APPENDIX 6-2

BAT REPORT

Appendix 6-2 - Bat Survey Report

Proposed Glenard Wind Farm, Co. Donegal

DOCUMENT DETAILS

Client:	**Futurenergy Glenard Designated Activity Company (DAC)**
Project Title:	**Proposed Glenard Wind Farm, Co. Donegal**
Project Number:	**190114**
Document Title:	**Bat Survey Report**
Document File Name:	**BR F – 2022.01.27- 190114**
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Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	26/11/2020	LD	JH
02	Draft	20/07/2021	AJ	JH
03	Draft	18/11/2021	AJ	JH
04	Final	28/01/2022	AJ	JH

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1. INTRODUCTION

MKO was commissioned to complete an assessment of the potential effects on bats of a proposed Project at Glenard, Co. Donegal. 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 any identified significant effects.

Bat surveys were undertaken throughout 2019 and 2020 were carried out in accordance with the methodologies described in NatureScot 2019 and are consistent with those described in the 2021[1] guidance update. 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. Surveys in 2019 were based on an indicative turbine layout of 16 turbines. Additional surveys were carried out in 2020, to account for additional proposed turbines, to ensure continued compliance with NatureScot Guidance. For the purposes of this report, the results from 2019 and 2020 are presented separately, however the assessment of risk and impact for the site are assessed as a whole.

The assessment and mitigation provided in this report has been designed in accordance with NatureScot 2021. Consideration was also given to the Northern Ireland Environment Agency (NIEA) Natural Environment Division (NED) Guidance [2], which was produced in August 2021, following the completion of the bat surveys at the Proposed Development site.

- For the purposes of this assessment, the entire project, including grid connection, is referred to as the 'Proposed Development', as delineated in green on Figure 2-1.
- For the purpose of this assessment, the term 'EIAR Study Area' or 'the site' refers to the site boundary as shown in Figure 2-1.
- The proposed development footprint, for the purposes of the planning permission application, occupies a smaller area within the Proposed Development. The term 'development footprint' is used to describe the lands that will be subject to the proposed infrastructure and associated construction works.

The EIAR Study Area, encompasses an area of approximately 851 hectares. The permanent footprint of the Proposed Development measures approximately 28 hectares, which represents approximately 2.9% of the EIAR Study Area. Further details on project description and components are outlined 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.

[1] *NatureScot published Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation. Version: August 2021 (NatureScot, 2021).*
[2] *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).*

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 was undertaken with reference to the latest 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 an 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

The 2019 survey scope development and project management was overseen by Dr. Úna Nealon. Úna's primary expertise lies in bat ecology. She completed her PhD with the Centre for Irish Bat Research, examining the impacts of wind farms on Irish bat species. The 2020 survey scope development and project management was overseen by Aoife Joyce (BSc., MSc.) and Luke Dodebier (BSc.).

Bat surveys were conducted by MKO ecologists Úna Nealon (BSc., PhD), Aoife Joyce (BSc., MSc.), Luke Dodebier (BSc.), Sara Fissolo (BSc.) and Colin Murphy (BSc., MSc.). They were assisted by Cathal Bergin who was completing work placement with MKO. 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 and Luke Dodebier under the supervision of John Hynes (BSc., MSc.) and Pat Roberts (BSc., MCIEEM), who both reviewed and approved the final document. 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. 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 north of Eskaheen Mountain, Inishowen, Co. Donegal in an upland area (Grid Ref: E244281 N431821). The proposed site lies approximately 7.5 kilometres east of Buncrana and approximately 5.2 kilometres west of Quigley's Point. The site is accessed via a number of local roads and Coillte forestry roads. The main site entrance is accessed via local roads that adjoin the R240 Regional Road which is located to the northeast of the site. The southern portion of the site is accessed via local roads and forestry tracks adjoining the R238 Regional Road which is located east of the site.

The primary land use in the area is commercial forestry, with mature and immature forestry coverage along with areas of clear fell across the majority of the Proposed Development site. Within the wider landscape, a mixture of agriculture, low-medium density housing, commercial forestry, peat-cutting and existing wind farms comprise the main land uses. A location map of the Proposed Development site is provided in Figure 2-1. The Proposed Development comprises:

1. *Construction of 15 No. wind turbines and associated hardstand areas with the following parameters:*
    a. *a total tip height in the range of 162 metres minimum to 173 metres maximum,*
    b. *hub height in the range of 96 metres minimum to 107 metres maximum, and*
    c. *rotor diameter in the range of 132 metres minimum to 140 metres maximum*
2. *1 no. 110kV permanent electrical substation including a control building with welfare facilities, all associated electrical plant and equipment, security fencing, all associated underground cabling, wastewater holding tank and all ancillary structures and works;*
3. *All works associated with the permanent 110kV connection from the proposed substation to the national electricity grid, via underground cabling within permanent cable ducts in the townlands of Meenyanly, Carnamoyle, Sorne, Owenkillew and Barnahone, Meenakeeragh Tullydush Upper, Annaslee and Ballynahone to the existing Trillick 110kV substation in the townland of Ballynahone;*
4. *All associated underground electrical and communications cabling connecting the turbines to the proposed wind farm substation;*
5. *1 no. Meteorological Mast of 104 metres in height;*
6. *Upgrade of existing tracks and roads, provision of new permanent site access roads including a new site entrance (in the townland of Glenard);*
7. *1 no. borrow pit;*
8. *1 permanent no. peat and spoil repository area;*
9. *Permanent placement of peat and spoil along sections of site access roads as part of the peat and spoil management plan for the site;*
10. *2 no. temporary construction compounds;*
11. *Permanent recreation and amenity works, including marked trails, seating areas, amenity car park, and associated amenity signage;*
12. *All temporary works associated with the facilitation of turbine component and abnormal load delivery;*
13. *Construction of a permanent link road between the R240 Regional Road and the L1731 local road; construction of a second permanent link road on the L1731; permanent road widening at three locations along the L1731 (in the townlands of Carrowmore or Glentogher and Illies) all of which will facilitate the delivery of abnormal loads to the site during the construction period and may be used during the operational period if necessary or to facilitate the decommissioning of the wind farm. Following the construction period, access to the link roads will be closed off;*
14. *Site Drainage;*
15. *Site Signage;*
16. *Ancillary Forestry Felling to facilitate construction and operation of the proposed development; and*
17. *All associated site development works.*

Map Legend

EIAR Site Boundary

N

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Drawing Title: Site Location Map	
Project Title: Proposed Glenard Windfarm	
Drawn By: PE	Checked By: JH
Project No.: 190114	Drawing No.: Fig 6-1
Scale: 1:75000	Date: 02.06.2021

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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 June 2019. 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 10th June 2021 and examined bat presence and roost records within a 10 km radius of a central point in the EIAR Study Area (IG E108565 N168915) (BCI 2012, Hundt 2012, NatureScot 2021). Available bat records were provided by Bat Conservation Ireland on 21/06/2021. Results from the National Biodiversity Data Centre were also reviewed 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 EIAR 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 EIAR 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

The Geological Survey Ireland (GSI) online mapping tool and University of Bristol Spelaeological 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 13th January 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 13th January 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 proposed, existing and permitted wind energy developments within 10km of the Proposed Development was undertaken (NatureScot, 2021) in conjunction with reviewing the IWEA interactive wind map (iwea.com). Other large infrastructure developments and proposals (e.g. roads) were also noted. Information on the location and scale of these developments was gathered to inform the potential for cumulative effects. Further details on infrastructure developments within the vicinity of the Proposed Development can be found in Chapter 2 of the main EIAR.

3.2.5 Multidisciplinary Surveys

Multidisciplinary walkover surveys were undertaken 2017, 2019 and 2020 (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 habitats (including any culverts/bridges) were assessed for bat commuting, foraging and roosting suitability. The grid connection and haul routes were visited as part of the multidisciplinary surveys outlined below and in Chapter 6 of the main EIAR.

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
13th June 2017	14th May 2019
14th August 2019	28th May 2019
15th August 2019	27th June 2019
2nd December 2019	8th July 2019
2nd July 2020	4th September 2019
2nd June 2021	17th September 2019
30th November 2021	16th April 2020
1st December 2021	28th April 2020
	17th June 2020
	18th August 2020
	1st September 2020
	30th June 2021

3.3 Field Surveys

3.3.1 Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out throughout 2019 and 2020. During these surveys, habitats within the EIAR 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, divided into *High*, *Moderate*, *Low* and *Negligible*, 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. 86.5m) of the Proposed Development footprint (SNH, 2019). The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. The site was visited in May, June, July and September 2019 and April, June, July, August and September 2020. Multiple walkovers were 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).

