect Route

N

Drawing Title
Summer Transect Route

Project Title
Seven Hills Wind Farm, Co. Roscommon

Drawn By	Checked By
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Project No.	Drawing No.
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Scale	Date
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Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Autumn Transect Route

N

Drawing Title

Autumn Transect Route

Project Title	
Seven Hills Wind Farm, Co. Roscommon	
Drawn By: AJ	Checked By: AJ
Project No.: 190907	Drawing No.: 3-3
Scale: 1:12447	Date: 19.05.2022

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3.3.4 Ground-level Static Surveys

Where developments have more than 10 turbines, NatureScot requires 1 detector per turbine up to 10 plus a third of additional turbines. Given that 21 turbines were initially proposed, 14 detectors were deployed to ensure compliance with NatureScot guidance.

Automated bat detectors were deployed at 14 no. locations for at least 10 nights in each of spring (April-May), summer (June-mid August) and autumn (mid-August-October) (NatureScot, 2021). Detector locations were based on indicative turbine locations and differ slightly to the final proposed layout. Detector locations achieved a representative spatial spread in relation to proposed turbines and sampled the range of available habitats. Figure 3-4 presents static detector locations in relation to the final proposed layout. Table 3-3 describes 2020 static detector locations.

Table 3-3 Ground-level Static Detector Locations

ID	Location (ITM)	Habitat	Linear Feature within 50m	Associated Turbine
D01	E186197 N248143	Stone wall, improved grassland, blackthorn hedge	Stone wall, Scattered trees	T1
D02	E186485 N247687	Stone wall, improved grassland, hawthorn trees	Stone wall, Scattered trees	T6 and T7
D03	E186906 N248015	Stone wall, improved grassland	Stone wall	T2 and T3
D04	E187749 N247656	Stone wall, improved grassland	Stone wall	T4
D05	E185858 N247813	Stone wall, improved grassland	Stone wall, Scattered trees	T5
D06	E190522 N244298	Stone wall, improved grassland, hawthorn stands	Stone wall, Scattered trees	T17 and T18
D07	E191225 N244383	Stone wall with hawthorn, improved grassland	Stone wall, Scattered trees/hedgerow	T19 and T20
D08	E189591 N243983	Stone wall, hazel, hawthorn	Stone wall, Scrub	T16
D09	E189373 N244493	Improved grassland, brambles	Stone wall, Scattered trees	T15
D10	E188950 N243661	Stone wall, improved grassland, hawthorn	Stone wall, Scattered trees	T13 and T14
D11	E187941 N243594	Blackthorn scrub	Scrub	T10 and T11
D12	E188259 N242452	Stone wall, hawthorn	Stone wall, Scattered trees/hedgerow	T9
D13	E188463 N242902	Hawthorn and hazel	Stone wall, Scattered trees, Scrub	T12
D14	E187814 N242713	Stone wall, blackthorn, hawthorn	Stone wall, Scattered trees,	T8

Full spectrum bat detectors, Song Meter SM4BAT (Wildlife Acoustics, Maynard, MA, USA), were employed using settings recommended for bats, with minor adjustments in gain settings and band pass filters to reduce background noise when recording. Detectors were set to record from 30 minutes before sunset until 30 minutes after sunrise. The Song Meter automatically adjusts sunset and sunrise times using the Solar Calculation Method when provided with GPS coordinates.

Onsite weather monitoring was undertaken concurrently with static detector deployments. One Vantage Pro 2 (Davis Instruments, CA, UCS) was deployed each season and night-time hourly data was tracked remotely to ensure a sufficient number of nights (i.e. minimum 10 no.) with appropriate weather conditions were captured (i.e. dusk temperatures above 8˚C, wind speeds less than 5m/s and no or only very light rainfall). Table 3-4 summarises survey effort achieved in 2020 for each of the 14 no. detector locations.

Table 3-4 Survey Effort - Ground-level Static Surveys

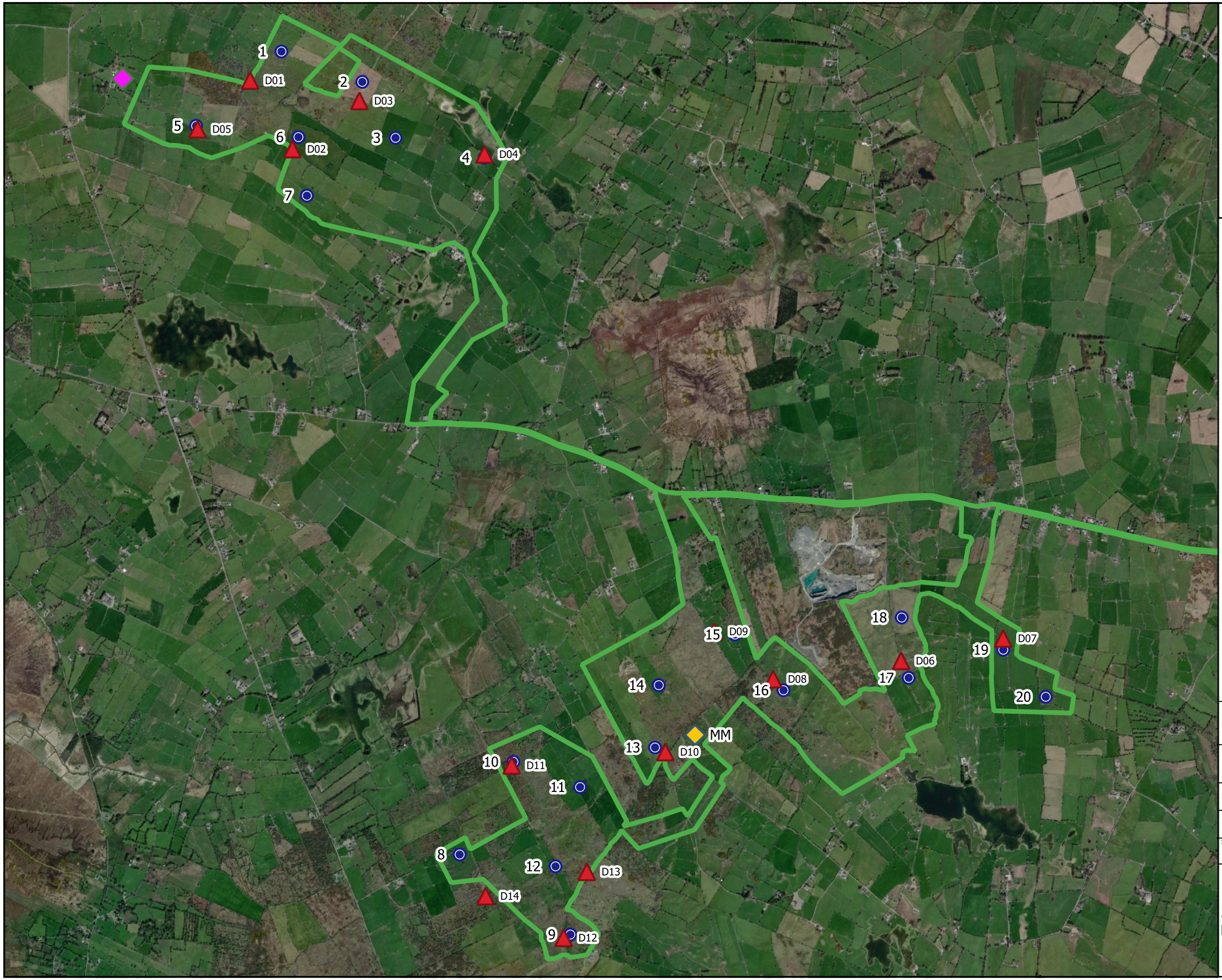
Season	Survey Period	Total Survey Nights per Detector Location	Nights with Appropriate Weather
Spring	8th April – 21st April 2020	13	12
Summer	2nd June – 25th June 2020	23	22
Autumn	18th August – 1st September 2020	14	13
Total Survey Effort		**50**	**47**

3.3.5 Static Surveys at Height

Monitoring at height can provide useful information on bat activity within the rotor sweep area and is particularly relevant at proposed key-holed sites (NatureScot, 2021). Simultaneous surveying at ground level and at height was undertaken throughout 2020. One Song Meter SM3BAT (Wildlife Acoustics, Maynard, MA, USA) was installed on a meteorological mast within the Proposed Development site (Grid Ref: E189176 N243812). The detector was equipped with two microphones; one at ground level and one at height (approx. 80m above ground level) to allow for simultaneous surveying. Table 3-5 describes survey effort in relation to surveys at height and the location of the met mast is illustrated in Figure 3-4.

Table 3-5 2020 Survey Effort - Static Surveys at Height

ID	Survey Period	Total Survey Nights
Period-1	19th – 29th August 2020	10
Period-2	1st – 16th September 2020	16
Period-3	6th – 12th October 2020	6
Total Survey Effort		**32**



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Static Detector Locations
- Met Mast
- Bat Roost

Drawing Title
Static detector, met mast and roost locations

Project Title
Seven Hills Wind Farm, Co. Roscommon

Drawn By	Checked By
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Project No. 190907	Drawing No. 3-4
Scale 1:32789	Date 19.05.2022

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Website: ww.mkoireland.ie

3.4 Bat Call Analysis

All recordings from 2020 were later analysed using bat call analysis software Kaleidoscope Pro v.5.1.9 (Wildlife Acoustics, MA, USA). The aim of this was to identify, to a species or genus level, what bats were present at the Proposed Development site. Bat species were identified using established call parameters, to create site-specific custom classifiers. All identified calls were also manually verified.

Echolocation signal characteristics (including signal shape, peak frequency of maximum energy, signal slope, pulse duration, start frequency, end frequency, pulse bandwidth, inter-pulse interval and power spectra) were compared to published signal characteristics for local bat species (Russ, 1999). Myotis species (potentially Daubenton's bat (*M. daubentonii*), Whiskered bat (*M. mystacinus*), Natterer's bat (*M. nattereri*) were considered as a single group, due to the difficulty in distinguishing them based on echolocation parameters alone (Russ, 1999). The echolocation of Soprano pipistrelle (*P. pygmaeus*) and Common pipistrelle (*P. pipistrellus*) are distinguished by having distinct (peak frequency of maximum energy in search flight) of ~55 kHz and ~46 kHz respectively (Jones & van Parijs, 1993).

Plate 3-1 below shows a typical sonogram of echolocation pulses for Common pipistrelle recorded with a SM4BAT bioacoustic static bat recording device. The recorded file is illustrated using Wildlife Acoustics Kaleidoscope software.

Individual bats of the same species cannot be distinguished by their echolocation alone. Thus, 'bat passes' was used as a measure of activity (Collins, 2016). A bat pass was defined as a recording of an individual species/species group's echolocation containing at least two echolocation pulses and of maximum 15s duration. All bat passes recorded in the course of this study follow these criteria, allowing comparison.

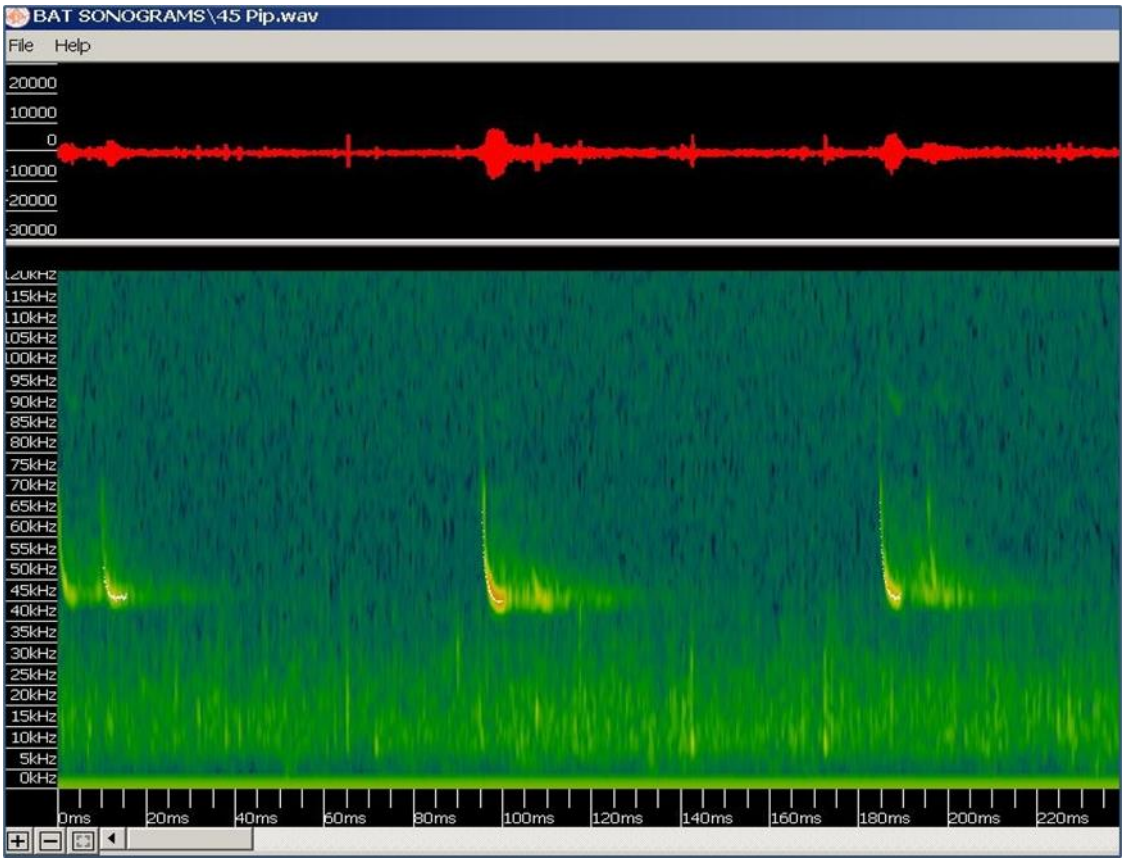

Plate 3-1 Sonogram of Echolocation Pulses of Common pipistrelle (Peak Frequency 45kHz)

3.5 Assessment of Bat Activity Levels

Static detector monitoring results were uploaded to the online database tool Eco bat (ecobat.org.uk). This web-based interface, launched in August 2016, allows users to upload activity data and to contrast results with a comparable reference range, allowing objective interpretation. Uploaded data then contributes to the overall dataset to provide increasingly robust outputs. Ecobat generates a percentile rank for each night of activity and provides a numerical way of interpreting levels of bat activity in order to provide objective and consistent assessments. Table 3-6 defines bat activity levels as they relate to Ecobat percentile values (NatureScot, 2021).

Static detector at ground level results for the Proposed Development were uploaded on the 13th November 2020. Database records used in analyses were limited to those within a similar time of year (within 30 days) and a within a similar geographic region (within 200km).

Guidelines in the use of Ecobat recommend a Reference Range of 2000+ to be confident in the relative activity level. The reference range is the stratified dataset of bat results recorded in the same region, at the same time of year, by which percentile outputs can be generated. This comprises all records of nightly bat activity across Ireland.

Although there is an increased uptake in the use of Ecobat in Ireland, some of the reference ranges remain below 2000. As Ecobat continues to be utilised in Ireland the accuracy of data outputs and results will improve over time. Results of Ecobat analysis for the Proposed Development site can be found in Table 4-7 in the results section below.

Table 3-6 Ecobat Percentile Score and Categorised Level of Activity (NatureScot, 2021)

Ecobat Percentile	Bat Activity Level
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate
0 to 20	Low

3.6 Assessment of Collision Risk

3.6.1 Population Risk

NatureScot (2021) provides a generic assessment of bat collision risk for UK species, based on species behaviour and flight characteristics. In the guidelines, this measure of collision risk is used, in combination with relative abundance, to indicate the potential vulnerability of British bat populations. No such assessment is provided for Irish bat populations.

In Plate 3-2, an adapted assessment of vulnerability for Irish bat populations to collision with wind turbine blades is provided. This adaptation of the NatureScot Guidance Table 2 was based on collision risk and species abundance of Irish bat populations. Species' collision risk follows those described in NatureScot (2021). Relative abundance for Irish species was determined in accordance with Wray *et al.* (2010) using population data available in the 2019 Article 17 reports (NPWS, 2019). Feeding and commuting behaviours, and habitat preferences for bat species in Ireland were also considered.

Relative Abundance	Low Collision Risk	Medium Collision Risk	High Collision Risk
Common species			Common pipistrelle Soprano pipistrelle
Rarer species	Daubenton's bat Brown long-eared bat Lesser horseshoe bat		Leisler's bat
Rarest species	Natterer's bat Whiskered bat		Nathusius' pipistrelle
	Low Population Vulnerability	Medium Population Vulnerability	High Population Vulnerability

Plate 3-2 Population Vulnerability of Irish Bat Species (Adapted from NatureScot, 2021)

3.6.2 Site Risk

The likely impact of a Proposed Development on bats is related to site-based risk factors, including habitat and development features. The cross-tablature result of habitat risk and project size determines the site risk (i.e. Low, Medium or High) (Plate 3-3) i.e. Table 3a (NatureScot, 2021). Table 5-1 in the results section describes the criteria and site-specific characteristics used to determine an indicative risk level for the proposed site. All site assessment levels, as per NatureScot (2021) are presented in **Appendix 2.**

		Project Size		
		Small	Medium	Large
Habitat Risk	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5
		Low/Lowest Site Risk (1-2)	Medium Site Risk (3)	High/Highest Site Risk (4-5)

Plate 3-3 Site-risk Level Assessment Matrix (Table 3a, NatureScot, 2021)

3.6.3 Overall Risk Assessment

An overall assessment of risk was made by combining the site risk level (i.e. Low/Medium/High) and the population risk (i.e. Ecobat bat activity outputs), as shown in the overall risk assessment matrix table (Plate 3-4) i.e. Table 3b (NatureScot, 2021). The assessment was carried out for both median and maximum Ecobat activity categories in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values).