Two derelict structures were identified as potential roost structures within the EIAR Study Area in 2019 (Grid Ref: E243951 N433658 and E243975 N433657) and were subject to a roost assessment. 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 undertaken on the evenings of the May 14th, June 27th, and September 4th, 2019. Two surveyors were equipped with Bat Logger M bat detectors (Elekon AG, Lucerne, Switzerland). On May 14th, conditions were suitable for bat surveys; dry, warm (12˚C), calm (Beaufort Force 0). On June 27th, conditions were suitable for bat surveys; dry, warm (16-20˚C), light air (Beaufort Force 1). On September 4th, conditions were less than suitable for bat surveys; drizzle-moderate rain, (10-14˚C), moderate-fresh breeze (Beaufort Force 4-5). The emergence surveys commenced before sunset and concluded 1 hour after sunset.

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

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 4-2 to 4-6 (Section 4.5 below).

Transects were walked or driven by two surveyors, recording bats in real time. Surveys commenced within 30 mins before sunset and were completed within 3 hours after sunset. 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 2019 and 2020. Table 3-2 summarises survey effort in relation to manual transects.

Table 3-2 2019 and 2020 Survey Effort – Manual Transects

Date	Surveyors	Sunset	Start-End	Weather	Transect (km)
Glenard - 2019					
27th June 2019	Aoife Joyce and Luke Dodebier	22:14	21:48 - 01:16	16-20˚; dry; light air.	5.7
4th September 2019	Luke Dodebier and Sara Fissolo	20:16	20:08 - 22:16	10-14˚; light drizzle/rain; moderate breeze.	2.8
Total 2019 Survey Effort					**12.88**
Glenard - 2020					
16th April 2020	Aoife Joyce and Luke Dodebier	20:36	20:08 – 22:39	10˚; dry; light air-light breeze.	4.4
17th June 2020	Luke Dodebier and Colin Murphy	21:43	21:43 – 00:43	15˚; dry; calm.	4.2
18th August 2020	Colin Murphy and Cathal Bergin	20:57	20:27 – 22:57	15˚; dry; light air.	4.28
Total 2020 Survey Effort					**12.88**

3.3.4 Ground-level Static Surveys

Where developments have more than 10 turbines, NatureScot requires 1 detector per turbine up to 10 plus 1 detector for every 3 additional turbines.

The scope of bat work was designed in 2019, prior to the finalising of the Proposed Development layout (i.e. 15 turbines). The surveys were designed for a potential layout of up to 14 turbines. Given that 14 turbines were initially proposed, 12 detectors were deployed to ensure compliance with SNH guidance. Detectors were numbered utilising an initial indicative layout that included 14 turbines. The extent of the Proposed Development changed through the design process, and the number of turbines reduced by 3. Further amendments to the layout in early 2020 also required static surveys to be carried out at 4no. additional locations. Therefore, the data from detectors deployed in 2019 and 2020 has been combined. The final layout includes 15 turbines (Figure 3-1). The static detector locations achieved a good spatial spread in relation to the proposed turbines and sampled the range of available habitats.

Although the location of T15 changed throughout the design process, the spatial spread of static detectors covered a good range of habitats throughout the site. T15 was considered in the context of bat activity at other similar habitats (e.g. D13, D14 and D15) (Figure 3-1) and was considered likely to have similar levels of bat activity i.e. low (See Section 4.5.4, Table 4-8 below).

Automated bat detectors were deployed at 13 no. locations for at least 10 nights in each of spring (April-May), summer (June-mid August) and autumn (mid-August-October) (SNH, 2019). Detector locations were based on indicative turbine locations and differ slightly to the final proposed layout.

Keyholing will be required where turbines are proposed in areas of forestry within the site. This involves only felling an area required to construct the turbine and associated infrastructure thus creating open areas, within the forest, around proposed turbines (IWEA, 2012). The 'keyhole' size is typically 50m from turbine blade tip to forestry edge, and these keyhole areas remain open during the wind farm lifetime. All proposed turbines will require keyhole felling. Further details on proposed key-hole locations can be found in Chapter 4 of the EIAR.

Where keyholing is proposed, detectors were located along nearby forestry edge in order to more closely reflect the likely post-construction habitat. 2019 and 2020 static detector locations are described in Table 3-3 and presented in Figure 3-1.

Table 3-3 2019 and 2020 Ground-level Static Detector Locations

ID	Location	Habitat	Linear Feature within 50m	Corresponding/ Nearest Turbine
Glenard - 2019				
D02	E244619 N432501	WD4 edge, access track	Conifer forestry edge	T2
D03	E244713 N432950	WD4 edge, access track	Conifer forestry edge	T3
D04	E244256 N432781	WD4 edge, access track	Conifer forestry edge	T4
D05	E244105 N431875	WD4 edge, access track	Conifer forestry edge	T7/T8
D06	E244510 N431449	WD4 edge, bog	Conifer forestry edge	T9
D07	E243794 N431183	WD4 edge	Conifer forestry edge	T11
D08	E243331 N431348	WD4 mature and immature break	Conifer forestry edge	T10/T11

ID	Location	Habitat	Linear Feature within 50m	Corresponding/ Nearest Turbine
D10	E243707 N432760	WD4 edge, clearfell	Conifer forestry edge	T6
D11	E243518 N433009	WD4 fire break	Conifer forestry edge	T5
Glenard - 2020				
D12	E241494 N430890	Cutover bog	N/A	T12
D13	E242221 N430975	WD4 ride	Conifer forestry edge	T13
D14	E242978 N431365	WD4 ride	Conifer forestry edge	T14
D15	E242864 N431922	In Birch buffer at edge of WD4	Birch treeline edge	-

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.

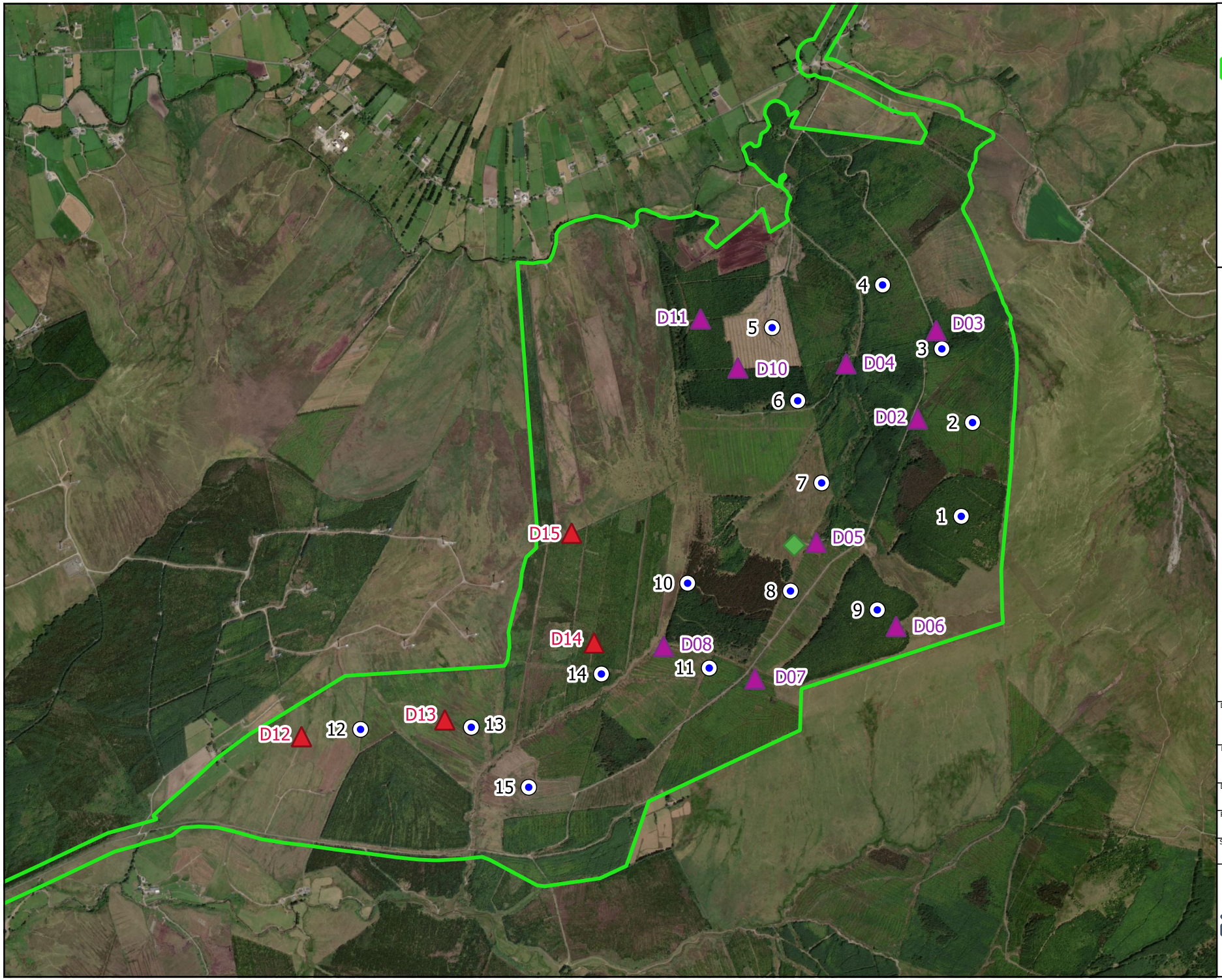
Onsite weather monitoring was undertaken concurrently with static detector deployments. One Vantage Pro 2 (Davis Instruments, CA, UCS) was deployed each season and night-time hourly data was tracked remotely to ensure a sufficient number of nights (i.e. minimum 10 no.) with appropriate weather conditions were captured (i.e. dusk temperatures above 8˚, wind speeds less than 5m/s and no or only very light rainfall). Tables 3-4 and 3-5 summarises survey effort achieved for each of the detector locations in 2019 and 2020.