	Ecobat Activity Category					
Site Risk Level	Nil (0)	Low (1)	Low-Moderate (2)	Moderate (3)	Moderate-High (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

Low Overall Risk (0-4)	Medium Overall Risk (5-12)	High Overall Risk (15-25)

Plate 3-4 Overall Risk Assessment Matrix (Table 3b, NatureScot, 2021)

This exercise was carried out for each high collision risk species. Plate 3-2 above outlines high collision risk species. Overall risk assessments were also considered in the context of any potential impacts at the population level, particularly for species identified as having high population vulnerability (Plate 3-2).

3.7 Limitations

A comprehensive suite of bat surveys has been undertaken at the Proposed Development site in 2020. The surveys undertaken in 2020, in accordance with NatureScot Guidance, provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the Proposed Development on bats receptors.

The information provided in this report accurately and comprehensively describes the baseline environment; provides an accurate prediction of the likely effects of the Proposed Development; prescribes mitigation as necessary; and describes the predicted residual impacts. The specialist studies, analysis and reporting have been undertaken in accordance with the appropriate guidelines.

No limitations in the scope, scale or context of the assessment have been identified. Overall, a comprehensive assessment has been achieved.

4. SURVEY RESULTS

4.1 Consultation

4.1.1 Bat Conservation Ireland

No response received from Bat Conservation Ireland as of the 24/05/2022.

4.1.2 Development Applications Unit - NPWS

A detailed scoping exercise was undertaken for the Proposed Development. A response from the Department of Culture, Heritage and the Gaeltacht provided recommendations regarding nature conservation, including bats. The relevant excerpts, specifically relating to bats, are summarised below and the full results of the scoping and consultation exercise are described in the main EIAR. The response was received on the 23/09/2020 and the letter is provided in Appendix 2-1 of the EIAR.

Hedgerows and Related Habitats

Hedgerows and uncultivated vegetation should be maintained where possible, as they form wildlife corridors and provide areas for birds to nest in; hedgerow trees provide a habitat for woodland flora, roosting places for bats and Badger setts may also be present. The EIAR should provide an estimate of the length/area of any hedgerow/uncultivated vegetation that will be removed. Where it is proposed that trees or hedgerows and uncultivated vegetation will be removed there should be suitable planting of native species in mitigation incorporated into the EIAR.

Bats

Bat roosts may be present in trees, buildings and bridges. All bat species are strictly protected under EC (Birds and Natural Habitats) Regulations, 2011 and listed on Annex IV of Habitats Directive. Bat roosts can only be disturbed and/or destroyed under licence issued under the Wildlife Act and a derogation under the EC (Birds and Natural Habitats) Regulations, 2011. An assessment of the impact of the proposed wind farm on bat species should be carried out noting recent guidance available, "Bat and Onshore Wind Turbines: Survey, Assessment and Mitigation, 2019" published jointly by Scottish Natural Heritage and Bat Conservation Trust and other stakeholders. The Department would like to highlight new survey research on patterns of bat activity in upland wind farms which indicates it is more appropriate to use 30 day survey periods with static automated detectors, in each season, and in different weather conditions to reduce sampling bias and to accurately determine when the curtailment mitigation is required during the operational phase. This survey should include use of detectors at different heights. Any proposed migratory bat friendly lighting should be proven to be effective and follow up to date guidance.

Post Construction Monitoring

The EIAR process should identify any pre and post construction monitoring which should be carried out. The post construction motoring should include bird and bat strikes/fatalities including the impact on any such results of the removal of carcasses by scavengers. Monitoring results should be made available to the competent authority and copied to this Department. A plan of action needs to be agreed at planning stage with the Planning Authority if the results in future show a significant mortality of birds and/or bat species.

Licences

Where there are impacts on protected species and their habitats, resting or breeding places, licenses may be required under the Wildlife Act 1976-2018 or derogations under the EC (Birds and Natural Habitats) Regulations 2011, as amended. In particular, bats and otters are strictly protected under Annex IV of the Habitats Directive.

In order to apply for any such licenses or derogations as mentioned above the results of a survey should be submitted to the National Parks and Wildlife Service of this Department. Such surveys are to be carried out by appropriately qualified person/s at an appropriate time of the year. Details of survey methodology should be provided.

Should this survey work take place well before construction commences, it is recommended that an additional ecological survey of the development site should take place immediately prior to construction to ensure no significant change in the findings of the baseline ecological survey has occurred. If there has been any significant change mitigation, this may require amendment and where a licence has expired, there will be a need for new licence applications for the protected species.

All recommendations made by the Department were fully considered in the design of bat surveys and the preparation of this report.

4.2 Desk Study

4.2.1 Bat Records

Bat Conservation Ireland

An information request form was sent to Bat Conservation Ireland to gather information on bat roosts and species composition within 1km and 10km of a central point within the Northern and Southern Study Areas (Grid Ref: E186656 N247682 and E189455 N244200). Available bat records were provided by Bat Conservation Ireland on 04/03/2022. The search yielded no results of roosts within a 1km radius of the Northern or Southern Cluster of the Proposed Development. The search was extended to include a 10km radius including roosts, transects and ad-hoc observations. A number of transects (n=2) and ad-hoc observations (n=49 including overlapping records) have been recorded. At least six of Ireland's nine resident bat species were recorded within 10 km of the proposed works including common and soprano pipistrelle, Leisler's bat, Daubenton's bat, Natterer's bat and brown long-eared bat, as well as several records of unidentified bats. The results of the database search are provided in Table 4-1.

Table 4-1 National Bat Database of Ireland Records within 10km

Record	Species	Grid Reference	Date	Locations/ Surveys
Within 10km of Northern Cluster				
Roost	*Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Plecotus auritus*	M9355	N/A	Private, Knockcroghery, County Roscommon
	Plecotus auritus, Nyctalus leisleri	M7852	N/A	Private, Ballygar, County Galway
Transect	*Myotis daubentonii, Unidentified bat, Pipistrellus spp.* (45kHz/55kHz)	M816463	N/A	Ballyforan Bridge Transect
	Myotis daubentonii	M8095057608	N/A	Rookwood Bridge Transect
Within 10km of Southern Cluster				
Transect	*Myotis daubentonii, Unidentified bat, Pipistrellus spp.* (45kHz/55kHz)	M816463	N/A	Ballyforan Bridge Transect
Northern and Southern Cluster				
Ad-hoc	*Myotis daubentonii, Myotis natterreri*	M9305655839	19/09/2005	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	M8753447834	01/06/2011	Consultancy Surveys
	Pipistrellus pygmaeus, Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M8792347747	01/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	M8708747588	01/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M8614048598	03/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M8650048474	03/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz)	M8643247379	03/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz)	M8575548212	26/05/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz)	M8610747676	26/05/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz)	M8570347835	26/05/2011	Consultancy Surveys
	Nyctalus leisleri	M8677247756	31/05/2011	Consultancy Surveys
	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz)	M8646647933	26/05/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M8749947462	31/05/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M8612748083	26/05/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M8691148164	31/05/2011	Consultancy Surveys
	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz)	M8610747676	26/05/2011	Consultancy Surveys
	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz)	M9037444336	17/06/2011	Consultancy Surveys
	Nyctalus leisleri	M8909944063	13/06/2011	Consultancy Surveys
	Nyctalus leisleri	M8774242691	15/06/2011	Consultancy Surveys
	Nyctalus leisleri	M8753542932	15/06/2011	Consultancy Surveys
	Pipistrellus pygmaeus, Pipistrellus pipistrellus (45kHz),Nyctalus leisleri	M9120244317	21/06/2011	Consultancy Surveys

	Pipistrellus pygmaeus, Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M9146844085	21/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri,Myotis spp.	M8838443633	04/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri, Plecotus auritus, Myotis spp.	M9052844069	17/07/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri, Pipistrellus pygmaeus, Myotis spp.	M9022144606	17/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M8860043292	13/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri, Pipistrellus pygmaeus	M8862143978	04/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri, Myotis spp.	M9092944514	17/07/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M8886544338	13/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M8810243127	04/06/2011	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Nyctalus leisleri	M8810243127	13/06/2011	Consultancy Surveys
	Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii	M775384	27/09/2009	BATLAS 2010
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	M8501643813	20/07/2018	BATLAS 2020
	Pipistrellus pygmaeus, Myotis daubentonii	M8159946316	20/07/2018	BATLAS 2020
	Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii	M8115253013	03/07/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Myotis daubentonii	M8089757668	03/07/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	M7945956732	04/09/2019	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Myotis spp.	M9464546908	23/05/2019	BATLAS 2020
	Pipistrellus pygmaeus	M9659343290	23/05/2019	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Pipistrellus spp. (45kHz/55kHz)	M9464546908	23/05/2019	BATLAS 2020
	Pipistrellus pygmaeus, Pipistrellus spp. (45kHz/55kHz)	M9437349627	23/05/2019	BATLAS 2020
	Pipistrellus pygmaeus, Nyctalus leisleri, Pipistrellus spp. (45kHz/55kHz)	M9531851102	23/05/2019	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	M9500047000	09/08/2004	Consultancy Surveys
	Pipistrellus pygmaeus, Nyctalus leisleri, Pipistrellus pipistrellus (45kHz)	M7880051400	20/05/2010	Consultancy Surveys
	Myotis daubentonii	M8170054700	04/06/2006	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz)	M8170054700	05/06/2006	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Pipistrellus spp. (45kHz/55kHz)	M9040835286	23/07/2019	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	M9688447252	23/05/2019	BATLAS 2020
	Pipistrellus pygmaeus, Pipistrellus spp. (45kHz/55kHz)	M9772451066	23/05/2019	BATLAS 2020

National Biodiversity Data Centre

The National Bat Database of Ireland was searched for records of bat activity and roosts within a 10km radius of the Proposed Development site (last search 06/05/2022). Hectads M84 and M94 lie within 10km of the proposed EIAR site boundary. Five of Ireland's nine resident bat species were recorded within 10 km of the proposed works including Brown long-eared bat, Soprano pipistrelle, Common pipistrelle, Leisler's bat, and Daubenton's bat. The results of the database search are provided in Table 4-2.

Table 4-2 NBDC Bat Records within 10km of Proposed Development

Grid Square	Species	Database	Designation
M94	Brown long-eared bat *Plecotus auratus*	National Bat Database of Ireland	HD Annex IV, WA
M84	Daubenton's bat *Myotis daubentonii*	National Bat Database of Ireland	HD Annex IV, WA
M84 & M94	Leisler's bat *Nyctalus leisleri*	National Bat Database of Ireland	HD Annex IV, WA
M84 & M94	Common pipistrelle *Pipistrellus pipistrellus*	National Bat Database of Ireland	HD Annex IV, WA
M84 & M94	Soprano pipistrelle *Pipistrellus pygmaeus*	National Bat Database of Ireland	HD Annex IV, WA

4.2.2 Bat Species Range

The potential for negative impacts is likely to increase where there are high risk species at the edge of their range (NatureScot, 2021). Therefore, range maps presented in the 2019 Article 17 Reports (NWPS, 2019) were reviewed in relation to the location of the Proposed Development.

The Proposed Development site is located outside the current known range for Nathusius' pipistrelle, Whiskered bat and Lesser horseshoe bat. The site is within range but at the edge for Natterer's bat and within range but not at the edge for all other species.

4.2.3 Designated Sites

Within Ireland, the Lesser horseshoe bat is the only bat species requiring the designation of Special Areas of Conservation (SACs) and the Proposed Development site is situated outside the known range of this species. Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) may be designated for any bat species. A search of NHAs and pNHAs within a 10 km radius of the EIAR Study Area found no sites designated for the conservation of bats.

4.2.4 Landscape Features and Habitat Suitability

A review of mapping and photographs provided insight into the habitats and landscape features present at the Proposed Development site. In summary, the primary land use within the proposed site is agriculture with mixed grassland habitats present.

A review of the GSI online mapper did not indicate the possible presence of any subterranean sites within the Study Area. A search of the National Monuments Database revealed the presence of three manmade subterranean sites within the EIAR Site Boundary of which the Proposed Development has avoided (Table 4-3).

Table 4-3 Man-made Subterranean Sites with the Study Area

Class	Location (ITM)	Description	Compiled by
Souterrain RO047-014002-	Townland: Cronin 586116 747585	On a gentle SE-facing slope. There is local knowledge of a short souterrain passage in the disturbed SW quadrant of the interior of rath (RO047-014001-).	Michael Moore 24 August 2010
Souterrain RO047-067—	Townland: Cronin 585859 747850	On a gentle S-facing slope c. 30m S of rath (RO047-010001-). An underground passage was discovered in 1934 (Irish Times 3-1-34; Connaught Tribune 6-1-34) which is described locally as a passage (L c. 4m) leading through a creep to a beehive chamber. It was closed c. 1980.	Michael Moore 24 August 2010
Souterrain RO047-084—	Townland: *Gortaphuill (Athlone North By.)* 587565 747699	On a gentle ENE-facing slope. A lintel of a drystone-built but inaccessible passage (L 2m; Wth 0.75m; H 0.2m) is oriented NE-SW with a further length of exposed and collapsed passage (L 2.6m) at its NE end, which leads to a circular depression (diam. c. 7m). Rath (RO047-029—) is c. 100m to the WNW.	Michael Moore 24 August 2010

A search of the UBSS Cave Database for the Republic of Ireland found no caves within the Proposed Development site or within 10km of the EIAR Site Boundary.

A review of the NBDC bat landscape map provided a habitat suitability index of 23.22 (yellow). This indicates that the Proposed Development area has moderate habitat suitability for bat species.

4.2.5 Other Wind Energy Developments

Table 4-4 provides an overview of wind farms in the vicinity of the Proposed Development.

Table 4-4 Wind Farm Developments within 10km of the Proposed Development

Wind Farm Name and Location	No. Turbines	Status
Within 5km of Proposed Seven Hills Wind Farm		
None	-	-
Within 10km of Proposed Seven Hills Wind Farm		
Skrine Wind Farm, Roscommon	2	Existing

4.3 Overview of Study Area and Bat Habitat Appraisal

A total of twelve habitats were recorded within the Proposed Development site, including;

- Improved agricultural grassland (GA1)
- Dry calcareous and neutral grassland (GS1)
- Scrub (WS1)
- Arable land (BC1)
- Turloughs (FL6)
- Eutrophic lakes (FL5)
- Eroding/upland rivers (FW1)
- Stone walls (BL1)
- Hedgerows (WL1)
- Spoil and bare ground (ED2)
- Recolonising bare ground (ED3)
- Buildings and Artificial Surfaces (BL3)

The habitats within the EIAR Site Boundary are dominated by Improved Agricultural and Dry Calcareous and Neutral grassland with smaller areas of Scrub, Arable land and Wet grassland (GS4) associated with Turloughs where they are subject to long periods of groundwater inundation. Chapter 6 of the main EIAR, describes the various habitats within the site in more detail.

Given the extent of low intensity managed seminatural grassland habitat occurring within the EIAR Study Area, scrub habitat occurs in association with much of this grassland habitat. Scrub habitat within the site is largely dominated by patches of blackthorn and hawthorn, although areas dominated by hazel or gorse scrub also occur throughout the EIAR Study Area. A number of fields within the EIAR Study Area have also been used for arable crop production, generally oats.

No watercourses occur within close proximity to any of the proposed turbine infrastructure. However, a number of watercourses occur along the proposed grid connection route.

Stone walls are the dominant boundary feature within the study area. In places, these stone walls have become enveloped by bramble and some lined with blackthorn, hawthorn or hazel.

Hedgerows occur throughout the study area, usually in association with stone walls. Hedgerows are largely dominated by blackthorn or hawthorn and in some areas hazel. Bramble dominated the understory in places, and on occasion bracken (*Pteridium aquilinum*).

There are some farm and residential buildings within the EIAR study area boundary comprised? of agricultural sheds. These were categorised as Buildings and artificial surfaces.

Results from the desktop review and walkover surveys were used to assess habitats for their suitability to support foraging and commuting bats, and roosting bats, according to Collins (2016). Suitability categories, divided into *High, Moderate, Low* and *Negligible*, are described fully in **Appendix 1**.

With regard to foraging and commuting bats, areas of open grassland habitats were considered *Negligible* suitability, i.e. negligible habitat features on site likely to be used by commuting or foraging bats (Collins, 2016). Hedgerows and scrub provide good connectivity to the surrounding landscape. As such, they were assessed as having *Moderate* to *High* suitability i.e. Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge (Collins, 2016). Stone walls forming field boundaries were assessed as having *Low* commuting and foraging potential i.e. habitat that could be used by small numbers of commuting bats (Collins, 2016).

An assessment of the various hedgerow and scrub habitats was undertaken. Trees present on site comprise a mixture of mature and immature hawthorn, blackthorn and hazel. Overall trees within the site did not provide optimal habitat for roosting bats and were assessed as having *Negligible* roosting potential.

A derelict structure located outside the EIAR Study Area was assessed as having *Moderate to High* roosting potential (i.e. A structure with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat).

All other habitats present were assigned a *Negligible* value.

4.3.1 Grid Connection Route

A connection between the onsite electrical substation and the national electricity grid will be necessary to export electricity from the Wind Farm site. It is proposed to construct a 110 kV substation within the site and to connect from here via a 110 kV underground cable connection to the existing Athlone 110 kV substation in Monksland, located approximately 11.3km to the east of the Southern Cluster, via underground cabling. The majority of the Grid Connection route is located within the public road and measures approximately 12km in total. No watercourses occur within close proximity to any of the proposed turbine infrastructure. However, a number of watercourses occur along the proposed Grid Connection route.