Table 3-4 2019 Survey Effort - Ground-level Static Surveys

Season	Survey Period	Total Survey Nights per detector location	Nights with Appropriate Weather
Glenard – 2019			
Spring	14th May – 28th May 2019	14	14
Summer	27th June – 8th July 2019	11	11
Autumn	4th September – 17th September 2019	13	12
Total Survey Effort		**38**	**37**

Table 3-5 2020 Survey Effort - Ground-level Static Surveys

Season	Survey Period	Total Survey Nights per detector location	Nights with Appropriate Weather
Glenard – 2020			
Spring	16th April – 28th April 2020	13	11
Summer	17th June – 2nd July 2020	15	10
Autumn	18th August – 1st September 2020	15	15
Total Survey Effort		**43**	**36**



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- 2019 Static Detector Locations
- 2020 Static Detector Locations
- Met Mast

N

Drawing Title: Staic Detector Locations

Project Title: Glenard Wind Farm

Drawn By	Checked By
AJ	JH
Project No.	Drawing No.
190114	Figure 3-1
Scale	Date
1:25,000	02/02/2022

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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 2019. One Song Meter SM3BAT (Wildlife Acoustics, Maynard, MA, USA) was installed on a meteorological mast within the Proposed Development site (Grid Ref: E243993 N431848). The detector was equipped with two microphones; one at ground level and one at height (approx. 75 m above ground level) to allow for simultaneous surveying. Table 3-6 describes survey effort in relation to surveys at height and the location of the met mast is illustrated in Figure 3-1.

Table 3-6 2019 Survey Effort - Static Surveys at Height

ID	Survey Period	Total Survey Nights
Deployment - 1	12th August – 23rd August 2019	10
Deployment - 2	4th September- 25th of September 2019	16
Total Survey Effort		**36**

3.4 Bat Call Analysis

All recordings from 2019 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.

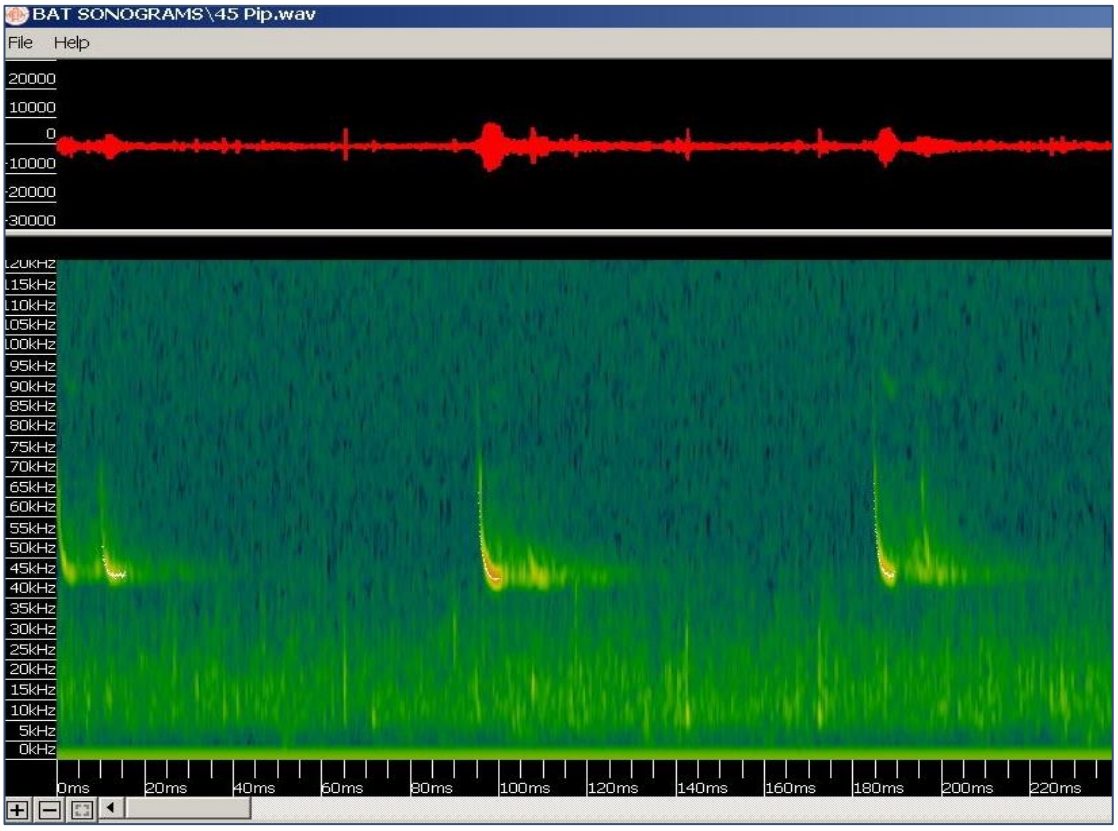


Plate 3-1 Sonogram of Echolocation Pulses of Common pipistrelle (Peak Frequency 45kHz)

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 3-7 defines bat activity levels as they relate to Ecobat percentile values (NatureScot, 2021).

2019/2020 static detector at ground level results for the proposed wind farm were uploaded on the 19th October 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 4-4 in the results section below.

Table 3-7 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

SNH (2019) 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 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 2019 and 2020. The surveys undertaken in 2019 and 2020, in accordance with SNH 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. RESULTS

4.1 Consultation

4.1.1 Bat Conservation Ireland

No response received from Bat Conservation Ireland as of the 27th January 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 details of the scoping and consultation exercise are described in the main EIAR. The response was received on the 15/01/2020 and the letter is provided in Appendix 2-1 of the EIAR.

Hedgerows and Related Species

Hedgerows should be maintained where possible as they form wildlife corridors and provide areas for birds to nest in; hedgerow trees may provide roosting places for bats. Where it is proposed that trees or hedgerows will be removed there should be suitable planting of native species in the mitigation incorporated into the EIAR.

Bats

Bat roosts may be present in trees, buildings and bridges. Bat roosts can only be destroyed under licence under the Wildlife Acts and derogation under the Birds and Natural Habitats Regulations and such a licence would only be given if suitable mitigation measures were implemented. Any proposed migratory bat friendly lighting should be proven to be effective.

Post Construction Monitoring

This Department recognises the importance of pre and post construction monitoring, such as recommended in Drewitt et al. (2006), and Bat Conservation Ireland (2012). The applicant should not use any proposed post construction monitoring as mitigation to supplement inadequate information in the assessment.

The EIAR process should identify any pre and post construction monitoring which should be carried out. The post construction monitoring 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 will 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 Acts or derogations under the Habitats Regulations. In particular, bats and otters are strictly protected under annex IV of the Habitats Directive.

In order to apply for any derogations, 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 also be provided.

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

The National Bat Database of Ireland was searched for records of bat activity and roosts within a 10 km radius of the proposed site (IG Ref: E244049 N431859). Available bat records were provided by Bat Conservation Ireland on 21/06/2021. A number of observations have been recorded within 10km; two roosts, two transects and thirty-four ad-hoc observations. 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, Brown long-eared bat, Daubenton's bat and Natterer's bat. The results of the database search are provided in Table 4-1.