The proposed underground cable route will leave the site of the Proposed Development to the north of the proposed on site electrical substation, initially passing through a short section of proposed access track before joining the R363, also categorised as *Buildings and artificial surfaces (BL3).* In addition, the proposed cable route will also travel north from the proposed onsite substation and leave the site via a proposed access track, categorised as *Buildings and Artificial Surfaces (BL3).* The underground cable route runs along the R363 for approximately 12km before joining the existing Athlone 110kV substation. The underground cable route will be confined to existing site and public roads.

A total of 5 no. watercourse crossings have been identified along the proposed Grid Connection route and the underground cabling connecting the two clusters of the site. Watercourse crossings WC1, WC3 and WC4 consist of concrete pipes while WC2 and WC5 contain stone arch bridges. Each of the water crossing locations along the underground cable route were assessed by means of a visual inspection survey on 24th September 2020 and 31st March 2021, for their suitability to support roosting bats (Table 4-5). No evidence of bat use, including live or dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises were identified at any of the water crossings.

Crossings over the 2 no. existing stone/concrete arch bridges will be either via a standard trefoil formation or horizontal directional drilling (HDD). Further details on water crossings along the underground cable route, locations and the proposed crossing method at each location is provided in Chapter 4, Table 4-7 of this EIAR.

With regard to commuting and foraging bats, features along the underground cable route were assessed as having *Low-Moderate* suitability i.e. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water (Collins, 2016).

With regard to roosting bats, habitat features along the underground cable route, including roads and tracks, were assessed as having *Negligible* suitability i.e. Negligible habitat features likely to be used by roosting bats/trees of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential (Collins, 2016).

Other than the features presented in Table 4-5 below, no potential roost features were identified along the underground cable route. No trees are proposed for removal along the underground cable route.

Table 4-5 Proposed Grid Connection Water Crossings

Watercourse Crossing Reference No.	Location (Irish Grid Ref)	Watercourse Bridge Type	Extent of Works	Bat Habitat Suitability
WC1	E188502 N245631	1,500mm Ø concrete pipe	No works required to concrete pipe.	***Negligible*** *– no suitable gaps/crevices. No evidence of bat use identified.*
WC2	E194367 N244305	1.5m stone arch bridge	No bridge arch works required.	***Moderate*** *– some gaps present in bridge arch where mortar has*

Watercourse Crossing Reference No.	Location (Irish Grid Ref)	Watercourse Bridge Type	Extent of Works	Bat Habitat Suitability
				become dislodged. No evidence of bat use identified.
WC3	E196502 N243324	1,500mm Ø concrete pipe	No works required to concrete pipe.	***Negligible** – no suitable gaps/ crevices. No evidence of bat use identified.*
WC4	E198134 N241946	>500mm Ø concrete pipe	No works required to concrete pipe.	***Negligible** – no suitable gaps/crevices. No evidence of bat use identified.*
WC5	E199391 N241746	2.5m concrete arch overbridge	No bridge arch/deck works required.	***Low** – gap present where bridge deck sits on abutment. No evidence of bat use identified.*

Plate 4-1 Bridge Watercourse Crossing - WC2 exterior

Plate 4-2 Bridge Watercourse Crossing - WC2 interior

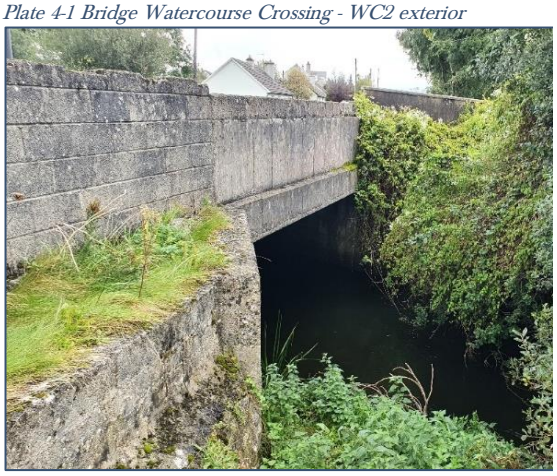

Plate 4-3 Bridge Watercourse Crossing - WC5 exterior

Plate 4-4 Bridge Watercourse Crossing - WC5 interior

4.4 Roost Surveys

Following the search for roosts in 2020, no structures containing potential suitable bat roost features were identified within 200m plus the rotor radius (81m) of the Proposed Development footprint. The initial indicative survey area included a wider study area that included a structure which was identified as a roost. This structure is located approximately 100m outside the final EIAR Study Area, approximately 550m away from the nearest proposed turbine, and is not within the likely zone of influence. However, the structure was subjected to a roost assessment in 2020 and is described below.

One structure was identified as a potential roost structure outside the EIAR Site Boundary (Grid Ref: E185346 N248163) and was subject to a roost assessment (Plate 4-5 and 4-6). This comprised a detailed inspection of the interior and exterior to look for evidence of bat use, including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises.

Dusk emergence surveys were carried out on the nights of the 2nd of June and 18th August 2020. Dawn re-entrance surveys were undertaken on the mornings of the 25th of June and 1st September 2020. For each survey, two surveyors were equipped with Bat Logger M bat detectors (Elekon AG, Lucerne, Switzerland). Conditions were suitable for bat surveys; dry, warm and calm. The emergence surveys commenced half an hour before sunset and lasted for one hour. The re-entrance surveys commenced two hours before sunrise and concluded at sunrise.

During the dusk survey on 2nd June, approximately 15 bats were observed emerging from various locations within the structure. These included Common and Soprano pipistrelles emerging from under chimney flashing, ridge tiles, broken windows and open doors. The dawn survey on 25th June identified 3 bats, Soprano and Common pipistrelle, re-entering the structure through the same locations mentioned above.

The dusk survey completed on 18th August yielded 2 Soprano pipistrelle bats emerging from the northern elevation. During the dawn survey on 1st September 3-4 Soprano pipistrelle and Common pipistrelle bats were observed foraging and swarming around the structure; however, no bats were observed re-entering the structure.

After emerging from the roost, all bats travelled in a northerly direction, away from the Proposed Development footprint.

The Proposed Development site was also checked for potential tree roosts but no trees with significant roosting features were identified within the site. Trees may have increased or decreased probability of hosting roosting bats in certain circumstances i.e. Having large broadleaf trees with cavities or other damage such as rot or loose bark increased probability whereas, Conifer plantations and young trees with little – no damage have a decreased probability of hosting bats (Kelleher and Marnell, 2006). The surrounding habitats were assessed as largely unsuitable for roosting bats.

Plate 4-5 South facing elevation of structure identified as a bat roost.

Plate 4-6 North facing elevation of structure identified as a bat roost.

4.5 Manual Transects

Manual transects were undertaken in Spring, Summer and Autumn 2020. Bat activity was recorded on all surveys. In general, Soprano pipistrelle (n=897) was recorded most frequently, followed by Common pipistrelle (n=744) and Leisler's bat (n=108). Instances of *Myotis spp.* (n=29), Nathusius' pipistrelle (n=12) and Brown long-eared bat (n=4) were less frequent. However, species composition and activity levels varied significantly between surveys. Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort). Plate 4-7 presents results for individual species per survey period. The dawn Summer and Autumn surveys focused on the re-entry of bats into the identified roost, set out above. Figures 4-1 – 4-3 present the spatial distribution of bat activity across the surveys. Bat activity was concentrated along hedgerows, scrub, walls and linear (road/track) habitats.

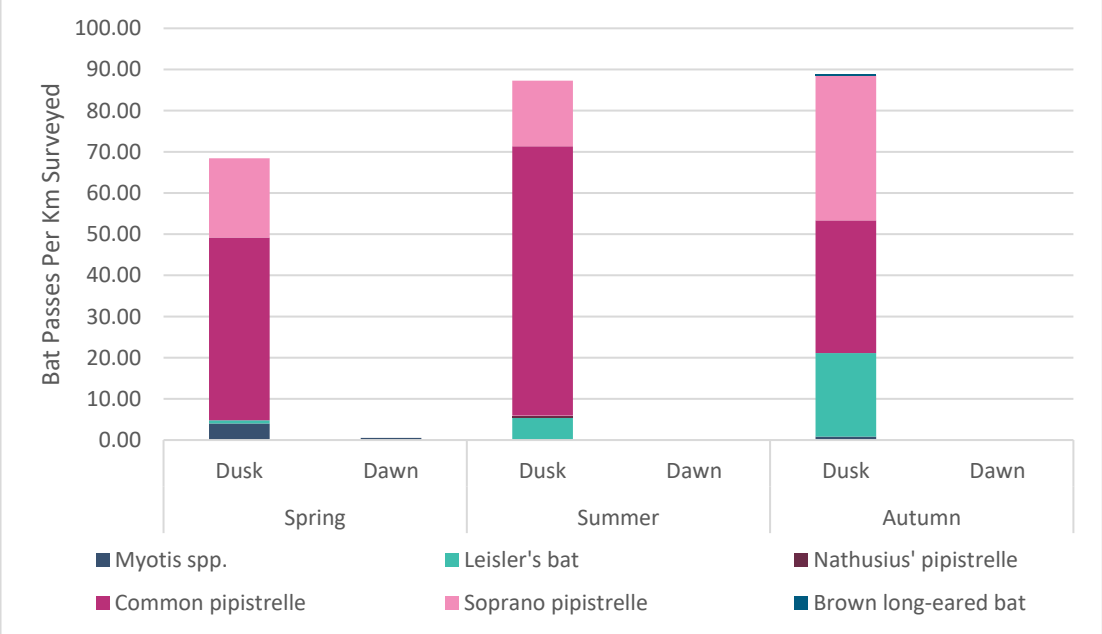

Plate 4-7 2020 Transect Results - Species Composition Per Survey Period

Figures 4-2 and 4-3 show bat activity which was concentrated at the derelict structure. Surveyors were positioned at the derelict structure, for 1.5hours during the dusk surveys and for the duration of the dawn surveys in Summer and Autumn, to look for bats exiting and re-entering the building. Bats were observed and recorded commuting between the building and treelines to surrounding areas.

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Spring Transect Route

Spring 2020 Transect Results

- Myotis spp.
- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title

Spring Transect Results

Project Title	Seven Hills Wind Farm, Co. Roscommon
Drawn By: AJ	Checked By: AJ
Project No.: 190907	Drawing No.: 4-1
Scale: 1:16895	Date: 19.05.2022

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Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Summer Transect Route

Summer 2020 Transect Results

- Leisler's bat
- Nathusius' pipistrelle
- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title

Summer Transect Results

Project Title: Seven Hills Wind Farm, Co. Roscommon	
Drawn By: AJ	Checked By: AJ
Project No.: 190907	Drawing No.: 4-2
Scale: 1:12447	Date: 19.05.2022

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Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Autumn Transect Route

Autumn 2020 Transect Results

- Myotis spp.
- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle
- Brown long-eared bat

Drawing Title

Autumn Transect Results

Project Title	
Seven Hills Wind Farm, Co. Roscommon	
Drawn By: AJ	Checked By: AJ
Project No.: 190907	Drawing No.: 4-3
Scale: 1:6223	Date: 19.05.2022

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4.6 Ground-level Static Surveys

In total, 64,082 bat passes were recorded across all deployments. In general, Common pipistrelle (n=43,072) occurred most frequently, followed by Leisler's bat (n=10,360), Soprano pipistrelle (n=5,203) and *Myotis spp.* (n=4,284). Instances of Brown long-eared bat (n=1,043) were significantly less. Nathusius' pipistrelle (n=120) was rare. Plate 4-8 presents relative species composition across all ground-level static detector surveys.

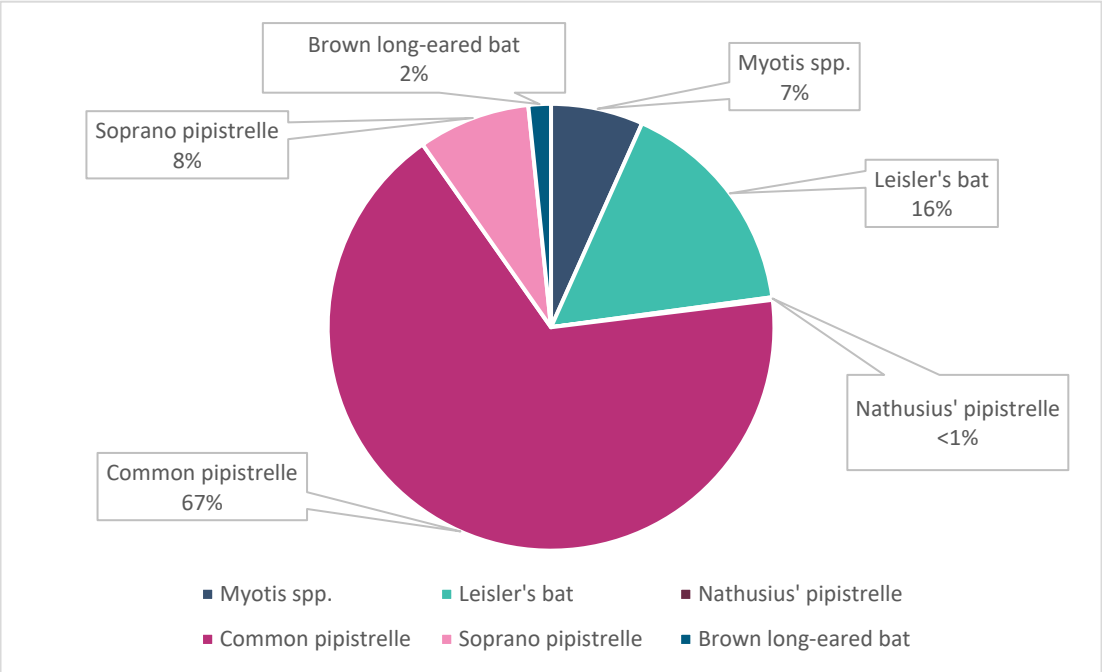


Plate 4-8 2020 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes)

Bat activity was calculated as total bat passes per hour (bpph) per season to account for any bias in survey effort, resulting from varying night lengths between seasons. Plate 4-9 and Table 4-6 presents these results for each species. Bat activity was dominated by Common pipistrelle across all seasons. In addition, Leisler's bat occurred frequently in Summer. Instances of Soprano pipistrelle and *Myotis* spp. were less frequent. Brown long-eared bat and Nathusius' pipistrelle were relatively rare.

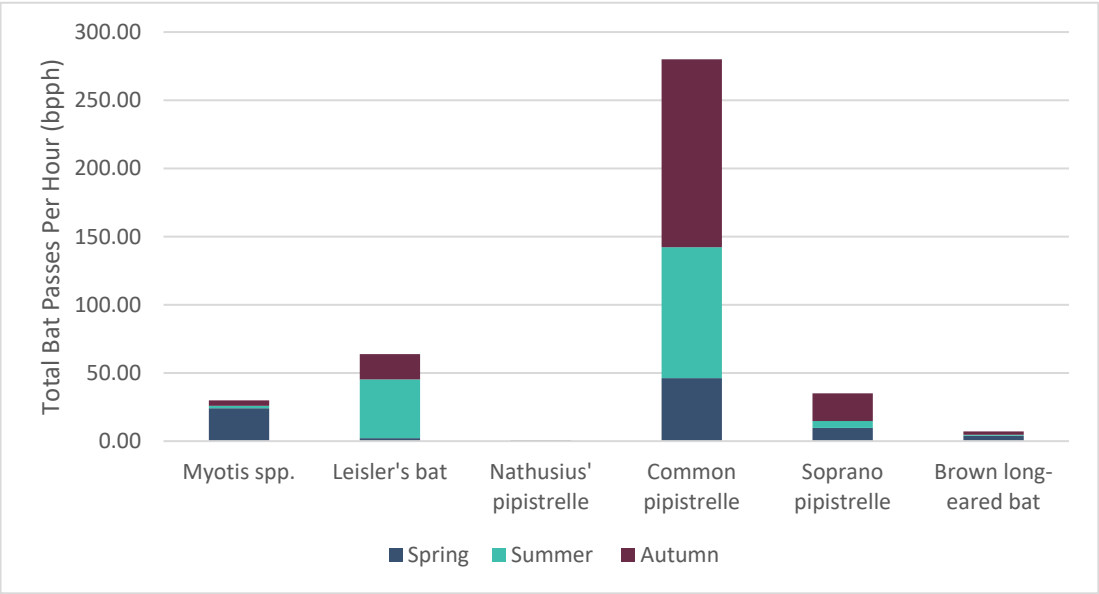


Plate 4-9 2020 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

Table 4-6 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

	Spring	Summer	Autumn
Total Survey Hours	**140.7**	**169.9**	**147**
Myotis spp.	24.16	1.74	4.01
Leisler's bat	2.13	43.12	18.60
Nathusius' pipistrelle	0.09	0.33	0.35
Common pipistrelle	46.25	96.03	137.75
Soprano pipistrelle	9.69	5.01	20.33
Brown long-eared bat	3.98	0.72	2.46

The Nightly Pass Rate (i.e. total bat passes per hour, per night) was used to determine typical bat activity at the Proposed Development site. Activity is often variable between survey nights. Therefore, the Median Nightly Pass Rate was used as the most appropriate measure of bat activity (Lintott & Mathews, 2018). Plate 4-10 illustrates the Median Nightly Pass Rate per species per deployment. Zero data, when a species was not detected on a night, was also included.

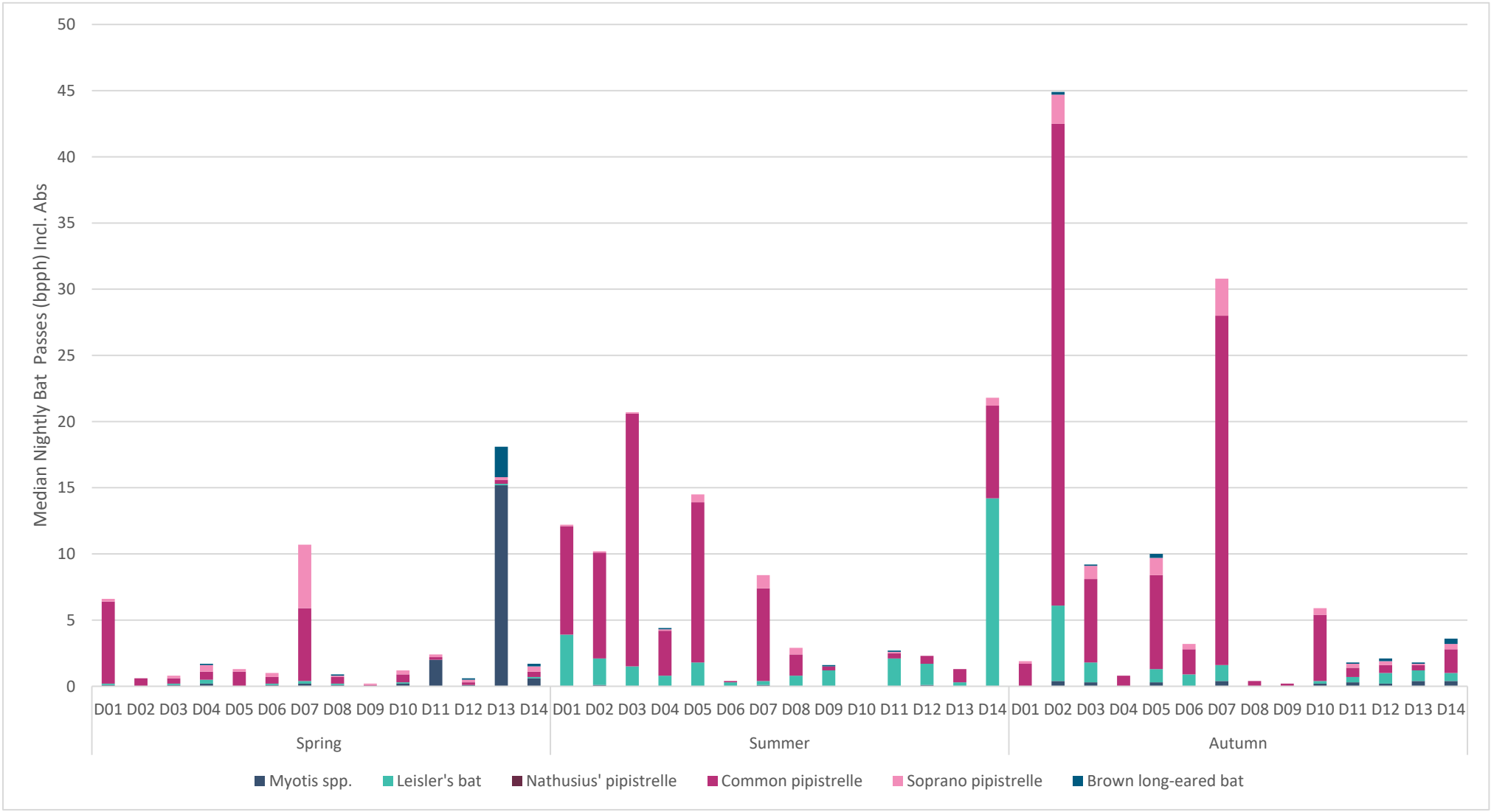


Plate 4-10 Static Detector Surveys: Median Nightly Pass Rate (bpph) Including Absences, Per Location Per Survey Period

Myotis spp. activity at D13 during the Spring period was significantly higher than all other deployments. *Myotis spp.* was also predominant at D11 and D14 in Spring. Common pipistrelle was predominant at all other detectors during the Spring survey period. Summer bat activity at all detectors was dominated by Common pipistrelle or Leisler's bat. Autumn activity was dominated by Common pipistrelle at the majority of detector locations. In addition, activity at D02 and D07 in Autumn was significantly higher than all other detectors during the same period.

Bat activity levels were objectively assessed against a reference dataset using Ecobat. Table 4-7 presents the results of Ecobat analysis for each species per season on a site-level. **Appendix 3** provides these results per detector. Median activity levels for Leisler's bat and Common pipistrelle peaked at ***Moderate to High*** for at least one season. Median activity levels for Soprano pipistrelle and *Myotis spp.* peaked at ***Moderate*** for at least one season. Median activity levels for Brown long-eared bat peaked with ***Low to Moderate*** activity for at least one season. Nathusius' pipistrelle recorded ***Low*** median bat activity across all seasons. Maximum activity levels peaked with ***High*** activity for all species for at least one season.

Table 4-7 Static Detector Surveys: Site-level Ecobat Analysis

Survey Period	Median Percentile	Median Bat Activity	Max Percentile	Max Bat Activity	Nights Recorded	Ref Range
Common pipistrelle						
Spring	56	Moderate	99	High	169	1816
Summer	80	Moderate - High	99	High	268	6291
Autumn	80	Moderate - High	100	High	173	5650
Soprano pipistrelle						
Spring	38	Low - Moderate	97	High	148	1576
Summer	30	Low - Moderate	83	High	191	5578
Autumn	58	Moderate	99	High	148	5849
Nathusius' pipistrelle						
Spring	5	Low	25	Low - Moderate	12	243
Summer	12	Low	75	Moderate - High	20	1307
Autumn	19	Low	85	High	19	1607
Leisler's bat						
Spring	25	Low - Moderate	78	Moderate - High	106	1717
Summer	64	Moderate - High	98	High	258	5575
Autumn	70	Moderate - High	97	High	136	4660
***Myotis* spp.**						
Spring	38	Low - Moderate	97	High	130	1345
Summer	12	Low	82	High	118	3806
Autumn	47	Moderate	91	High	113	4194
Brown long-eared bat						
Spring	25	Low - Moderate	87	High	75	531
Summer	12	Low	64	Moderate - High	75	1937
Autumn	38	Low - Moderate	82	High	103	2852

4.7 Surveys at Height

Simultaneous surveying at ground level and at height was undertaken using an SM3 static detector. One U1 microphone was attached at height (Approx. 80m) to the meteorological mast while another U1 microphone was placed 2m from ground level.

In 2020, 32 nights of simultaneous bat monitoring at ground level and at height was achieved. In total, 107 bat passes were recorded with bat activity significantly higher at ground level (75%) compared to activity at height (25%) (Plate 4-11). Leisler's bat (n=24) and Soprano pipistrelle (n=3) were recorded at height. Leisler's bat (n=34), Soprano pipistrelle (n=18), Brown long-eared bat (n=12), Common pipistrelle (n=8), *Myotis spp.* (n=5) and Nathusius' pipistrelle (n=3) were recorded at ground level. Plate 4-12 shows species composition per night.

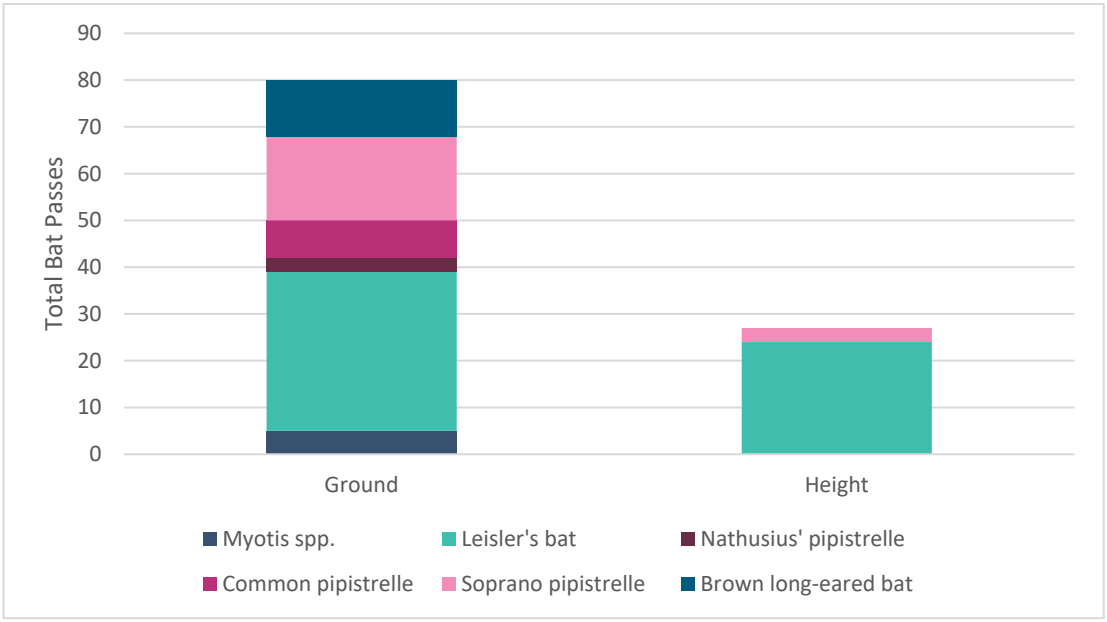


Plate 4-11 Surveys at Height: Species Composition Per Microphone Per Deployment

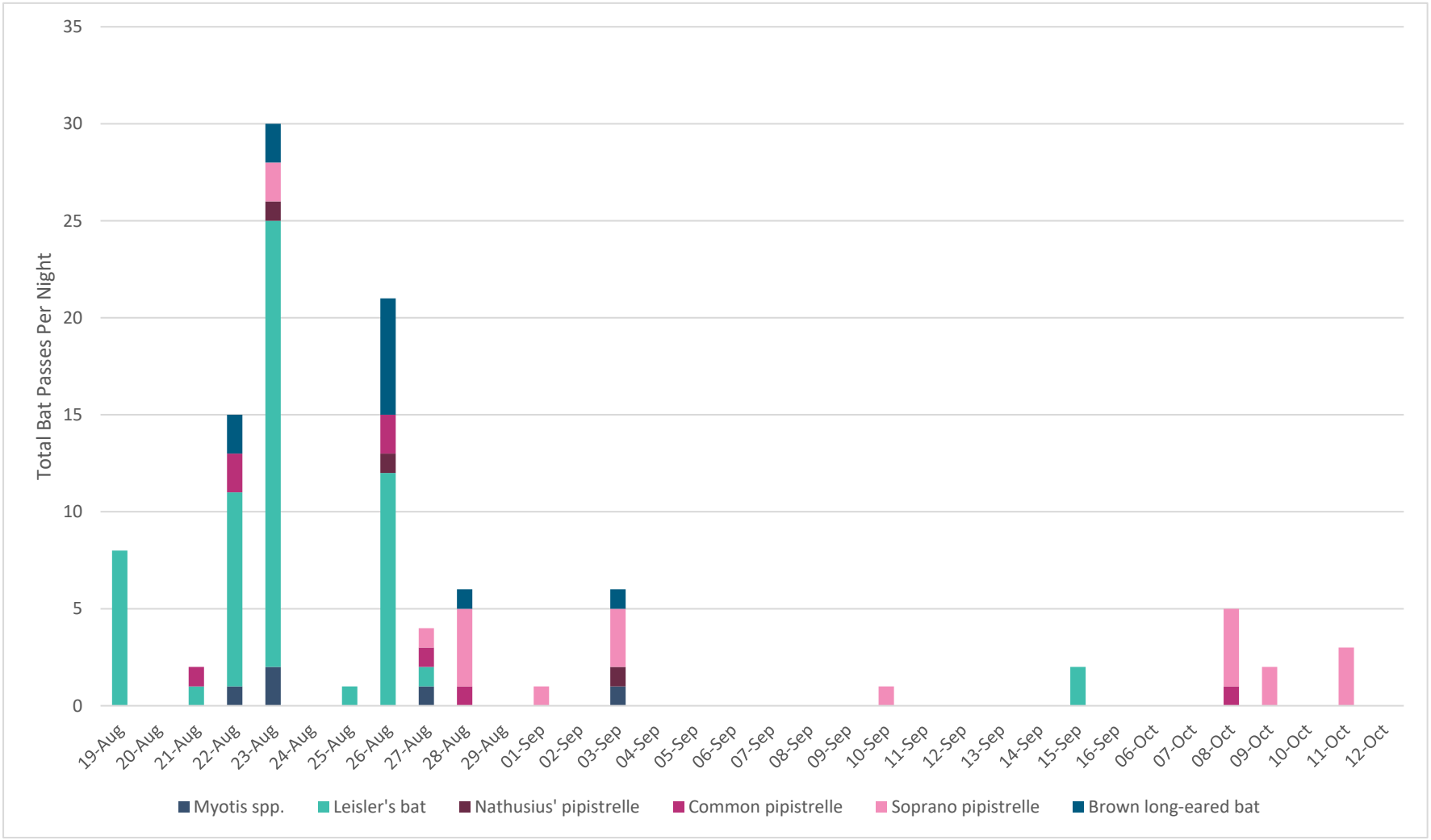


Plate 4-12 2020 Surveys at Height: Species Composition Per Night

Table 4-8 presents met mast monitoring as total bat passes. Individual bat records arising from static detector monitoring are appended to this report in **Appendix 4.**

Table 4-8 Static Detector Surveys at Height: 2020 Total Bat Passes

	Met Mast		Total
Species	**Low**	**High**	
Myotis spp.	5	-	**5**
Leisler's bat	34	24	**58**
Nathusius' pipistrelle	3	-	**3**
Common pipistrelle	8	-	**8**
Soprano pipistrelle	18	3	**21**
Brown long-eared bat	12	-	**12**
Total	**80**	**27**	**107**

4.8 Importance of Bat Population Recorded at the Site

Ecological evaluation within this section follows a methodology that is set out in Chapter 3 of the *'Guidelines for Assessment of Ecological Impacts of National Roads Schemes'* (NRA, 2009).

All bat species in Ireland are protected under the Bonn Convention (1992), Bern Convention (1982) and the EU Habitats Directive (92/43/EEC). Additionally, in Ireland bat species are afforded further protection under the Birds and Natural Habitats Regulations (2011) and the Wildlife Acts 1976-2021. Bats as an Ecological Receptor have been assigned ***Local Importance (Higher value)*** on the basis that the habitats within the study area are utilized by a regularly occurring bat population of Local Importance.

No bat roosts were identified within the EIAR boundary of the Proposed Development. However, the initial indicative survey area included a wider study area that included a structure which was identified as a roost. This structure is located approximately 100m outside the final EIAR Study Area, approximately 550m away from the nearest turbine, and is not within the likely zone of influence.

The bat roost of Local Importance was identified outside the final EAIR Study Area and will be avoided as part of the Proposed Development. No roosting site of National Importance (i.e. site greater than 100 individuals) was recorded.

5. RISK AND IMPACT ASSESSMENT

This risk and impact assessment has been undertaken in accordance with NatureScot Guidance. As per NatureScot, wind farms present four potential risks to bats:

- Collision mortality, barotrauma and other injuries
- Loss or damage to commuting and foraging habitat
- Loss of, or damage to, roosts
- Displacement of individuals or populations

For each of these four risks, the detailed knowledge of bat distribution and activity within the study area has been utilized to predict the potential effects of the wind farm on bats.

5.1 Collision Mortality

5.1.1 Assessment of Site-Risk

The likely impact of a Proposed Development on bats is related to site-based risk factors, including habitat and development features. The site risk assessment, as per Table 3a of the NatureScot guidance, is provided in Table 5-1 below.

Table 5-1 Site-risk Level Determination for the Proposed Development Site (Adapted from NatureScot, 2021)

Criteria	Site-specific Evaluation	Site Assessment
Habitat Risk	One low value roost identified outside the EIAR site boundary. No potential roost features were identified within the site and no roosts were identified within the site during the surveys undertaken. However, the habitat could be used extensively by foraging bats and is connected to the wider landscape by linear features such as stone walls, scrub, hedgerows and scattered trees. It does not provide an extensive and diverse habitat mosaic of high quality for foraging bats or meet any of the criteria of a high-risk site as set out in Table 3a of NatureScot 2021.	Moderate
Project Size	Following the criteria set out in NatureScot 2021, the project is of Medium scale as it consists of 20 no. turbines. Whilst those turbines are over 100m in height, it is well below the number of turbines that would constitute a Large development (NatureScot, 2021). There are no existing wind energy developments within 5km. One other wind energy development within 10km. Comprising turbines >100 m in height	Medium
Site Risk Assessment (from criteria in Plate 3-3)		**Medium Site Risk (3)**

The site of the Proposed Development is located in an area of predominantly Improved Agricultural and Dry Calcareous and Neutral grassland. As per Table 3a of the NatureScot Guidance (2021), it has a *moderate* habitat risk score. As per Table 3a, the Proposed Development is a Medium project (20

turbines) with a moderate habitat risk. The cross tabulation of a *Medium* project on a *Moderate* risk site results in an overall risk score of **Medium** (NatureScot Table 3a).

5.1.2 Assessment of Collision Risk

The following high-risk species were recorded during the dedicated surveys:

- Leisler's bat,
- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle

The Overall Risk Assessment for high collision risk species is provided in the sections below. Overall Risk was determined, in accordance with Table 3b of NatureScot guidance (**Appendix 5**), by a cross-tablature of the site risk level (i.e. Medium) and Ecobat bat activity outputs for each species. The assessment was carried out for both median and maximum Ecobat activity categories in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values). NatureScot recommends that that most appropriate activity level (i.e. median or maximum) be utilised to determine the overall risk assessment for a species.

As per NatureScot guidance there is no requirement to complete an Overall Risk Assessment for low-risk species. During the extensive suite of surveys undertaken that following low-risk species were recorded:

- *Myotis spp.*
- Brown long-eared bat

Overall activity levels were low for the above species; therefore, no significant collision related effects are anticipated.