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

Record	Species	Grid Reference	Date	Location
Roost	Unidentified bat	C4000022000	N/A	Bridge End Bridge; Co. Donegal
	Nyctalus leisleri	C3426	N/A	Private
Transect	*Myotis daubentonii*, *Nyctalus leisleri*, Unidentified bat	C3480432892	N/A	Crana Park Transect
	Myotis daubentonii, Unidentified bat	C3530023200	N/A	Inch Wildfowl Reserve Transect
Ad-Hoc	*Pipistrellus pygmaeus*	C3724434099	24/09/2009	BATLAS 2010
	N/A	C3803723678	27/09/2009	BATLAS 2010
	Myotis daubentonii; Pipistrellus pygmaeus	C4040024263	23/09/2009	BATLAS 2010
	Pipistrellus pygmaeus	C3949023985	23/09/2009	BATLAS 2010
	Nyctalus leisleri; Pipistrellus pygmaeus	C3830630153	24/09/2009	BATLAS 2010
	Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus; Pipistrellus spp. (45kHz/55kHz)	C3803723678	27/09/2009	BATLAS 2010
	Pipistrellus pygmaeus	C4177224661	23/09/2009	BATLAS 2010
	Pipistrellus pygmaeus	C4858935311	24/09/2009	BATLAS 2010
	Pipistrellus pygmaeus	C4144334306	28/08/2017	BATLAS 2020
	N/A	C3830630153	29/08/2018	BATLAS 2020
	Nyctalus leisleri; Pipistrellus pipistrellus (45kHz)	C3811240721	16/09/2016	BATLAS 2020
	Myotis daubentonii; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	C3484724045	10/05/2016	BATLAS 2020
	Pipistrellus pygmaeus	C4858935311	28/08/2017	BATLAS 2020
	Pipistrellus pygmaeus	C5142231371	30/08/2017	BATLAS 2020
	Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	C4177924620	13/09/2016	BATLAS 2020
	Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	C5184236297	30/08/2017	BATLAS 2020

Record	Species	Grid Reference	Date	Location
	Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	C4922633254	28/08/2017	BATLAS 2020
	N/A	C4624326553	13/09/2016	BATLAS 2020
	N/A	C4433337170	28/08/2017	BATLAS 2020
	Nyctalus leisleri; Pipistrellus pygmaeus	C3638934278	29/08/2018	BATLAS 2020
	Pipistrellus pygmaeus	C4785329330	13/09/2016	BATLAS 2020
	Pipistrellus pygmaeus	C4705640634	31/08/2017	BATLAS 2020
	Myotis spp.; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	C4862422377	01/08/2017	BATLAS 2020
	Pipistrellus pygmaeus	C4410834307	29/08/2017	BATLAS 2020
	Pipistrellus pygmaeus; Unidentified bat	C4968130701	28/08/2017	BATLAS 2020
	Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	C4039024250	13/09/2016	BATLAS 2020
	N/A	C5291235553	29/08/2017	BATLAS 2020
	Myotis daubentonii; Myotis natterreri; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus; Plecotus auritus	C3433432596	15/08/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	C4033825291	13/09/2016	BATLAS 2020
	N/A	C4413936763	28/08/2017	BATLAS 2020
	N/A	C5395334047	30/08/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	C4417627135	13/09/2016	BATLAS 2020
	Pipistrellus pygmaeus	C4755039080	28/08/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	C3494931598	10/10/2011	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 site (IG Ref: E108565 N168915; last search 19/07/2020). Hectads C43, C42, C33 and C32 lie within 10km of the proposed study area. Four of Ireland's nine resident bat species were recorded within 10 km of the proposed works. The results of the database search are provided in Table 4-2.

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

Grid Square	Species	Record Count	Latest Record	Dataset
C43	Soprano pipistrelle	1	24/09/2009	National Bat Database of Ireland
C42	Daubenton's bat	4	23/09/2009	National Bat Database of Ireland
C42	*Pipistrelle* spp.	1	27/09/2009	National Bat Database of Ireland
C42	Soprano pipistrelle	2	23/09/2009	National Bat Database of Ireland
C33	Daubenton's bat	5	09/08/2014	National Bat Database of Ireland
C33	Lesser Noctule	1	24/09/2009	National Bat Database of Ireland
C33	*Pipistrelle* spp.	1	10/10/2011	National Bat Database of Ireland
C33	Soprano pipistrelle	3	10/10/2011	National Bat Database of Ireland
C32	Daubenton's bat	4	26/08/2014	National Bat Database of Ireland
C32	Lesser Noctule	2	30/06/2011	National Bat Database of Ireland
C32	*Pipistrelle* spp.	1	27/09/2009	National Bat Database of Ireland
C32	Soprano pipistrelle	2	27/09/2009	National Bat Database of Ireland

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 Lesser horseshoe bat, Nathusius' pipistrelle, Whiskered bat, Natterer's bat and Brown long-eared bat, and within range for all other species, as mapped in the Article 17 reporting.

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 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

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 plantation forestry, while the remainder of the wind farm infrastructure site supports marginal farmland and peatland habitats.

A review of the GSI online mapper did not indicate the possible presence of any subterranean sites within the EIAR Study Area and a search of the National Monuments Database did not reveal the presence of any manmade subterranean sites within the EIAR Study Area.

A search of the UBSS Cave Database for the Republic of Ireland found no caves within the proposed site or within 10km of the study area.

A review of the NBDC bat landscape map provided a habitat suitability index of 8.22 (green). This indicates that the proposed development area has low habitat suitability for bat species.

4.2.5 Other Wind Energy Developments

Table 4-2 provides an overview of wind farms in the vicinity of the Proposed Development. No other large infrastructure developments and proposals (e.g. roads) were identified within the vicinity of the Proposed Development.

Table 4-3 Wind Farm Developments within 10km of the Proposed Development Site

Wind Farm Name and Location	No. Turbines	Status
Within 5 km of proposed Glenard Wind Farm		
Sorne Hill I	16	Existing
Sorne Hill II	3	Existing
Colpey Rock	1	Permitted
Malkell Wind Farm	2	Permitted
Meenkeeragh I Wind Farm	2	Existing
Meenkeeragh II Wind Farm	1	Existing
Meenkeeragh III Wind Farm	1	Existing
Glackmore Hill	1	Permitted

Glackmore Hill	1	Existing
Three Trees	2	Existing
Flughland	4	Existing
Crockahenny	10	Existing
Carrowglen	6	Permitted
Aught	14	Permitted
J. McCarron Wind Turbine	1	Permitted
Within 10 km of proposed Glenard Wind Farm		
Meenaward	3	Existing
Beam Hill	8	Existing
Sladran	2	Permitted
Drumlough Hill	8	Existing
Drumlough Hill Extension	12	Existing

4.3 Overview of Study Area and Bat Habitat Appraisal

The habitats within the EIAR Study Area boundary are dominated by Conifer plantation (WD4) with small areas of Wet heath (HH3), Cutover bog (PB4), Wet grassland (GS4), Eroding/ upland rivers (FW1) and Scrub (WS1). Chapter 6 of the main EIAR, describes the various habitats within the site in more detail.

The majority of the site is comprised of different stages of commercial coniferous plantation forestry including recent clear-fell, second rotation, immature, semi-mature and mature forestry. The species consist mainly of sitka spruce (*Picea sitchensis*) with some smaller areas of lodgepole pine (*Pinus contorta*). Given the nature of such densely planted coniferous plantations, few other woody plant species occur. A number of small areas within the site have also been planted with alder along the peripheries of the plantation or in small blocks. The forest edges support species including willow (*Salix spp.*), rowan (*Sorbus aucuparia*), ash (*Fraxinus excelsior*), alder (*Alnus glutinosa*) and hawthorn (*Crataegus monogyna*).

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 closed canopy forestry as well as exposed areas of grassland and peatland habitats were considered *Negligible* suitability, i.e. negligible habitat features on site likely to be used by commuting or foraging bats (Collins, 2016). Forestry edge habitats created by commercial forestry and roadways show potential for foraging and commuting bats. However, these habitats are surrounded by wide expanses of agricultural grassland and peatland habitats and thus, are not very well connected to the surrounding landscape. As such, these habitats were classified as *Moderate* suitability, i.e. habitat connected to the wider landscape that could be used by bats for foraging and commuting (Collins, 2016).

An assessment of the various woodland and forestry habitats was undertaken. Trees present on site comprise a mixture of mature and immature commercial coniferous species with *Negligible – Low* roosting potential.

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

4.4 Grid Connection, Haul Route and Amenity Walkway

4.4.1 Underground Cable Route

The grid connection cabling route is approximately 8 kilometres in length.

It is proposed to construct a 110kV electricity substation within the site of the Proposed Development as shown in Figure 4-1a, Chapter 4.