5.1.2.1 Leisler's bat

This site is within the current range of the Leisler's bat (NPWS, 2019). Leisler's bats are classed as a rarer species of a high population risk which have a high collision risk (Plate 3-4). Leisler's bats were recorded during activity surveys across the Proposed Development site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021) overall activity risk for Leisler's bat was found to be ***Medium*** at typical activity levels across all three seasons. Peak activity levels were ***Medium*** in Spring and ***High*** in Summer and Autumn for Leisler's bat (See Table 5-2 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is predominantly agricultural and dry calcareous grasslands with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is ***Medium*** collision risk level assigned to the local population of Leisler's Bat.

Table 5-2 Leisler's bat - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot 2021)
Spring	Medium (3)	Low to Moderate (2)	Typical Risk is Medium (6)	Moderate to High (4)	Peak Risk is Medium (12)
Summer		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)

Autumn		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)

Detector locations with High median Leisler's bat activity levels

A summary of Ecobat bat activity results, as shown in **Appendix 3**, provides key metrics for Leisler's bat recorded, per detector, per survey period. Detectors D01 and D02 all registered nights with High levels of Leisler's bat activity in Summer 2020. D14 registered nights with High levels of Leisler's bat activity in Autumn 2020. These detectors correspond to Turbines T1, T6 and T7, and T8 respectively (Figure 3-4). Given that high median activity levels were recorded near Turbines T1, T6, T7 and T8, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development in line with the case study example provided in Appendix 5 of the NatureScot Guidance. Further details on proposed curtailment can be found in section 7.2 below.

No other detectors recorded High levels of Leisler's bat activity across any other season in 2020.

5.1.2.2 Soprano pipistrelle

This site is within the current range of the Soprano pipistrelle bat (NPWS, 2019). Soprano pipistrelle are classed as a common species of a medium population risk which have a high potential collision risk (Plate 3-4). Soprano pipistrelle were recorded during activity surveys across the Proposed Development site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021) overall activity risk for soprano pipistrelle was found to be ***Medium*** at typical activity levels and ***High*** at peak activity levels across all three seasons (See Table 5-3 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is predominantly agricultural and dry calcareous grasslands with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is ***Medium*** collision risk level assigned to the local population of Soprano pipistrelle.

Table 5-3 Soprano pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot 2021)
Spring	Medium (3)	Low to Moderate (2)	Typical Risk is Medium (6)	High (5)	Peak Risk is High (15)
Summer		Low to Moderate (2)	Typical Risk is Medium (6)	High (5)	Peak Risk is High (15)
Autumn		Moderate (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)

Detector locations with High median Soprano pipistrelle activity levels

A summary of Ecobat bat activity results, as shown in **Appendix 3**, provides key metrics for Soprano pipistrelle recorded, per detector, per survey period. Detector D02 registered nights with High levels of Soprano pipistrelle activity in Autumn 2020. Detector D07 registered nights with High levels of Soprano pipistrelle activity in Spring and Autumn 2020. These detectors correspond to Turbines T6 and T7, and T19 and T20, respectively (Figure 3-4). Given that high median activity levels were recorded near Turbines T6, T7, T20 and T21, an adaptive monitoring and mitigation strategy has been devised for the

Proposed Development in line with the case study example provided in Appendix 5 of the NatureScot Guidance. Further details on proposed curtailment can be found in section 7.2 below.

No other detectors recorded High levels of Soprano pipistrelle activity across any other season in 2020.

5.1.2.3 Common pipistrelle

This site is within the current range of the Common pipistrelle bat (NPWS, 2019). Common pipistrelle are classed as a common species of a medium population risk which have a high collision risk (Plate 3-4). Common pipistrelle were recorded during activity surveys across the Proposed Development site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021); overall activity risk for Common pipistrelle at typical activity levels was found to be ***Medium*** across all seasons. Peak risk levels for Common pipistrelle were found to be ***High*** across all seasons (See Table 5-4 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is predominantly agricultural and dry calcareous grasslands with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is ***Medium*** collision risk level assigned to the local population of Common pipistrelle.

Table 5-4 Common pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot 2021)
Spring	Medium (3)	Moderate (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)
Summer		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)
Autumn		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)

Detector locations with High median Common pipistrelle activity levels

A summary of Ecobat bat activity results, as shown in **Appendix 3**, provides key metrics for Common pipistrelle recorded, per detector, per survey period. Detectors D01 and D07 registered nights with High levels of Soprano pipistrelle activity in Spring 2020. Detectors D01, D02, D05, D07 and D14 registered nights with High levels of Common pipistrelle activity in Summer 2020. Detectors D02, D03, D05, D07 and D10 registered nights with High levels of Common pipistrelle activity in Autumn 2020. These detectors correspond to Turbines T1, T2, T3, T5, T6, T7, T8, T13, T14, T19 and T20 (Figure 3-4). Given that high median activity levels were recorded near these turbines, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development in line with the case study example provided in Appendix 5 of the NatureScot Guidance. Further details on proposed curtailment can be found in section 7.2 below.

No other detectors recorded High levels of Common pipistrelle activity across any other season in 2020.

5.1.2.4 Nathusius' pipistrelle

This Proposed Development site is outside the current known range of the Nathusius' pipistrelle bat (NPWS, 2019). Nathusius' pipistrelle are classed as a rarest species of a high population risk which have

a high collision risk (Plate 3-4). Low numbers of Nathusius' pipistrelle (n=120) were recorded during static activity surveys across the Proposed Development site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021); overall activity risk for Nathusius' pipistrelle at typical activity levels was found to be ***Low*** across all seasons. Peak risk levels for Nathusius' pipistrelle were found to be ***Medium*** in Spring and Summer and ***High*** in Autumn. (See Table 5-5 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is predominantly agricultural and dry calcareous grasslands with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is **Low** collision risk level assigned to the local population of Nathusius' pipistrelle.

Table 5-5 Nathusius' Pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot 2021)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	Low to Moderate (2)	Peak Risk is Medium (6)
Summer		Low (1)	Typical Risk is Low (3)	Moderate to High (4)	Peak Risk is Medium (12)
Autumn		Low (1)	Typical Risk is Low (3)	High (5)	Peak Risk is High (15)

Detector locations with High median Nathusius' pipistrelle activity levels

A summary of Ecobat bat activity results, as shown in **Appendix 3**, provides key metrics for Nathusius' pipistrelle recorded, per detector, per survey period. Detector D02 registered nights with High levels of Nathusius' pipistrelle activity in Autumn 2020. This detector corresponds to Turbines T6 and T7 (Figure 3-4). Given that high median activity levels were recorded near Turbines T6, and T7, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development in line with the case study example provided in Appendix 5 of the NatureScot Guidance. Further details on proposed curtailment can be found in section 7.2 below.

No other detectors recorded High levels of Common pipistrelle activity across any other season in 2020.

5.1.3 Collision Risk Summary

Site-level collision risk for high collision risk bat species was typically *Medium*. Overall bat activity levels were typical of the nature of the site, which is predominantly agricultural and dry calcareous grasslands with low levels of bat activity recorded during the static detector surveys as well as the walked transects undertaken.

However, following per detector Ecobat analysis, detectors D01, D02, D03, D05, D07, D10 and D14 showed high median activity levels across at least one season (Table 5-6). Taking a precautionary approach and given the potential for high collision risk recorded at median activity levels at these detectors, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development, in line with the case study example provided in Appendix 5 of the NatureScot 2021 Guidance and based on the site-specific data. This would involve curtailment during periods with high median bat activity (i.e. Spring at T1, T19 and T20, Summer at T1, T2, T3, T5, T6, T7, T8, T19 and T20, and Autumn at T2, T3, T5, T6, T7, T13, T14, T19 and T20), with simultaneous activity

monitoring taking place. Turbines would be curtailed during the weather conditions most suitable for bat activity at the site, see Section 7.2.1.2 "Determining curtailment" below. Proposed curtailment and monitoring is outlined in section 7.2 below.

Table 5-6 Ecobat Results High Median Bat Activity Per Detector 2020

Survey Period	Nights Recorded	Detector ID	Corresponding Turbine	Median Bat Activity	Median Bat Activity Level	Max Bat Activity	Max Bat Activity Level
LEISLER'S BAT							
Summer	22	D01	T1	81	High	90	High
Summer	21	D14	T8	94	High	98	High
Autumn	15	D02	T6 and T7	90	High	97	High
SOPRANO PIPISTRELLE							
Spring	14	D07	T19 and T20	86	High	90	High
Autumn	15	D02	T6 and T7	81	High	94	High
Autumn	15	D07	T19 and T20	84	High	99	High
COMMON PIPISTRELLE							
Spring	14	D01	T1	88	High	99	High
Spring	14	D07	T19 and T20	87	High	94	High
Summer	24	D01	T1	88	High	96	High
Summer	24	D02	T6 and T7	88	High	97	High
Summer	24	D03	T2 and T3	94	High	99	High
Summer	24	D05	T5	91	High	95	High
Summer	23	D07	T19 and T20	86	High	94	High
Summer	24	D14	T8	86	High	96	High
Autumn	15	D02	T6 and T7	98	High	100	High
Autumn	15	D03	T2 and T3	91	High	99	High
Autumn	15	D05	T5	91	High	99	High
Autumn	15	D07	T19 and T20	98	High	100	High
Autumn	15	D10	T13 and T14	89	High	99	High
NATHUSIUS' PIPISTRELLE							
Autumn	1	D02	T6 and T7	85	High	85	High

5.2 Loss or Damage to Commuting and Foraging Habitat

In absence of appropriate design, the loss or degradation of commuting/foraging habitat has potential to reduce feeding opportunities and/or displace bat populations. However, the Proposed Development is predominantly located within agricultural and dry calcareous grasslands and there will be no net loss of bat foraging/commuting habitat associated with the Proposed Development.

As part of the Proposed Development, some small areas of scrub clearance and site preparation works will be required within and around the development footprint to allow the construction of turbine bases, access roads and the other ancillary infrastructure. There are no areas of forestry within the Proposed Development site. Therefore, there is no requirement for a Felling Licence application to the Forest Service.

Approximately 2.53km of hedgerow/scrub will be permanently removed within and around the footprint of the Proposed Development. This removal of hedgerow/scrub is provided to achieve the required buffer distance for the protection of bats, from the turbines to the canopy of the nearest habitat feature, as recommended by the Natural England (2014) and NatureScot (2021). Further details on buffer calculations can be found in section 6.1.3 of this report.

The majority of stone walls within the site will be maintained as part of the Proposed Development. Proposed replanting will ensure there will be no significant effect in relation to habitat fragmentation or loss of foraging habitat for bats in the area. Table 6-1, Section 6.1.4 below, describes linear habitat features within the proposed turbine buffers, which are proposed for removal for the duration of the Proposed Development, as well as proposed replanting associated with each turbine.

Overall, the proposed replanting will result in a net gain of approximately 290m in the linear landscape features within the site. Planting will be of species indigenous to the local area. This will have a positive impact on bats as it will provide more commuting and foraging opportunities.

Where upgrades to existing roads and site tracks are proposed, there may be some requirement for road widening to facilitate the initial construction phase. No permanent road widening, or junction accommodation works are required along the turbine delivery route. Some temporary hardcore surfacing will be required at roundabouts or areas off oversail. Some minor modifications to street furniture will also be required along the turbine delivery route such as temporary removal of some street signs, traffic lights, etc. No loss of, or damage to, commuting or foraging habitats is anticipated to facilitate the turbine delivery.

The underground cable route will be confined to existing site and public roads. There will be no requirement to remove trees/hedgerows etc. as part of the underground cable route and no loss or damage to commuting or foraging habitats is anticipated.

Given the extensive area of habitat that will remain undisturbed throughout the site and the avoidance of the most significant areas of faunal habitat (i.e. natural hedgerows and scrub), no significant effects with regard to loss of commuting and foraging habitat are anticipated.

5.3 Loss of, or Damage to, Roosts

The Proposed Development is located within an area of agricultural and dry calcareous grasslands. The trees within the site are comprised predominantly of hawthorn, blackthorn and hazel, and do not provide potential roosting habitat of significance for bats. One derelict structure was identified as a roost outside the EIAR Site Boundary. A small number of bats were observed emerging and re-entering the building during the roost surveys; however, the structure will be avoided and retained, thus no loss or damage to roosts is anticipated.

The underground cabling will connect from the Proposed Development site to the existing Athlone 110kV substation, predominately confined to proposed and existing roads and tracks. There will be no requirement to remove trees/forestry as part of the underground cable route. Therefore, there will be no loss of tree roosting habitat or linear landscape connectivity associated with these works.

Although no bats were observed, and no evidence of bat use was identified within the bridges, the stone arch bridge (WC2) along the cable route was assessed as having moderate value for roosting bats. And the concrete arch bridge (WC5) was assessed as having low value potential for roosting bats. The bridges along the route will not be altered, in any regard, by the proposed works as the options for crossing bridges do not require any works to be carried out on the bridge structure. The cable will either be installed within the road surface or else directional drilling will be used. No loss of potential roosting habitat is anticipated.

No potential for significant effect with regard to the loss of, or damage to, roosting habitat as a result of the Proposed Development or underground cable route, is anticipated.

5.4 Displacement of Individuals or Populations

The Proposed Development is predominantly located within agricultural and dry calcareous grasslands. There will be no net loss of linear landscape features for commuting and foraging bats and there will be no loss of any roosting site of ecological significance. The habitats on the site will remain suitable for bats and no significant displacement of individuals or populations is anticipated.

6. BEST PRACTICE AND MITIGATION MEASURES

This section describes the best practice and site-specific mitigation measures that are in place to avoid and reduce the potential for significant effects on local bat populations.

6.1 Standard Best Practice Measures

6.1.1 Noise Restrictions

During the construction phase, plant machinery will be turned off when not in use and all plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (S.I. No. 632 of 2001).

6.1.2 Lighting Restrictions

Where lighting is required, directional lighting will be used to prevent overspill on to woodland/forestry edges. Exterior lighting, during construction and post construction, shall be designed to minimize light spillage, thus reducing the effect on areas outside the Proposed Development, and consequently on bats i.e. Lighting will be directed away from mature trees/treelines around the periphery of the site boundary to minimize disturbance to bats. Directional accessories can be used to direct light away from these features, e.g. through the use of light shields (Stone, 2013). The luminaries will be of the type that prevent upward spillage of light and minimize horizontal spillage away from the intended lands.

The proposed lighting around the site shall be designed in accordance with the Institute of Lighting Professionals Guidance Note 08/18 Bats and artificial lighting in the UK.

In addition, the applicant commits to the use of lights during construction, operation and decommissioning (such that they are necessary) in line with the following guidance that is provided in the Dark Sky Ireland Lighting Recommendations:

- Every light needs to be justifiable,
- Limit the use of light to when it is needed,
- Direct the light to where it is needed,
- Reduce the light intensity to the minimum needed,
- Use light spectra adapted to the environment,
- When using white light, use sources with a “warm” colour temperature (less than 3000K).

With regard to the potential for lighting to increase collision risk, it is noted that there will be some illumination of the turbines in the form of aviation lighting, and whilst this lighting is unlikely to result in any significant increase in collision risk, a comprehensive and site-specific mitigation and monitoring programme, described in section 6.2, is proposed for a period of at least 3 years post construction. No significant effects of lighting on bats are anticipated; however, if in the course of this monitoring, any potential for significant effects on bats is identified, specific measures including curtailment, will be implemented to avoid any such impacts.

6.1.3 Buffering

In accordance with NatureScot Guidance, a minimum 50m buffer to all habitat features used by bats (e.g., hedgerows, tree lines etc.) will be applied to the siting of all wind turbines (See example provided in Plate 6-1 below).

NatureScot recommends that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features) is adequate mitigation. This 50m buffer will be implemented from the outset and monitored as per the post construction monitoring. The success of the buffer mitigation will be assessed as part of post construction monitoring and updated where necessary, as described in section 6.2.

The formula below is presented to provide appropriate mitigation in relation to bats, and the relevant input required from turbine parameters, is the combination of the blade length and hub height. In this context, the worst-case scenario arises from the longest blade on the lowest hub. The turbine model to be installed on the site will have an overall ground-to-blade tip height of 180m maximum; rotor diameter of 162m maximum and hub height of 99m maximum. The worst-case scenario has therefore been considered in the bat impact assessment.

The proposed turbines are located predominantly in areas of agricultural and calcareous grasslands with some hedgerows, scattered trees and stone walls in the wider area. Small areas of tree/hedgerow removal will be required to implement the bat buffer. These vegetation-free areas will be maintained during the operational life of the Proposed Development. Additional tree planting is proposed to offset any loss in habitat features within the bat buffers and are described in further detail in section 6.1.4 below.

It is necessary to calculate the distance between the edge of the habitat feature and the centre of the tower (b). Using the formula:

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

Where, bl =Blade length, hh = hub height, fh = feature height all in metres. E.g. (below) b = 69.3m (Plate 6-1)

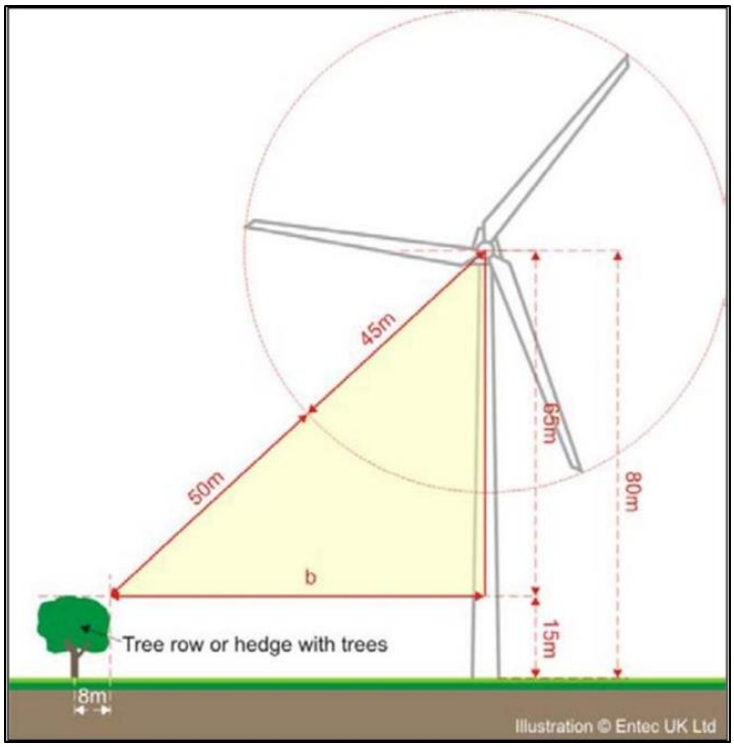


Plate 6-1 Calculate buffer distances (Natural England, 2014).

6.1.4 Turbine Specific Replanting

In the absence of appropriate design, the loss or degradation of commuting/foraging habitat has potential to reduce feeding opportunities and/or displace bat populations. However, the Proposed Development is predominantly located within agricultural and dry calcareous grasslands and linear landscape features such as hedgerows, trees and stone walls have been largely retained or avoided.

Stone walls within the site are protected and will be maintained as part of the Proposed Development. While stone walls are classified as low-quality linear features, replanting design has been curated to draw bats away from turbine buffers. The loss of these short sections will not result in any significant effect in relation to habitat fragmentation or loss of foraging habitat for bats in the area.

To comply with NatureScot recommendations in relation to habitat buffering to avoid bat fatalities, a total of approximately 2.53km of hedgerow/tree habitat will be lost as a result of the recommended buffers applied for bats (Table 6-1). There is an extensive network of linear landscape features in the wider area that will be fully retained, and the loss of hedgerow/trees is not anticipated to have a significant effect on local bat populations. However, it is proposed to plant approximately 2.82km of new hedgerow to offset any potential loss in linear habitat features and to provide additional new opportunities for commuting and foraging bats. Table 6-1 describes linear habitat features within the proposed turbine buffers which are proposed for removal for the duration of the Proposed Development as well as proposed replanting associated with each turbine. The locations in which the proposed planting will take place will be subject to final landowner agreement. However, indicative areas for planting are proposed in Figures 6-1 and 6-2.

Overall, the proposed replanting will result in a net gain of approximately 290m in the linear landscape features within the site. Planting will be of species indigenous to the local area. Further details are provided in the Landscape and Visual Chapter (Chapter 12) of the EIAR.

Consequently, no significant effects with regard to loss of commuting and foraging habitat are anticipated.

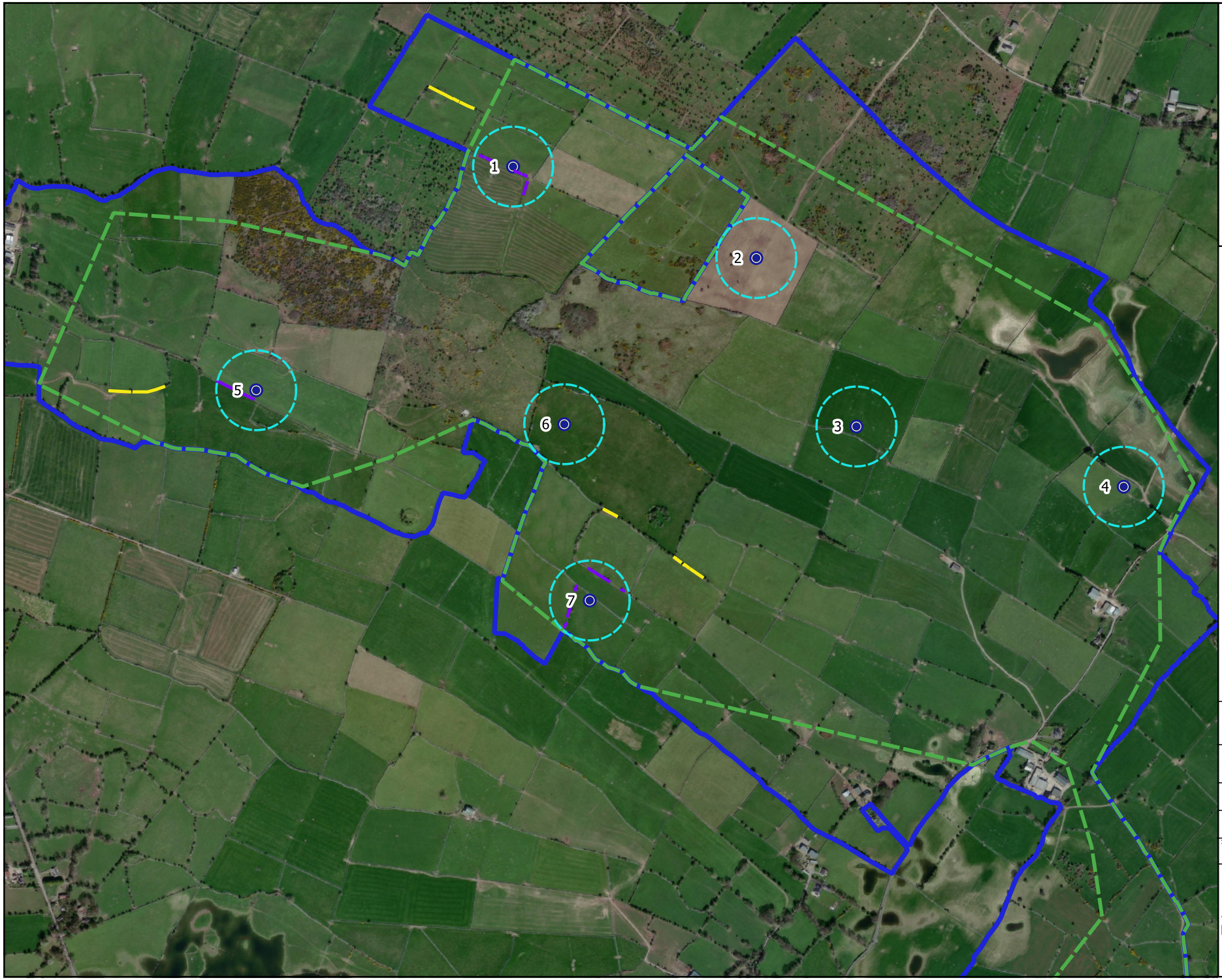
Table 6-1 Assessment of Linear Habitat Features within Turbine Buffers

Turbine No.	Description of linear habitats within the buffer	Linear habitat features proposed for removal (Approx. length)	Linear habitat features proposed for replanting (Approx. length)	Proposed removal and replanting per turbine
Northern Cluster				
Turbine 1	Three sections of stone walls with sparse mature and semi-mature trees fall within the proposed turbine buffer.	54m	82m	Stone walls within the buffer will be retained and cleared of vegetation. While approximately 54m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 82m of hedgerow to the northwest of the proposed turbine, outside the buffer. This will bolster existing linear habitat features thus providing additional commuting and foraging habitat away from the proposed turbine. Post construction monitoring is also proposed.
Turbine 2	Partial stone wall and sparse individual trees inside the northern edge of the buffer. Areas of low scrub to the west of the proposed turbine.	0m	0m	No loss of linear habitat features is proposed as a result of the buffer at T2. Areas of low stone walls and sparse trees at the edge of the buffer will be retained and monitored post construction. No additional planting is proposed at T2.
Turbine 3	One unvegetated stone wall within the turbine buffer.	0m	0m	No loss of linear habitat features is proposed as a result of the buffer at T3. Areas of low stone walls will be retained and monitored post construction. No additional planting is proposed at T3.
Turbine 4	Low stone wall and existing roadway traversing the buffer. Partial sections of conifer treelines fall within the edges of the buffer to the northwest and southeast. However, they do not provide significant connectivity to the wider habitat.	0m	0m	No loss or severing of linear habitat features is proposed as a result of the buffer at T4. Areas of low stone walls will be retained and monitored post construction. No additional planting is proposed at T4.
Turbine 5	Partially vegetated stone wall traversing the proposed turbine buffer. Additional vegetated stone wall within northern edge of buffer, to be retained.	88m	110m	Stone walls within the buffer will be retained and partially cleared of vegetation. While approximately 88m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 110m of hedgerow to the west of the proposed turbine, outside the buffer. This will provide additional commuting and foraging habitat away from the proposed turbine. Post construction monitoring is also proposed.

Turbine 6	Two partially vegetated stone walls occur to the north and west of the proposed turbine, at the edge of the buffer.	0m	0m	No loss or severing of linear habitat features is proposed as a result of the buffer at T6. Areas of low stone walls with sparse vegetation will be retained and monitored post construction. No additional planting is proposed at T6.
Turbine 7	Stone walls with sparse mature and semi-mature trees traversing the proposed turbine buffer.	85m	85m	Stone walls within the buffer will be retained and cleared of vegetation. While approximately 85m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 85m of hedgerow to the north and northeast of the proposed turbine, outside the buffer. This will bolster existing linear habitat features and provide additional commuting and foraging habitat away from the proposed turbine. Post construction monitoring is also proposed.
Total Linear Habitat Features Proposed for Removal (Northern Cluster): 227m				
Total Linear Habitat Features Proposed for Replanting (Northern Cluster): 277m				
Southern Cluster				
Turbine 8	Small areas of stone walls fall within the edges of the proposed turbine buffer to the north and east.	0m	0m	No loss or severing of linear habitat features is proposed as a result of the buffer at T8. Areas of low stone walls with sparse vegetation at the edge of the buffer will be retained and monitored post construction. No additional planting is proposed at T8.
Turbine 9	Areas of mature and semi-mature trees with scrub traversing the proposed turbine buffer.	412m	-	T9 and the surrounding area is in a designated Annex I habitat and is not suitable for replanting. Therefore, replanting will take place elsewhere within the site. See T11.
Turbine 10	Areas of mature and semi-mature trees with low scrub traversing the proposed turbine buffer.	86m	100m	T10 and the surrounding area is located in Annex I habitat and is not suitable for replanting. Therefore, replanting will take place to the north of the proposed turbine. It is proposed to plant approximately 100m of hedgerow north of the proposed turbine, outside the buffer.
Turbine 11	Partially vegetated stone wall traversing the proposed turbine buffer. Additional vegetated stone wall within north-eastern edge of buffer.	106m	530m	Stone walls within the buffer will be retained and partially cleared of vegetation. While approximately 125m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 530m of hedgerow north of the proposed turbine, outside the buffer. This will provide additional commuting and foraging habitat away from the proposed turbine and will offset any losses from T9. Post construction monitoring is also proposed.
Turbine 12	Vegetated stone walls within the buffer extending either side of the proposed turbine.	345m	345m	Stone walls within the buffer will be retained and cleared of vegetation. While approximately 345m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 345m of hedgerow to the north and northwest of the proposed turbine, outside the buffer.

				This will provide additional commuting and foraging habitat away from the proposed turbine. Post construction monitoring is also proposed.
Turbine 13	Partially vegetated stone wall, with mature and semi-mature trees, traversing the proposed turbine buffer.	92m	125m	Stone walls within the buffer will be retained and cleared of vegetation. While approximately 92m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 125m of hedgerow to the southwest of the proposed turbine, outside the buffer. This will provide additional commuting and foraging habitat away from the proposed turbine. Post construction monitoring is also proposed.
Turbine 14	Partially vegetated stone wall, with mature and semi-mature trees, traversing the proposed turbine buffer.	89m	114m	Stone walls within the buffer will be retained and cleared of vegetation. While approximately 89m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 114m of hedgerow to the north of the proposed turbine, outside the buffer. This will provide additional commuting and foraging habitat away from the proposed turbine. Post construction monitoring is also proposed.
Turbine 15	Partially vegetated stone walls, with mature and semi-mature trees, traversing the proposed turbine buffer.	302m	316m	Stone walls within the buffer will be retained and cleared of vegetation. While approximately 302m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 316m of hedgerow to the northwest of the proposed turbine, outside the buffer. This will provide additional commuting and foraging habitat away from the proposed turbine. Post construction monitoring is also proposed.
Turbine 16	Partially vegetated stone wall, with mature and semi-mature trees, traversing the proposed turbine buffer.	50m	115m	T16 is located within an area of partially designated Annex I habitat. The buffer will require the removal of small areas of scrub. Scrub outside of the buffer will continue provide suitable habitat for commuting and foraging bats. A section of 50m of mature/semi-mature trees will also require removal. A section of 115m of hedgerow is proposed to be planted along the field boundary to the southeast of T16.
Turbine 17	Partially vegetated stone walls, with mature and semi-mature trees, traversing the proposed turbine buffer.	282m	300m	Stone walls within the buffer will be retained and cleared of vegetation. While approximately 282m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 300m of hedgerow to the south of the proposed turbine, outside the buffer. This will provide additional commuting and foraging habitat away from the proposed turbine. Post construction monitoring is also proposed.
Turbine 18	Partially vegetated stone wall, with mature and semi-mature trees, along western edge of the proposed turbine buffer.	0m	0m	No loss or severing of linear habitat features is proposed as a result of the buffer at T18. Areas of low stone walls with sparse vegetation at the western edge of the buffer will be retained and monitored post construction. This linear feature will be

				separated further from the proposed turbine by the proposed access road. No additional planting is proposed at T18.
Turbine 19	Vegetated stone wall with mature and semi mature trees traverses the proposed turbine buffer from north to northeast. An area of partially vegetated stone wall occurs to the western edge of the buffer.	174m	220m	Stone walls along the northern section of the buffer will be retained and cleared of vegetation. While approximately 174m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 220m of hedgerow to the east of the proposed turbine, outside the buffer. This will provide additional commuting and foraging habitat away from the proposed turbine. Areas of low stone walls with sparse vegetation at the western edge of the buffer will be retained to prevent severing of habitat connectivity. Post construction monitoring is also proposed.
Turbine 20	Mature and semi mature hedgerow occur along stone wall field boundaries within the proposed turbine buffer.	367m	378m	Stone walls within the buffer will be retained and cleared of vegetation. While approximately 367m of stone wall will be cleared of vegetation to reduce linear connectivity directed towards the proposed turbine, it is proposed to plant 378m of hedgerow to the west, northwest and northeast of the proposed turbine, outside the buffer. This will provide additional commuting and foraging habitat away from the proposed turbine. Post construction monitoring is also proposed.
Total Linear Habitat Features Proposed for Removal (Southern Cluster): 2,305m (2.31km)				
Total Linear Habitat Features Proposed for Replanting (Southern Cluster): 2,543m (2.54km)				
Grand Total Linear Habitat Features Proposed for Removal: 2,532m (2.53km)				
Grand Total Linear Habitat Features Proposed for Replanting: 2,820m (2.82km)				



Map Legend

- EIAR Site Boundary
- Landowner Boundary
- Turbine Buffer 88.1m
- Proposed Turbine Layout
- Proposed Hedgerow-Tree Removal
- Proposed Replanting Areas

N

Drawing Title
Northern Package Proposed Removal/Replanting Areas

Project Title
Seven Hills Wind Farm, Co. Roscommon

Drawn By	Checked By
AJ	AJ
Project No.	Drawing No.
190907	6-1
Scale	Date
1:10895	19.05.2022

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Map Legend

- EIAR Site Boundary
- Landowner Boundary
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- Proposed Hedgerow-Tree Removal
- Proposed Replanting Areas

N

Drawing Title
Southern Package Proposed Removal/Replanting Areas

Project Title
Seven Hills Wind Farm, Co. Roscommon

Drawn By	Checked By
AJ	AJ
Project No.	Drawing No.
190907	6-2
Scale	Date
1:17895	19.05.2022

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6.1.5 Blade Feathering

On a precautionary basis, and in addition to buffers applied to habitat features, it is proposed that all wind turbines are subject to 'feathering' of turbine blades when wind speeds are below the cut-in speed of the proposed turbine. This means that the turbine blades are pitched at 90 degrees or parallel to the wind to reduce their rotation speed to below two revolutions per minute while idling. This measure has been shown to significantly reduce bat fatalities (by up to 50%) in some studies (NIEA, 2021).

6.2 Bat Mitigation and Monitoring Plan

Overall risk levels for high collision risk bat species was typically ***Medium***. This risk level is reflective of the nature of the site, which is dominated by semi-natural grassland habitats and scrub, with low levels of bat activity recorded during the walked and driven transects undertaken.

However, taking a precautionary approach and given that high collision risk was recorded at median and peak activity levels, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development in line with the case study example provided in Appendix 5 of the NatureScot (2021) Guidance and based on the site-specific data.

6.2.1 Curtailment

Curtailment involves raising the cut-in speed with associated loss of power generation in combination with reducing the blade rotation (blade feathering) below the cut-in speed.

Site-level collision risk for high collision risk bat species was typically ***Medium***. Overall bat activity levels were typical of the nature of the site, which is semi-natural grassland habitats and scrub with low levels of bat activity recorded during the static detector surveys as well as walked transects undertaken.

However, following per detector Ecobat analysis, detectors D01 (i.e. Turbine 1), D02 (i.e. Turbines 6 & 7), D03 (i.e. Turbines 2 & 3), D05 (i.e. Turbine 5), D07 (i.e. Turbines 19 & 20), D10 (i.e. Turbines 13 & 14) and D14 (i.e. Turbine 8) showed high median activity levels across at least one season (Table 5-6). Taking a precautionary approach and given the potential for high collision risk was recorded at median activity levels at these detectors, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development. The strategy is in line with the case study example provided in Appendix 5 of the NatureScot Guidance and has been informed by the extensive suite of site-specific survey data. Curtailment will be implemented during periods with high median bat activity (i.e. Spring at T1, T19 & T20, Summer at T1, T2, T3, T5, T6, T7, T8, T19 and T20, and Autumn at T2, T3, T5, T6, T7, T13, T14, T19 and T20), with simultaneous activity monitoring taking place. Turbines will be curtailed during the weather conditions most suitable for bat activity at the site.