This underground cable connection will originate at the proposed onsite substation and will run southwest along the existing forestry road before meeting the local public road in the townland of Meenyanly. The habitats along the existing road are dominated by *Wet grassland (GS4),* willow and gorse dominated *scrub (WS1).* The grid connection cabling route will continue west along the local road through the townlands of Owenkillew and Barnahone before turning south at the bridge at Tullydish Upper. The bridge spans the Owenkillew River. The grid connection cabling route will

continue south past the Old School House before turning west along Gransha Road before turning northeast into the 110kV Trillick substation, located within the townland of Ballynahone.

The proposed cable route will involve 6 no. bridge crossings including 5 no. horizontal directional drilling (HDD) crossings and 1 no. bridge deck replacement works with flatbed formation.

The proposed cable route will cross 5 no. culvert crossings. It is proposed to cross existing culverts using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert.

Each of the water crossing locations along the underground cable route were assessed by means of a visual inspection survey on 30th June 2021, for their suitability to support roosting bats (Table 4-4). 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.

Further details on watercourse crossings along the grid connection route can be found in the Construction Methodology – 110kV Underground Cable Connection Report and Chapter 4 of the EIAR.

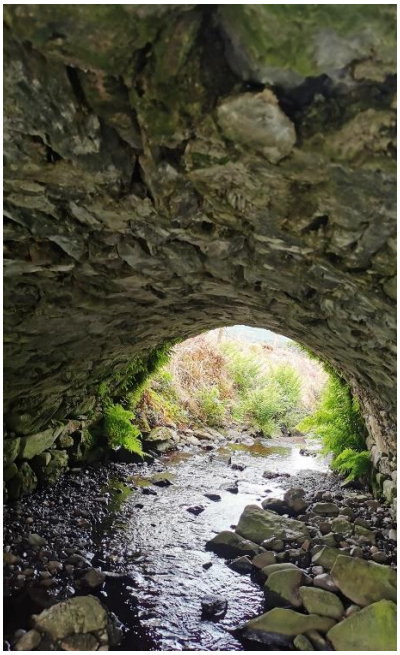
With regard to commuting and foraging bats, features along the underground cable route were assessed as having *Moderate* suitability i.e. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water (Collins, 2016).

With regard to roosting bats, habitat features along the underground cable route, including wet grassland and scrub, 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).

The underground cable route will be confined to existing public/forestry roads and tracks through conifer plantation. Other than the features presented in Table 4-4 below, no potential roost features were identified along the underground cable route. No trees are proposed for felling along the underground cable route.

Table 4-4 Water Crossings along Grid Connection Route

Watercourse Crossing Reference No.	Location (Irish Grid Ref)	Watercourse Bridge Type	Extent of Works	Bat Habitat Suitability
Bridge 1	E237695 N429218	Concrete arch overbridge with stone abutments	HDD approximately 1500mm beneath the waterway and bridge foundations.	***Negligible*** *– no suitable gaps/crevices. No evidence of bat use identified.*
Bridge 2	E238428 N428997	Concrete arch overbridge with stone abutments	HDD approximately 1500mm beneath the waterway and bridge foundations.	***Low*** *– gap present where bridge deck sits on abutment. No evidence of bat use identified.*
Bridge 3	E238429 N429172	Stone masonry arch overbridge	HDD approximately 1500mm beneath the waterway and bridge foundations.	***Moderate*** *– some gaps present in bridge arch where mortar has become dislodged. No evidence of bat use identified.*
Bridge 4	E238300 N430110	Stone masonry arch overbridge (A) and concrete arch overbridge with stone abutments (B)	Replacement of bridge deck surface.	***Moderate*** *– A: some gaps present in bridge arch where mortar has become dislodged. No evidence of bat use identified.* *B: gaps present where bridge deck sits on abutment. No evidence of bat use identified.*
Bridge 5	E239762 N429970	Stone masonry arch overbridge with concrete and stone abutments	HDD approximately 1500mm beneath the waterway and bridge foundations.	***Moderate*** *– some gaps present in bridge stone abutments where mortar has become dislodged. No evidence of bat use identified.*
Bridge 6	E242353 N430296	Concrete arch overbridge	HDD approximately 1500mm beneath the waterway and bridge foundations.	***Negligible*** *– no suitable gaps/crevices. No evidence of bat use identified.*
Culvert 1	N/A	750mm x 700mm Stone Masonry Box	Overcrossing	*Negligible*
Culvert 2	N/A	750mm x 700mm Twin Stone Masonry Box	Undercrossing	*Negligible*
Culvert 3	N/A	300mm HDPE twin walled pipe culvert	Undercrossing	*Negligible*
Culvert 4	N/A	500mm x 500mm stone masonry box	Undercrossing	*Negligible*
Culvert 5	N/A	450mm HDPE twin walled pipe culvert	Undercrossing	*Negligible*

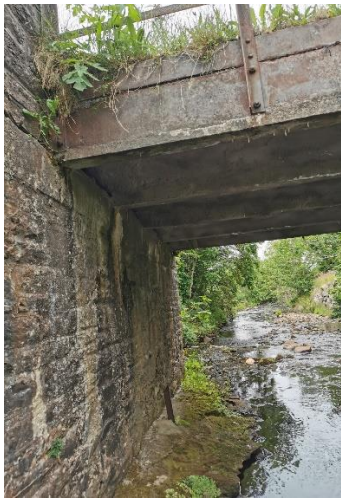


Bridge Crossing No.1

Bridge Crossing No.2

Bridge Crossing No.3

Bridge Crossing No.4 (A)



Bridge Crossing No.4 (B)

Bridge Crossing No.5

Bridge Crossing No.6

4.4.2 Haul Route

As described in Chapter 4, Section 4.4.1.1 of the EIAR, to facilitate the delivery of large turbine components and other abnormal loads during the construction of the wind farm, this application includes for the construction of:

- Link road between the R240 in the townland of Carrowmore or Glentogher through Coillte owned land and the L1731 road; and,
- Link road through Coillte-owned land joining two parts of the L1731 road also in the townland of Carrowmore or Glentogher.

Habitats along the proposed link roads are dominated by immature second rotation forestry with some wet grassland (GS4) and willow dominated scrub (WS1) occurring between the forestry and the existing roads. The roads have been classified as *Buildings and artificial surfaces (BL3).*

In addition to the proposed link roads, in order to accommodate the delivery of turbine components and other abnormal loads, road widening works will be required along the L1731 in the townland of Illies and along the local access road in the townland of Glenard. The habitats recorded within these areas is largely improved agricultural grassland (GA1) or Wet grassland (GS4) of low biodiversity value with a highly cut back Hedgerow (WL1) present along the northern side of the existing road. There will be some hedgerow loss along the haul route which is proposed for replanting.

The locations of these road widening areas are illustrated in Chapter 4, Figure 4-24 and on the site layout drawings in Appendix 4-1 of the EIAR.

With regard to commuting and foraging bats, features along the haul route where road widening is proposed were assessed as having *Low* suitability i.e. Habitat that could be used by small numbers of commuting bats such as gappy hedgerow or unvegetated stream, but isolated (Collins, 2016).

With regard to roosting bats, habitat features along the haul route where road widening is proposed, including agricultural grassland, wet grassland, willow scrub and highly managed hedgerow, 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).

4.4.3 Amenity Walkway

It is proposed to open sections of site roads, in combination with proposed new gravel walkways as marked trails for walkers, cyclists, trail runners and general outdoor recreation. Two separate sections of proposed new gravel walkways are proposed between Turbines No. 1 and No. 2 and Turbines No. 2 and No. 3, which will join up with existing and proposed new site roads, forming a number of looped trails within the site of the proposed development. All proposed walkways will have a 2.5 metre-running width.

In total, there will be approximately 1km of amenity walkways constructed and linking into wind farm site roads. The proposed walkways are shown on Figure 4-1 and Figure 4-24, Chapter 4. The amenity walkways will be located within Conifer plantation.

With regard to commuting and foraging bats, the existing closed canopy forestry along the proposed amenity walkway was assessed as having *Low* suitability i.e. Habitat that could be used by small numbers of commuting bats such as gappy hedgerow or unvegetated stream, but isolated (Collins, 2016).

With regard to roosting bats, habitat features along the proposed amenity walkway 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).

4.5 Survey Results

4.5.1 Roost Surveys

Two derelict structures were identified in 2019 as potential roosts within the EIAR Study Area (IG Ref: E243950 N433653 and E243976 N433654) (Plate 4-1). The structures have been avoided and will not be impacted by the Proposed Development.

The first identified bat roost was a two-storey derelict stone building, with brick chimneys, and a tile roof with underfelt lining. The building also had rotten timber fascia and all windows and doors were removed or collapsed. The structure was in a poor state of repair with the second storey partially collapsed to the ground floor. Bat access points included gaps in roof tiles and fascia boards, cracks in gable apex, chimney walls and open windows and doors at front and back of building (Plate 4-2).