Recent research used to inform NatureScot guidance has found that 90% of all bat activity can occur on sites when temperature exceeded 11.5°C and windspeed was below 5m/s. In addition, the bat activity is generally recorded 30 minutes after sunset and 40 minutes prior to sunrise. These conditions are largely consistent with the high seasonal activity peaks recorded at the proposed development site. Therefore, a software module will be programmed into the SCADA system controlling the turbines to curtail turbines when all these criteria are met. Curtailment is achieved by opening the blade pitch into the fully-feathered position, which reduces blade rotation speed to <1rpm.

The effectiveness of curtailment will be monitored in order to determine (a) whether it is working effectively (i.e. whether bat mortality is detected, thereby confirming its effectiveness), and (b) whether the curtailment regime can be refined such that turbine down-time can be minimised whilst ensuring that it remains effective at preventing casualties.

A summary of the proposed seasonal curtailment is provided in Table 6-2 below.

Table 6-2 Turbine Specific Curtailment Strategy for High-risk Species

Turbine No.	Proposed Curtailment Period		
	Spring (April to May)	Summer (June to mid-August)	Autumn (mid-August to October)
Turbine 1	Yes	Yes	No
Turbine 2	No	Yes	Yes
Turbine 3	No	Yes	Yes
Turbine 5	No	Yes	Yes
Turbine 6	No	Yes	Yes
Turbine 7	No	Yes	Yes
Turbine 8	No	Yes	No
Turbine 13	No	No	Yes
Turbine 14	No	No	Yes
Turbine 19	Yes	Yes	Yes
Turbine 20	Yes	Yes	Yes

6.2.2 Operational Monitoring

As per NatureScot Guidance at least 3 years of post-construction monitoring is required to assess the effects of construction related habitat modification on bat activity i.e. the 50 metre separation between the proposed turbine blade tips and the nearest landscape feature. For example, it may be that the construction of wind turbines significantly reduces bat activity at the site relative to that recorded pre-construction and to a level at which there is no longer potential for significant effects on bats (NatureScot, 2021).

Post construction monitoring will include static detector surveys, walked survey transects and corpse searching to record any bat fatalities resulting from collision. At a minimum monitoring will be conducted for 3 years post construction.

The results of post construction monitoring shall be utilised to assess changes in bat activity patterns post construction and to monitor the implementation of the mitigation strategy. The performance of the curtailment programme in terms of its ability to respond to the changes in bat abundance based on temperature and wind speed will be analysed to confirm the efficacy of the curtailment during different periods of bat activity. At the end of each year, the efficacy of the curtailment programme will be reviewed, and any identified efficiencies incorporated into the curtailment programme. This approach allows for an evidence-based review of the potential for bat fatalities at the site, post construction, to ensure that the necessary measures, based on a new baseline post-construction, are implemented for the protection of bat species locally.

The below subsections provide additional detail on the proposed survey effort, timing, and mitigation.

6.2.2.1 Monitoring Year 1

6.2.2.1.1 *Bat activity surveys*

Static monitoring at turbine bases and nacelle shall take place at each turbine during the bat activity season (between April and October) (NatureScot, 2021). Full spectrum recording detectors will be utilised for the same duration as during pre-application surveys and at the same density (NatureScot, 2021). As described in Section 3.5 above, the assessment of bat activity levels will include the use of 'Ecobat', a web-based interface, allowing uploaded activity data to be contrasted with a comparable reference range, allowing objective and robust interpretation.

Key weather parameters and other factors that are known to influence collision risk will be monitored and will include:

- Windspeed in m/s (measured at nacelle height)
- Temperature (ºC)
- Precipitation (mm/hr)

6.2.2.1.2 Carcass searches

Carcass searches, to monitor and record bat fatalities, shall be conducted at each turbine in accordance with NatureScot Guidance (See section 6.1.2.3 below). This shall include searcher efficiency trials and an assessment of scavenger removal rates to determine the appropriate correction factor to be applied in relation to determining an accurate estimate of collision mortality. Casualty searches shall use a method with high observer efficiency (>50% as per NatureScot). NatureScot guidance states that conservation dogs "*should preferably be used to achieve more robust results*". Therefore, the use of conservation dogs will be necessary where observed human searcher efficiency is less than 50%.

Calculating casualty rates across the site shall be done in accordance with the methods and formulas provided in Appendix 4 of the NatureScot Guidance. Surveys will cover all activity seasons and will be undertaken by trained surveyors.

Should no bat fatalities be recorded in Year 1, curtailment in Year 2 could be reduced/re-evaluated or removed with monitoring continuing to inform this strategy.

The curtailment programme for Year 2 will then be devised/altered as necessary around key activity periods and weather parameters recorded in Year 1.

6.2.2.2 Monitoring Years 2 & 3

Monitoring surveys shall continue in Year 2 and 3, and the success of the curtailment strategy shall be assessed in line with the baseline data collected in the preceding year(s).

The performance of the curtailment programme in terms of its ability to respond to the changes in bat abundance based on temperature and wind speed shall be analysed to confirm it is neither significantly over- nor under- curtailing during different periods of bat activity.

At the end of each year, the efficacy of the curtailment programme shall be reviewed, and any identified efficiencies incorporated into the curtailment programme. The requirement for continued post-construction monitoring will also be considered. Should no bat fatalities be recorded in Year 1, curtailment in Year 2 and Year 3 could be reduced/re-evaluated or removed with monitoring continuing to inform this strategy.

6.2.2.3 Carcass Search Survey Methodology

As per NatureScot (2021), it is recommended that systematic searches should be conducted within a 100m x 100m grid centred on the turbine, although the exact protocol for carcass searches will vary given the precise objectives of the surveys (i.e. survey may be targeted at particular times of year or locations). It is recommended that at least two search periods (Summer and Autumn) are used. Spring should also be included if there is particular reason to do so, for example if there are multiple casualties during other survey periods. For a given amount of resource available for carcass searches, there is a trade-off between search frequency and the time period that can be monitored. The longer the inter-search interval, the greater the likelihood of the bat being predated before it is found.

Daily searches are recommended in order to refine mitigation. At other sites, searches at 2-4 day intervals are acceptable, based on the predation rates observed at most locations in the National Bats

and Wind Turbines study (NatureScot, 2021). Data will be obtained from the turbine operators on whether or not the target turbine was operational on the night preceding the search, with the surveying protocol being adjusted as necessary if the turbines were either non-operational or were not rotating because of a lack of wind. To maximise the duration of monitoring during each season, whilst maintaining low carcass removal rates, surveying will be split into blocks as illustrated in Table 6-3.

Table 6-3 Proposed survey effort approach to maximise the duration of monitoring during each season (Source: NatureScot, 2021)

Days 1-10	Days 11-20	Days 21-30	Days 31-40	Days 41-50	Days 51-60
Initial 'sweep' then survey alternate days (d2, d4, d6, d8, d10)	No Survey	Initial 'sweep' then survey alternate days	No Survey	Initial 'sweep' then survey alternate days	No Survey

Searcher efficiency trials

Searcher efficiency trials will be conducted at the site to provide appropriate correction factors. The trials should ideally use dead bats, however if unavailable, similar coloured mammals of equivalent size can be used. The exact methods used will be documented and it is proposed that at least 10 carcasses are used, as otherwise the correction of casualty rates becomes very coarse (missing just 1 bat out of 5 would substantially influence the correction factor) (NatureScot, 2021). The best detailed search efficiency trial methodology has been published by NatureScot (2021) and will form the basis for this project.

Scavenger removal rates

Estimates of carcass removal rates will be undertaken as part of the post-construction monitoring and will inform the results of mortality monitoring. The standard best practice for this is fully described in the NatureScot (2021) guidance document and will be followed during the implementation of this proposed post-construction monitoring protocol.

The results of the scavenger removal rates and corpse searching will be used to obtain an 'estimate of total carcasses per site per month', see NatureScot (2021) Appendix 4 for calculations.

6.3 Residual Impacts

Not Significant Effect

Taking into consideration the sensitive design of the project, the proposed best practice and adaptive mitigation measures; significant residual effects on bats with regard to 1) Collision mortality, barotrauma and other injuries, 2) Loss or damage to commuting and foraging habitat, 3) Loss of, or damage to, roosts and 4) Displacement of individuals or populations are not anticipated.

6.4 Cumulative effects

The Proposed Development was considered in combination with other plans, existing and approved projects and planning applications pending a decision, in the surrounding area that could result in cumulative impacts on bats. This included a review of online Planning Registers and served to identify past, present and future plans and projects, their activities and their predicted environmental effects. The plans and projects considered are listed in Chapter 2 of the EIAR: Background of the Proposed Development.

Following the detailed assessment provided in the preceding sections, it is concluded that, the Proposed Development will not result in any residual adverse effects on bats, when considered on its own. Therefore, no potential for the Proposed Development to contribute to any cumulative adverse effects on any bat populations when considered in-combination with other plans and projects.

In the review of the projects that was undertaken, no connection, that could potentially result in additional or cumulative impacts was identified. Neither was any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the Proposed Development.

Taking into consideration the reported residual impacts from other plans and projects in the area and the predicted impacts with the current proposal, no residual cumulative impacts have been identified regarding bats.

7. CONCLUSION

This report provides a full and comprehensive assessment of the potential for impact on bat populations at the Proposed Development site. The surveys and assessment provided in this report are in accordance with NatureScot guidance. Following consideration of the residual effects (post mitigation) it is noted that the Proposed Development will not result in any significant effects on bats.

Provided that the proposed wind farm development is constructed and operated in accordance with the design, best practice and mitigation that is described within this report, significant effects on bats are not anticipated at any geographic scale.

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APPENDIX 1

BAT HABITAT SUITABILITY APPRAISAL

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Bat Survey Report

Appendix 1 – Habitat Suitability Assessment

HABITAT SUITABILITY ASSESSMENT

Guidelines for assessing the potential suitability of a site for bats, based on the presence of habitat features (taken from Collins, 2016)

Suitability	Roosting Habitats	Commuting and Foraging Habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions1 and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats, i.e. unlikely to be suitable for maternity or hibernation2. A tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen with only very limited roosting potential3.	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitats. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

[1] For example, in terms of temperature, humidity, height above ground, light levels or levels of disturbance.
[2] Larger numbers of Common pipistrelle may be present during autumn and winter in large buildings in highly urbanised areas, based on evidence from the Netherlands (Korsten *et al.* 2015).
[3] Categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

APPENDIX 2

SITE RISK ASSESSMENT

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Appendix 2 – Site Risk Assessment (Table 3a, NatureScot, 2021)

SITE RISK ASSESSMENT

Table 3a: *Stage 1 - Initial site risk assessment*

Site Risk Level (1-5)*		**Project Size**		
		Small	**Medium**	**Large**
Habitat Risk	**Low**	1	2	3
	Moderate	2	3	4
	High	3	4	5

Key: Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk.

* Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

Habitat Risk	**Description**
Low	Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality for foraging bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/near edge of range and/or on an important flyway. Close to key roost and/or swarming site.

Project Size	**Description**
Small	Small scale development (≤10 turbines). No other wind energy developments within 10km. Comprising turbines <50m in height.
Medium	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5km. Comprising turbines 50-100m in height.
Large	Largest developments (>40 turbines) with other wind energy developments within 5km. Comprising turbines >100m in height.

APPENDIX 3

ECOBAT RESULTS

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Appendix 3 – 2020 Ecobat Per Detector Results

Summary tables are provided in the main bat report for each species recorded showing key metrics per detector per survey period.

LEISLER'S BAT

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	9	1717	D01	25	Low - Moderate	56	Moderate
Spring	1	1717	D02	25	Low - Moderate	25	Low - Moderate
Spring	9	1717	D03	25	Low - Moderate	52	Moderate
Spring	10	1717	D04	51	Moderate	78	Moderate - High
Spring	5	1717	D05	5	Low	46	Moderate
Spring	9	1717	D06	38	Low - Moderate	61	Moderate - High
Spring	11	1717	D07	25	Low - Moderate	61	Moderate - High
Spring	10	1717	D08	25	Low - Moderate	46	Moderate
Spring	3	1717	D09	5	Low	25	Low - Moderate
Spring	9	1717	D10	5	Low	25	Low - Moderate
Spring	6	1717	D11	15	Low	56	Moderate
Spring	6	1717	D12	5	Low	25	Low - Moderate
Spring	9	1717	D13	25	Low - Moderate	61	Moderate - High
Spring	9	1717	D14	5	Low	61	Moderate - High
Summer	22	5575	D01	81	High	90	High
Summer	24	5575	D02	70	Moderate - High	84	High
Summer	22	5575	D03	67	Moderate - High	85	High
Summer	19	5575	D04	60	Moderate	83	High
Summer	24	5575	D05	68	Moderate - High	24	Low - Moderate
Summer	21	5575	D06	30	Moderate - High	77	Moderate - High
Summer	14	5575	D07	35	Low - Moderate	51	Moderate
Summer	24	5575	D08	55	Moderate	87	High
Summer	23	5575	D09	63	Moderate - High	86	High
Summer	-	5575	D10	-	Nil	-	Nil
Summer	21	5575	D11	72	Moderate - High	90	High
Summer	21	5575	D12	69	Moderate - High	89	High
Summer	2	5575	D13	49	Moderate	67	Moderate - High
Summer	21	5575	D14	94	High	98	High
Autumn	1	4660	D01	19	Low	19	Low
Autumn	15	4660	D02	90	High	97	High
Autumn	15	4660	D03	77	Moderate - High	89	High
Autumn	-	4660	D04	-	Nil	-	Nil
Autumn	15	4660	D05	71	Moderate - High	89	High
Autumn	15	4660	D06	69	Moderate - High	86	High

Autumn	14	4660	D07	74	Moderate - High	87	High
Autumn	1	4660	D08	19	Low	19	Low
Autumn	1	4660	D09	19	Low	19	Low
Autumn	9	4660	D10	58	Moderate	83	High
Autumn	13	4660	D11	58	Moderate	92	High
Autumn	12	4660	D12	72	Moderate - High	89	High
Autumn	13	4660	D13	67	Moderate - High	91	High
Autumn	12	4660	D14	67	Moderate - High	88	High

MYOTIS SPP.

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	11	1345	D01	25	Low - Moderate	46	Moderate
Spring	-	1345	D02	-	Nil	-	Nil
Spring	11	1345	D03	25	Low - Moderate	52	Moderate
Spring	9	1345	D04	25	Low - Moderate	52	Moderate
Spring	7	1345	D05	25	Low - Moderate	25	Low - Moderate
Spring	9	1345	D06	25	Low - Moderate	38	Low - Moderate
Spring	11	1345	D07	25	Low - Moderate	59	Moderate
Spring	12	1345	D08	5	Low	46	Moderate
Spring	4	1345	D09	5	Low	25	Low - Moderate
Spring	10	1345	D10	38	Low - Moderate	56	Moderate
Spring	13	1345	D11	77	Moderate - High	93	High
Spring	7	1345	D12	25	Low - Moderate	73	Moderate - High
Spring	14	1345	D13	93	High	97	High
Spring	12	1345	D14	58	Moderate	70	Moderate - High
Summer	11	3806	D01	12	Low	74	Moderate - High
Summer	15	3806	D02	47	Moderate	75	Moderate - High
Summer	5	3806	D03	12	Low	12	Low
Summer	11	3806	D04	12	Low	12	Low
Summer	6	3806	D05	12	Low	30	Low - Moderate
Summer	6	3806	D06	12	Low	12	Low
Summer	20	3806	D07	12	Low	40	Low - Moderate
Summer	4	3806	D08	12	Low	12	Low
Summer	5	3806	D09	12	Low	30	Low - Moderate
Summer	-	3806	D10	-	Nil	-	Nil
Summer	9	3806	D11	30	Low - Moderate	51	Moderate
Summer	15	3806	D12	30	Low - Moderate	82	High

Summer	-	3806	D13	-	Nil	-	Nil
Summer	11	3806	D14	12	Low	30	Low - Moderate
Autumn	3	4194	D01	19	Low	19	Low
Autumn	13	4194	D02	58	Moderate	67	Moderate - High
Autumn	12	4194	D03	54	Moderate	74	Moderate - High
Autumn	-	4194	D04	-	Nil	-	Nil
Autumn	12	4194	D05	47	Moderate	72	Moderate - High
Autumn	7	4194	D06	19	Low	67	Moderate - High
Autumn	14	4194	D07	54	Moderate	71	Moderate - High
Autumn	-	4194	D08	-	Nil	-	Nil
Autumn	-	4194	D09	-	Nil	-	Nil
Autumn	10	4194	D10	38	Low - Moderate	72	Moderate - High
Autumn	9	4194	D11	65	Moderate - High	91	High
Autumn	12	4194	D12	43	Moderate	71	Moderate - High
Autumn	10	4194	D13	67	Moderate - High	78	Moderate - High
Autumn	11	4194	D14	67	Moderate - High	79	Moderate - High