Emergence surveys were carried out in Spring, Summer and Autumn 2019. In Spring, four Soprano pipistrelle bats were observed emerging from the two-storey house at dusk. In Summer, ten Soprano pipistrelle bats were observed emerging from the same two storey building, though not all registered on the Batlogger detectors. The bats were seen light sampling inside the building before emerging, as well as feeding/commuting throughout the building for the duration of the survey. Species observed in Summer comprised Common and Soprano pipistrelle as well as instances of *Myotis sp.* In Autumn, three pipistrelle bats were observed emerging from the two-storey building, but weather conditions were not ideal for bat activity.

The second structure, located opposite the derelict two-storey building, was a single-storey stone shed with a slate roof and partial underfelt. Potential bat access points were through open doors, windows, gaps in slates and stonework. While no bats were seen emerging from the shed during any of the roost surveys, there was evidence of bat use within the sheds with droppings located on interior walls (Plate 4.3).

The surrounding habitats were assessed as *Low to Moderate* suitability for roosting bats with large stands of coniferous forestry, clear fell and agricultural grasslands. There was a mixed broadleaved driveway, comprising hawthorn and sycamore, leading to the abandoned structures providing good potential roost features and connectivity for commuting and foraging bats in the area.

Plate 4-1 Two Identified Bat Roost Structures

Plate 4-2 Two-storey Derelict Structure with Identified Bat Roost

Plate 4-3 Single-storey Derelict Farm Shed with Identified Bat Roost

4.5.2 Manual Transects 2019

Manual bat activity surveys were undertaken in spring, summer and autumn 2019. Bat activity was recorded on all surveys. A total of 474 bat passes were recorded. In general, common pipistrelle (n=294) was recorded most frequently, followed by soprano pipistrelle (n=147), Leisler's bat (n=23), *Pipistrelle* sp. (n=7) and *Myotis* spp. (n=3). However, species composition and activity levels varied significantly between surveys.

The spring bat activity survey consisted of an emergence survey on the two identified roosts only. Walked or driven transects were carried out throughout the site in summer and autumn. Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort). Plate 4-4 presents results for individual species per survey period (summer and autumn).

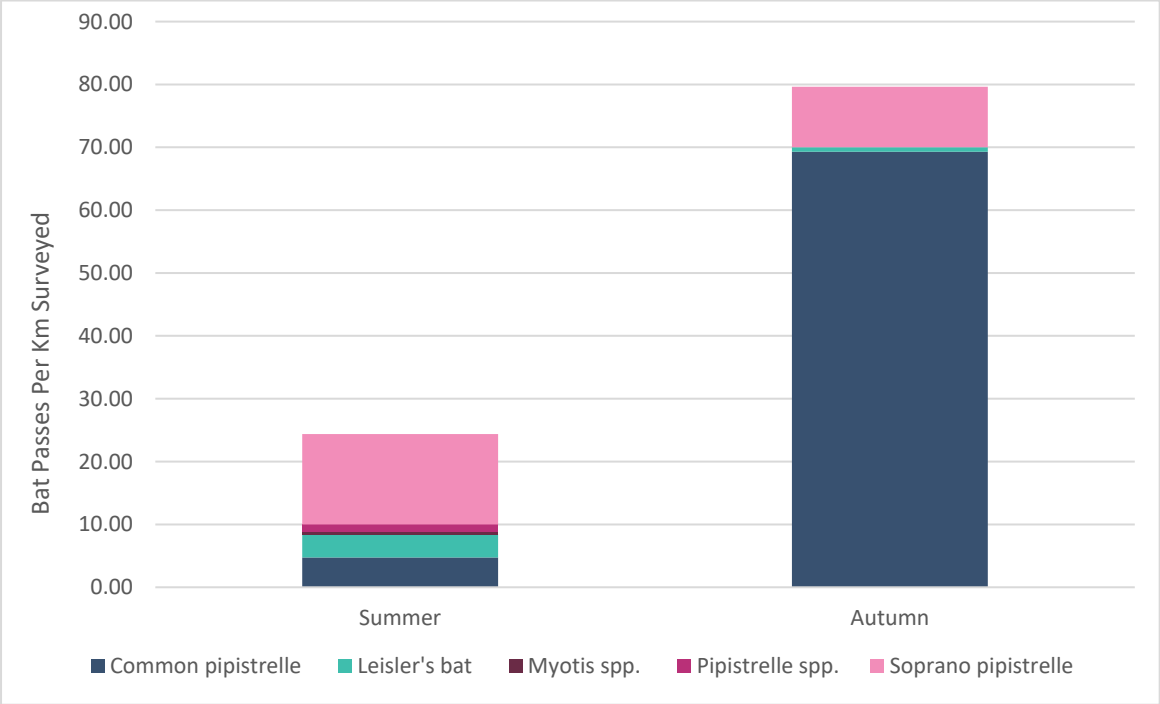
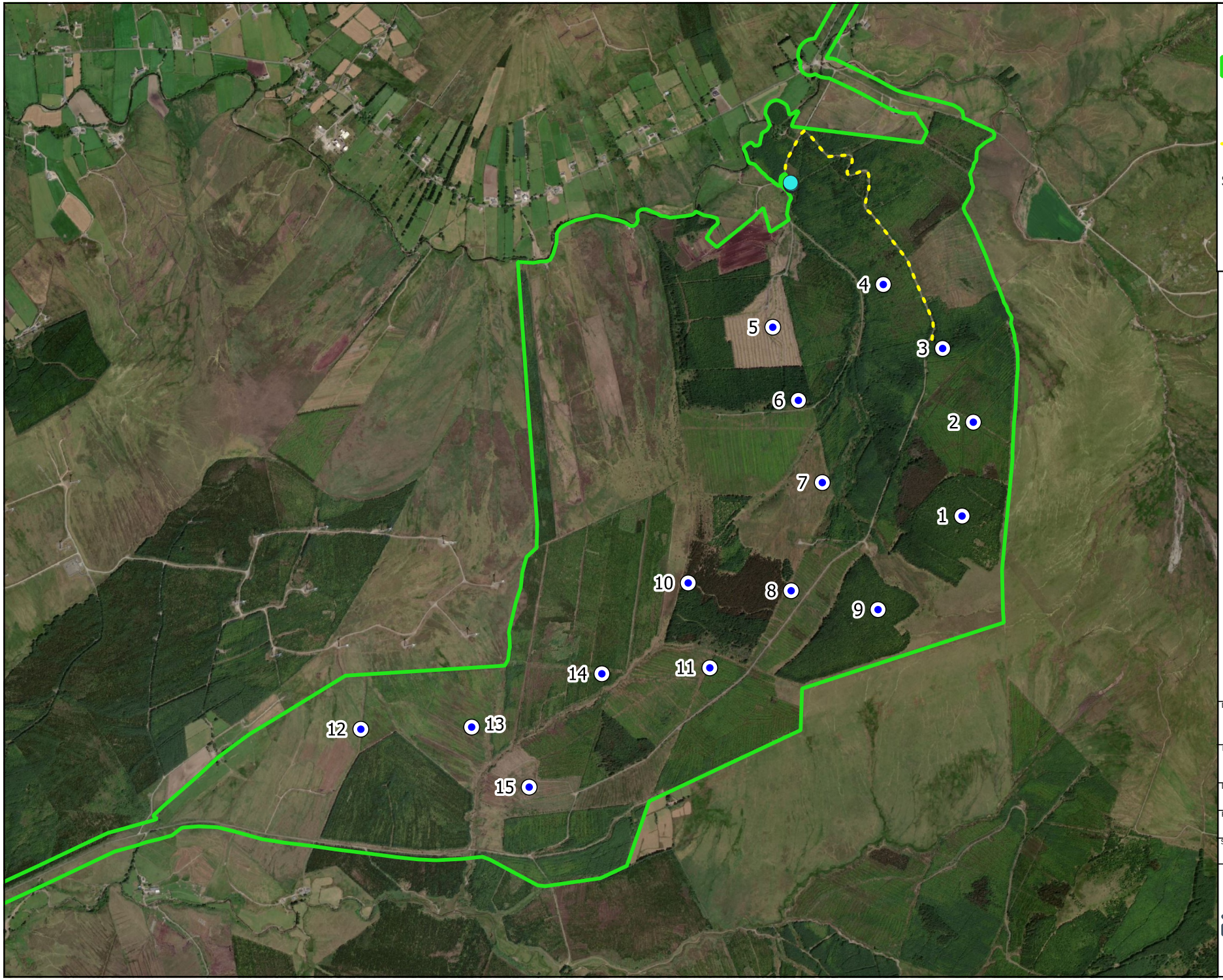