SOPRANO PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	13	1576	D01	25	Low - Moderate	66	Moderate - High
Spring	2	1576	D02	49	Moderate	92	High
Spring	12	1576	D03	32	Low - Moderate	68	Moderate - High
Spring	13	1576	D04	52	Moderate	80	Moderate - High
Spring	10	1576	D05	32	Low - Moderate	46	Moderate
Spring	11	1576	D06	46	Moderate	86	High
Spring	14	1576	D07	86	High	90	High
Spring	10	1576	D08	22	Low - Moderate	79	Moderate - High
Spring	7	1576	D09	25	Low - Moderate	61	Moderate - High
Spring	10	1576	D10	45	Moderate	77	Moderate - High
Spring	11	1576	D11	25	Low - Moderate	52	Moderate
Spring	10	1576	D12	25	Low - Moderate	66	Moderate - High
Spring	13	1576	D13	38	Low - Moderate	61	Moderate - High
Spring	12	1576	D14	46	Moderate	68	Moderate - High
Summer	16	5578	D01	30	Low - Moderate	66	Moderate - High
Summer	13	5578	D02	30	Low - Moderate	78	Moderate - High
Summer	13	5578	D03	30	Low - Moderate	47	Moderate
Summer	15	5578	D04	40	Low - Moderate	58	Moderate
Summer	21	5578	D05	51	Moderate	82	High

Summer	10	5578	D06	12	Low	30	Low - Moderate
Summer	22	5578	D07	58	Moderate	73	Moderate - High
Summer	22	5578	D08	47	Moderate	66	Moderate - High
Summer	11	5578	D09	12	Low	58	Moderate
Summer	-	5578	D10	-	Nil	-	Nil
Summer	15	5578	D11	30	Low - Moderate	47	Moderate
Summer	11	5578	D12	30	Low - Moderate	60	Moderate
Summer	1	5578	D13	40	Low - Moderate	40	Low - Moderate
Summer	21	5578	D14	51	Moderate	83	High
Autumn	9	5849	D01	47	Moderate	76	Moderate - High
Autumn	15	5849	D02	81	High	94	High
Autumn	15	5849	D03	71	Moderate - High	82	High
Autumn	3	5849	D04	19	Low	67	Moderate - High
Autumn	15	5849	D05	74	Moderate - High	98	High
Autumn	12	5849	D06	54	Moderate	78	Moderate - High
Autumn	15	5849	D07	84	High	99	High
Autumn	2	5849	D08	43	Moderate	47	Moderate
Autumn	2	5849	D09	29	Low - Moderate	38	Low - Moderate
Autumn	12	5849	D10	64	Moderate - High	84	High
Autumn	13	5849	D11	47	Moderate	69	Moderate - High
Autumn	10	5849	D12	51	Moderate	69	Moderate - High
Autumn	12	5849	D13	29	Low - Moderate	65	Moderate - High
Autumn	13	5849	D14	54	Moderate	80	Moderate - High

COMMON PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	14	1816	D01	88	High	99	High
Spring	5	1816	D02	56	Moderate	90	High
Spring	11	1816	D03	59	Moderate	97	High
Spring	12	1816	D04	59	Moderate	80	Moderate - High
Spring	14	1816	D05	67	Moderate - High	80	Moderate - High
Spring	13	1816	D06	52	Moderate	69	Moderate - High
Spring	14	1816	D07	87	High	94	High
Spring	13	1816	D08	56	Moderate	86	High
Spring	10	1816	D09	15	Low	78	Moderate - High
Spring	14	1816	D10	57	Moderate	85	High
Spring	12	1816	D11	25	Low - Moderate	73	Moderate - High

Spring	13	1816	D12	25	Low - Moderate	82	High
Spring	12	1816	D13	38	Low - Moderate	75	Moderate - High
Spring	12	1816	D14	46	Moderate	72	Moderate - High
Summer	24	6291	D01	88	High	96	High
Summer	24	6291	D02	88	High	97	High
Summer	24	6291	D03	94	High	99	High
Summer	23	6291	D04	78	Moderate - High	98	High
Summer	24	6291	D05	91	High	95	High
Summer	17	6291	D06	12	Low	87	High
Summer	23	6291	D07	86	High	94	High
Summer	24	6291	D08	66	Moderate - High	87	High
Summer	20	6291	D09	35	Low - Moderate	60	Moderate
Summer	-	6291	D10	-	Nil	-	Nil
Summer	18	6291	D11	47	Moderate	58	Moderate
Summer	20	6291	D12	47	Moderate	86	High
Summer	3	6291	D13	58	Moderate	87	High
Summer	24	6291	D14	86	High	96	High
Autumn	12	5650	D01	77	Moderate - High	96	High
Autumn	15	5650	D02	98	High	100	High
Autumn	15	5650	D03	91	High	99	High
Autumn	6	5650	D04	57	Moderate	96	High
Autumn	15	5650	D05	91	High	99	High
Autumn	15	5650	D06	80	Moderate - High	92	High
Autumn	15	5650	D07	98	High	100	High
Autumn	8	5650	D08	54	Moderate	69	Moderate - High
Autumn	5	5650	D09	38	Low - Moderate	58	Moderate
Autumn	15	5650	D10	89	High	99	High
Autumn	14	5650	D11	67	Moderate - High	81	High
Autumn	13	5650	D12	65	Moderate - High	93	High
Autumn	11	5650	D13	58	Moderate	85	High
Autumn	14	5650	D14	79	Moderate - High	94	High

NATHUSIUS' PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	-	243	D01	-	Nil	-	Nil
Spring	-	243	D02	-	Nil	-	Nil
Spring	2	243	D03	5	Low	5	Low

Spring	1	243	D04	5	Low	5	Low
Spring	-	243	D05	-	Nil	-	Nil
Spring	-	243	D06	-	Nil	-	Nil
Spring	1	243	D07	5	Low	5	Low
Spring	2	243	D08	5	Low	5	Low
Spring	-	243	D09	-	Nil	-	Nil
Spring	1	243	D10	5	Low	5	Low
Spring	1	243	D11	25	Low - Moderate	52	Moderate
Spring	-	243	D12	-	Nil	-	Nil
Spring	2	243	D13	5	Low	5	Low
Spring	1	243	D14	5	Low	5	Low
Summer	1	1307	D01	12	Low	12	Low
Summer	2	1307	D02	12	Low	12	Low
Summer	8	1307	D03	35	Low - Moderate	75	Moderate - High
Summer	3	1307	D04	12	Low	12	Low
Summer	4	1307	D05	21	Low - Moderate	30	Low - Moderate
Summer	-	1307	D06	-	Nil	-	Nil
Summer	1	1307	D07	12	Low	12	Low
Summer	-	1307	D08	-	Nil	-	Nil
Summer	-	1307	D09	-	Nil	-	Nil
Summer	-	1307	D10	-	Nil	-	Nil
Summer	-	1307	D11	-	Nil	-	Nil
Summer	-	1307	D12	-	Nil	-	Nil
Summer	-	1307	D13	-	Nil	-	Nil
Summer	1	1307	D14	12	Low	12	Low
Autumn	-	1607	D01	-	Nil	-	Nil
Autumn	1	1607	D02	85	High	85	High
Autumn	5	1607	D03	19	Low	38	Low - Moderate
Autumn	-	1607	D04	-	Nil	-	Nil
Autumn	2	1607	D05	19	Low	19	Low
Autumn	1	1607	D06	19	Low	19	Low
Autumn	2	1607	D07	19	Low	19	Low
Autumn	-	1607	D08	-	Nil	-	Nil
Autumn	-	1607	D09	-	Nil	-	Nil
Autumn	1	1607	D10	19	Low	19	Low
Autumn	4	1607	D11	19	Low	38	Low - Moderate
Autumn	-	1607	D12	-	Nil	-	Nil
Autumn	1	1607	D13	19	Low	19	Low
Autumn	2	1607	D14	19	Low	19	Low

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BROWN LONG-EARED BAT

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	7	531	D01	5	Low	25	Low - Moderate
Spring	-	531	D02	-	Nil	-	Nil
Spring	2	531	D03	5	Low	5	Low
Spring	8	531	D04	15	Low	59	Moderate
Spring	4	531	D05	5	Low	5	Low
Spring	1	531	D06	5	Low	5	Low
Spring	5	531	D07	5	Low	25	Low - Moderate
Spring	9	531	D08	25	Low - Moderate	73	Moderate - High
Spring	1	531	D09	5	Low	5	Low
Spring	1	531	D10	25	Low - Moderate	25	Low - Moderate
Spring	7	531	D11	25	Low - Moderate	87	High
Spring	8	531	D12	5	Low	25	Low - Moderate
Spring	13	531	D13	79	Moderate - High	86	High
Spring	9	531	D14	38	Low - Moderate	71	Moderate - High
Summer	3	1937	D01	12	Low	40	Low - Moderate
Summer	6	1937	D02	12	Low	40	Low - Moderate
Summer	2	1937	D03	12	Low	12	Low
Summer	14	1937	D04	12	Low	47	Moderate
Summer	6	1937	D05	12	Low	30	Low - Moderate
Summer	5	1937	D06	12	Low	12	Low
Summer	3	1937	D07	12	Low	40	Low - Moderate
Summer	7	1937	D08	12	Low	30	Low - Moderate
Summer	12	1937	D09	12	Low	64	Moderate - High
Summer	-	1937	D10	-	Nil	-	Nil
Summer	11	1937	D11	12	Low	51	Moderate
Summer	1	1937	D12	12	Low	12	Low
Summer	1	1937	D13	12	Low	12	Low
Summer	4	1937	D14	21	Low - Moderate	30	Low - Moderate
Autumn	2	2852	D01	19	Low	19	Low
Autumn	11	2852	D02	47	Moderate	71	Moderate - High
Autumn	11	2852	D03	38	Low - Moderate	47	Moderate
Autumn	1	2852	D04	19	Low	19	Low
Autumn	12	2852	D05	47	Moderate	82	High
Autumn	7	2852	D06	19	Low	65	Moderate - High
Autumn	7	2852	D07	38	Low - Moderate	47	Moderate

Autumn	-	2852	D08	-	Nil	-	Nil
Autumn	-	2852	D09	-	Nil	-	Nil
Autumn	7	2852	D10	19	Low	47	Moderate
Autumn	10	2852	D11	38	Low - Moderate	58	Moderate
Autumn	11	2852	D12	47	Moderate	72	Moderate - High
Autumn	11	2852	D13	38	Low - Moderate	74	Moderate - High
Autumn	13	2852	D14	54	Moderate	80	Moderate - High

APPENDIX 4

SURVEY AT HEIGHT RESULTS

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Bat Survey Report

Appendix 4 – Seven Hills Static Detector Survey at Height Results 2020

SURVEY AT HEIGHT RESULTS 2020

Date	Time	Mic. level	Species
19/08/2020	23:44:01	Ground	Leisler's bat
19/08/2020	21:11:16	Ground	Leisler's bat
19/08/2020	21:18:23	Ground	Leisler's bat
19/08/2020	21:18:39	Ground	Leisler's bat
19/08/2020	21:18:43	Ground	Leisler's bat
19/08/2020	21:18:59	Ground	Leisler's bat
19/08/2020	21:19:25	Ground	Leisler's bat
19/08/2020	23:55:20	Ground	Leisler's bat
21/08/2020	22:42:15	Ground	Leisler's bat
21/08/2020	03:29:17	Ground	Common pipistrelle
22/08/2020	03:50:11	Ground	Myotis spp.
22/08/2020	22:09:39	Ground	Leisler's bat
22/08/2020	22:16:37	Ground	Leisler's bat
22/08/2020	23:56:19	Ground	Leisler's bat
22/08/2020	00:10:43	Ground	Leisler's bat
22/08/2020	00:10:52	Ground	Leisler's bat
22/08/2020	00:11:03	Ground	Leisler's bat
22/08/2020	23:56:19	Height	Leisler's bat
22/08/2020	23:56:26	Ground	Leisler's bat
22/08/2020	00:10:43	Height	Leisler's bat
22/08/2020	00:11:03	Height	Leisler's bat
22/08/2020	23:25:02	Ground	Common pipistrelle
22/08/2020	23:55:35	Ground	Common pipistrelle
22/08/2020	00:47:23	Ground	Brown long-eared bat
22/08/2020	00:47:28	Ground	Brown long-eared bat
23/08/2020	00:31:37	Ground	Myotis spp.
23/08/2020	01:15:35	Ground	Myotis spp.
23/08/2020	01:36:22	Ground	Leisler's bat
23/08/2020	21:34:53	Ground	Leisler's bat
23/08/2020	00:19:42	Ground	Leisler's bat
23/08/2020	00:19:49	Ground	Leisler's bat
23/08/2020	00:26:42	Ground	Leisler's bat
23/08/2020	00:30:48	Ground	Leisler's bat
23/08/2020	00:30:53	Ground	Leisler's bat
23/08/2020	03:00:14	Ground	Leisler's bat
23/08/2020	03:05:33	Ground	Leisler's bat
23/08/2020	03:52:48	Ground	Leisler's bat

Date	Time	Mic. level	Species
23/08/2020	04:19:43	Ground	Leisler's bat
23/08/2020	04:37:47	Ground	Leisler's bat
23/08/2020	02:37:20	Height	Leisler's bat
23/08/2020	01:36:22	Height	Leisler's bat
23/08/2020	00:19:42	Height	Leisler's bat
23/08/2020	00:19:49	Height	Leisler's bat
23/08/2020	00:30:48	Height	Leisler's bat
23/08/2020	00:30:53	Height	Leisler's bat
23/08/2020	03:00:33	Ground	Leisler's bat
23/08/2020	03:05:33	Height	Leisler's bat
23/08/2020	03:52:48	Height	Leisler's bat
23/08/2020	04:19:43	Height	Leisler's bat
23/08/2020	04:37:47	Height	Leisler's bat
23/08/2020	02:50:12	Ground	Nathusius' pipistrelle
23/08/2020	23:53:17	Ground	Soprano pipistrelle
23/08/2020	04:32:41	Ground	Soprano pipistrelle
23/08/2020	23:45:02	Ground	Brown long-eared bat
23/08/2020	01:26:18	Ground	Brown long-eared bat
25/08/2020	21:27:38	Ground	Leisler's bat
26/08/2020	21:55:16	Height	Leisler's bat
26/08/2020	23:04:07	Ground	Leisler's bat
26/08/2020	05:03:39	Ground	Leisler's bat
26/08/2020	21:53:53	Height	Leisler's bat
26/08/2020	21:54:08	Height	Leisler's bat
26/08/2020	21:54:22	Height	Leisler's bat
26/08/2020	21:54:38	Height	Leisler's bat
26/08/2020	21:54:54	Height	Leisler's bat
26/08/2020	21:55:10	Height	Leisler's bat
26/08/2020	03:43:32	Height	Leisler's bat
26/08/2020	22:57:16	Ground	Leisler's bat
26/08/2020	22:57:16	Height	Leisler's bat
26/08/2020	04:23:25	Ground	Nathusius' pipistrelle
26/08/2020	22:48:10	Ground	Common pipistrelle
26/08/2020	00:22:37	Ground	Common pipistrelle
26/08/2020	22:51:22	Ground	Brown long-eared bat
26/08/2020	23:19:20	Ground	Brown long-eared bat
26/08/2020	23:26:23	Ground	Brown long-eared bat

Date	Time	Mic. level	Species
26/08/2020	01:41:16	Ground	Brown long-eared bat
26/08/2020	02:45:43	Ground	Brown long-eared bat
26/08/2020	04:22:23	Ground	Brown long-eared bat
27/08/2020	00:58:20	Ground	Myotis spp.
27/08/2020	21:52:31	Ground	Leisler's bat
27/08/2020	01:50:44	Ground	Common pipistrelle
27/08/2020	22:46:20	Ground	Soprano pipistrelle
28/08/2020	21:48:02	Ground	Common pipistrelle
28/08/2020	06:19:41	Ground	Soprano pipistrelle
28/08/2020	06:22:54	Ground	Soprano pipistrelle
28/08/2020	20:45:55	Ground	Soprano pipistrelle
28/08/2020	20:45:55	Height	Soprano pipistrelle

Date	Time	Mic. level	Species
28/08/2020	21:15:54	Ground	Brown long-eared bat
08/10/2020	07:35:16	Ground	Common pipistrelle
08/10/2020	07:44:47	Ground	Soprano pipistrelle
08/10/2020	19:02:08	Ground	Soprano pipistrelle
08/10/2020	07:07:03	Ground	Soprano pipistrelle
08/10/2020	07:17:05	Ground	Soprano pipistrelle
09/10/2020	19:24:44	Ground	Soprano pipistrelle
09/10/2020	19:04:12	Ground	Soprano pipistrelle
11/10/2020	18:50:23	Ground	Soprano pipistrelle
11/10/2020	18:55:24	Ground	Soprano pipistrelle
11/10/2020	18:59:38	Ground	Soprano pipistrelle

APPENDIX 5

OVERALL SITE RISK

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Bat Survey Report

Appendix 5 – Overall Risk Assessment (Table 3b, NatureScot, 2021)

Table 3b: *Stage 2 - Overall risk assessment*

Site risk level (from Table 3a)	Ecobat activity category (or equivalent justified categorisation)					
	Nil (0)	Low (1)	Low-moderate (2)	Moderate (3)	Moderate-high (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Med (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

The scores in the table are a product of multiplying site risk level and the Ecobat activity category (or equivalent). The activity categories equate to those given in Table 1 for high collision risk species. Nil (0) means no bat activity was recorded across the whole site, but caution is needed here, because although the values given in this column are "0", at sites where pre-construction surveys found no bat activity, there remains the possibility that new turbines could attract some bat species, thereby altering the level of risk that applies in reality.

Overall assessment:

Low (green)	0-4
Medium (amber)	5-12
High (red)	15-25

It is important to have an understanding of both "typical" and unusually high levels of bat activity at a site so that potentially important peaks in activity are not overlooked. It is therefore recommended that both the highest Ecobat activity category and the most frequent activity category (i.e. the median) are assessed separately in Table 3b and presented in the overall risk assessment. A judgement can then be made on which is the most relevant. It should be noted that presenting mean activity levels can be highly misleading where the data are highly skewed, as is frequently the case with bat activity at wind turbines (Lintott & Mathews, 2018).