Plate 4-4 2019 Manual Transects - Species Composition Per Survey Period (Summer and Autumn)

Figures 4-1 to 4-3 present the spatial distribution of bat activity across the 2019 surveys. Bat activity was concentrated along mature forestry edge habitats.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- 2019 Spring Transect Route

Species

- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title: Spring Manual Results

Project Title: Glenard Wind Farm

Drawn By	Checked By
AJ	JH
Project No.	Drawing No.
190114	Figure 4-1
Scale	Date
1:25000	02/02/2022

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Map Legend

- Proposed EIAR Boundary
- Proposed Turbine Layout
- Walked Transect Route
- Driven Transect Route

Summer 2019 - Manual Results

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

N

Drawing Title

Summer Manual Results

Project Title

Glenard Wind Farm

Drawn By	Checked By
AJ	JH
Project No.	Drawing No.
190114	Figure 4-2
Scale	Date
1:21500	21/07/2021

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Map Legend

- Proposed EIAR Boundary
- Proposed Turbine Layout
- Driven Transect Route

Autumn 2019 - Manual Results

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title

Autumn Manual Results

Project Title

Glenard Wind Farm

Drawn By	Checked By
AJ	JH
Project No.	Drawing No.
190114	Figure 4-3
Scale	Date
1:21500	21/07/2021

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4.5.3 Manual Transects 2020

Manual transects were undertaken in spring, summer and autumn 2020. Bat activity was recorded on all surveys. A total of 45 bat passes were recorded. In general, Leisler's bat (n=36) was recorded most frequently, followed by Common pipistrelle (n=6), *Myotis* spp. (n=2) and Brown long-eared bat (n=1). 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 4-5 presents results for individual species per survey period.

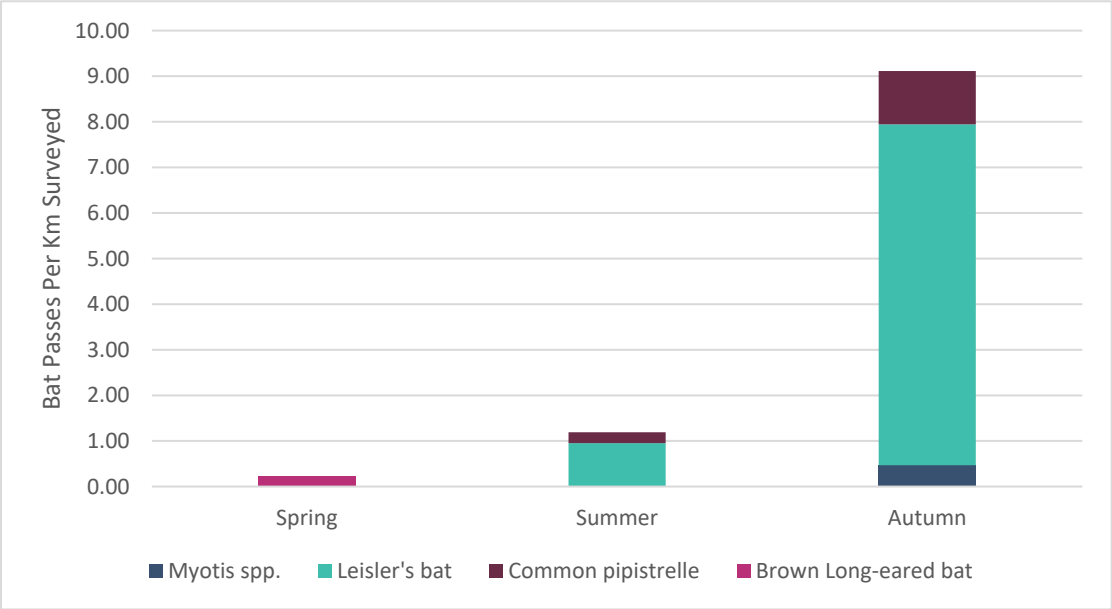
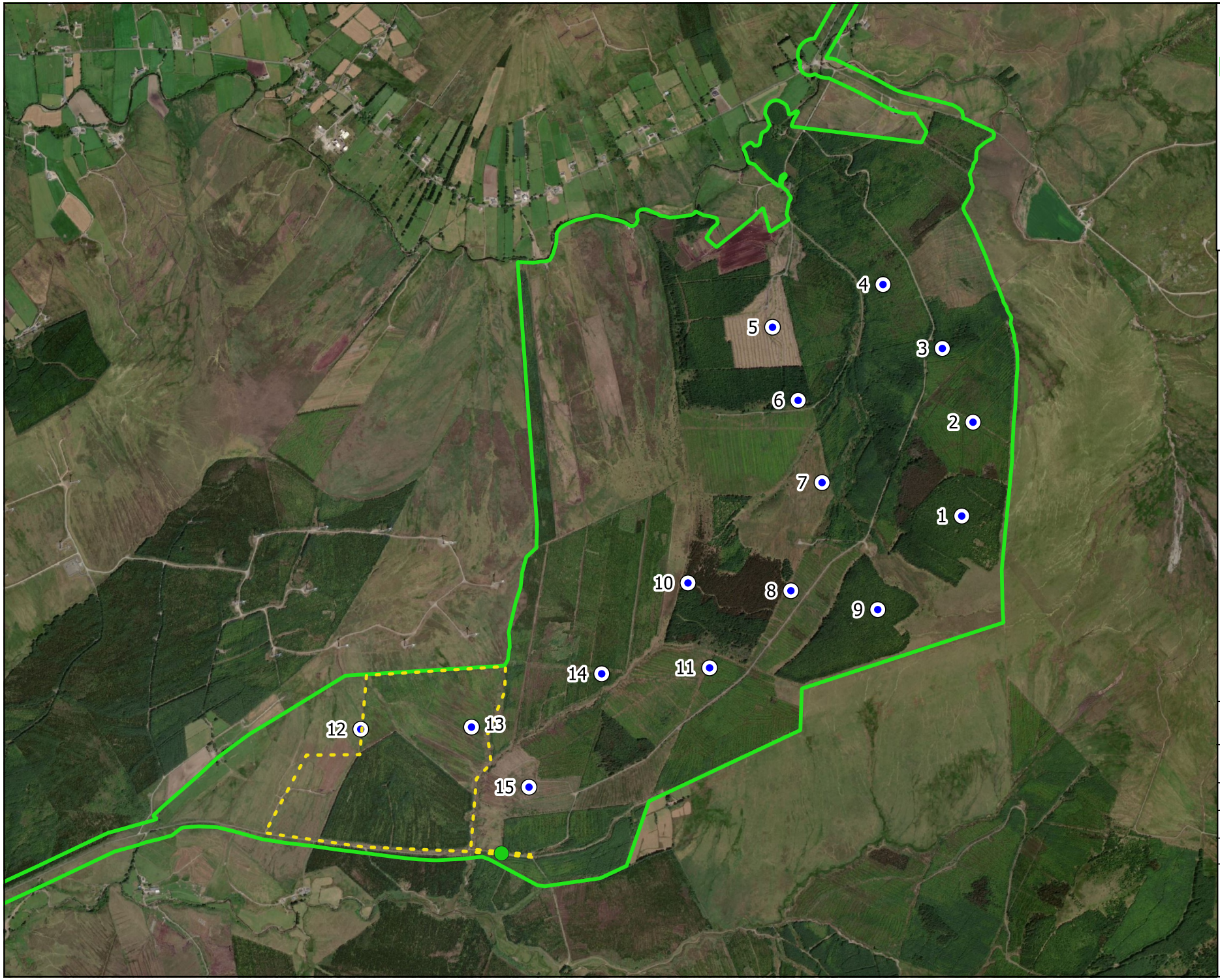


Plate 4-5 2019 Manual Transects - Species Composition Per Survey Period

Figures 4-4 to 4-6 present the spatial distribution of bat activity across the 2020 surveys. Bat activity was concentrated along mature forestry edge habitats.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- 2020 Spring Transect Route

Species

- Brown long-eared bat

Drawing Title

Spring 2020 Manual Results

Project Title

Glenard Wind Farm

Drawn By	Checked By
AJ	JH
Project No.	Drawing No.
190114	Figure 4-4
Scale	Date
1:25,000	02/02/2022

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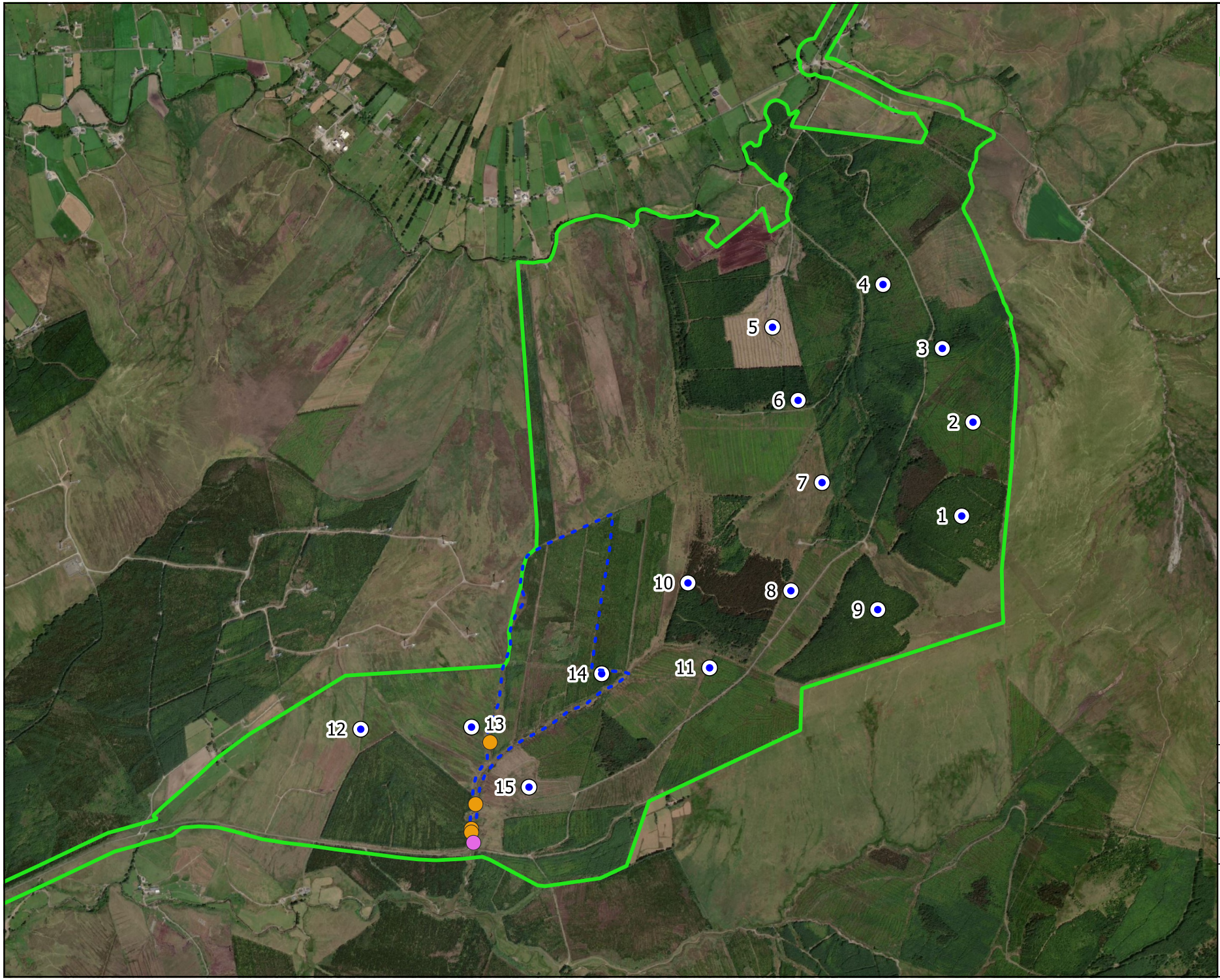
Map Legend
EIAR Site Boundary
Proposed Turbine Layout
2020 Summer Transect Route
Species
Leisler's bat
Common pipistrelle
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
N
Microsoft product screen shots reprinted with permission from Microsoft Corporation
Drawing Title
Summer 2020 Manual Results
Project Title
Glenard Wind Farm
Drawn By
AJ
Checked By
JH
Project No.
190114
Drawing No.
Figure 4-5
Scale
1:25,000
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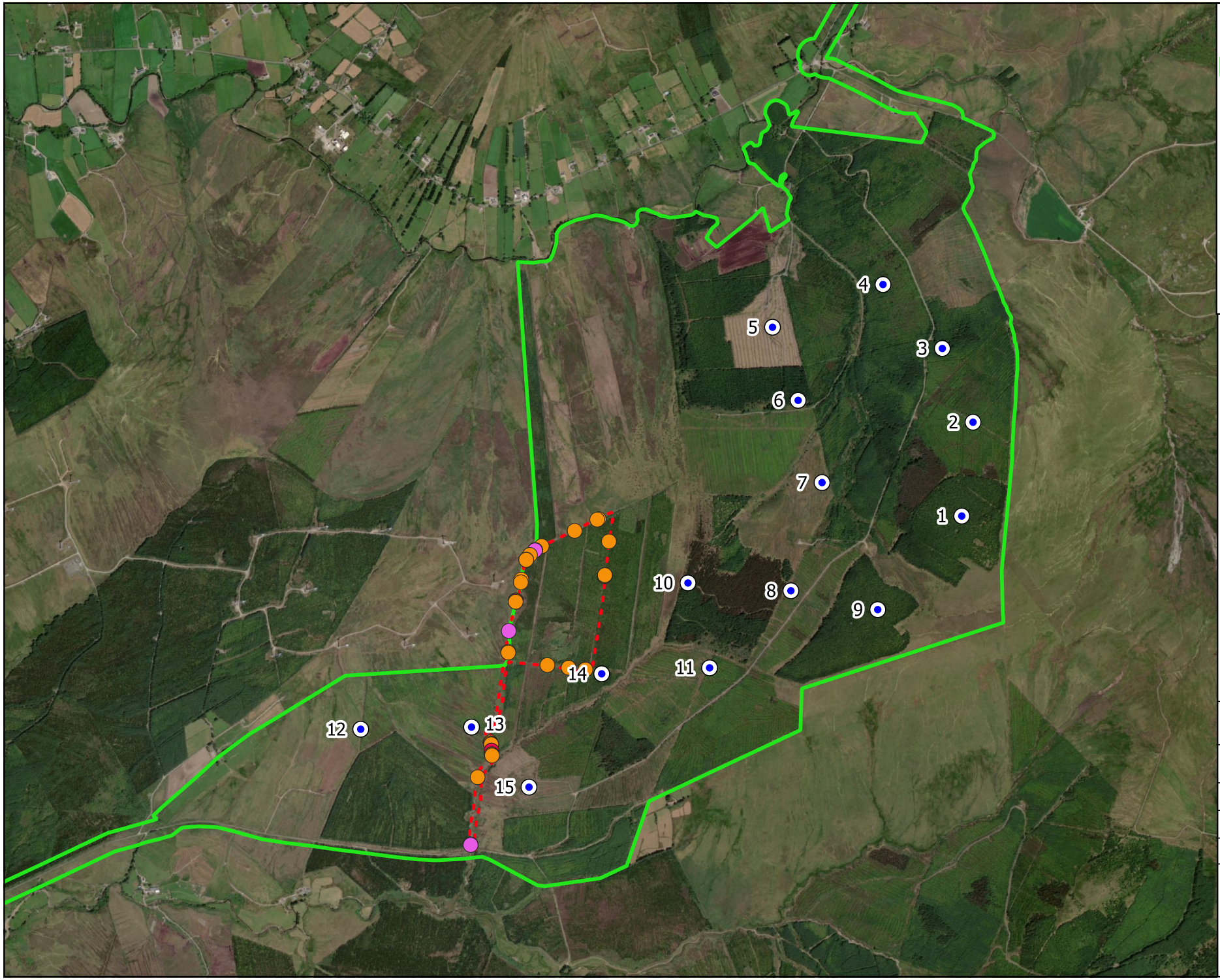

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- 2020 Autumn Transect Route

Species

- Myptis spp.
- Leisler's bat
- Common pipistrelle

N

Drawing Title

Autumn 2020 Manual Results

Project Title

Glenard Wind Farm

Drawn By	Checked By
AJ	JH
Project No.	Drawing No.
190114	Figure 4-6
Scale	Date
1:25,000	02/02/2022

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4.5.4 Ground-level Static Surveys (2019 and 2020)

In total, 18,309 bat passes were recorded across all deployments. In general, Common pipistrelle (n=13,132) occurred most frequently, while Soprano pipistrelle (n=3,631), Leisler's bat (n=1,040), *Myotis* spp. (n=250), and Brown long-eared bat (n=256) were significantly less. Plate 4-6 presents species composition across all ground-level static detectors.

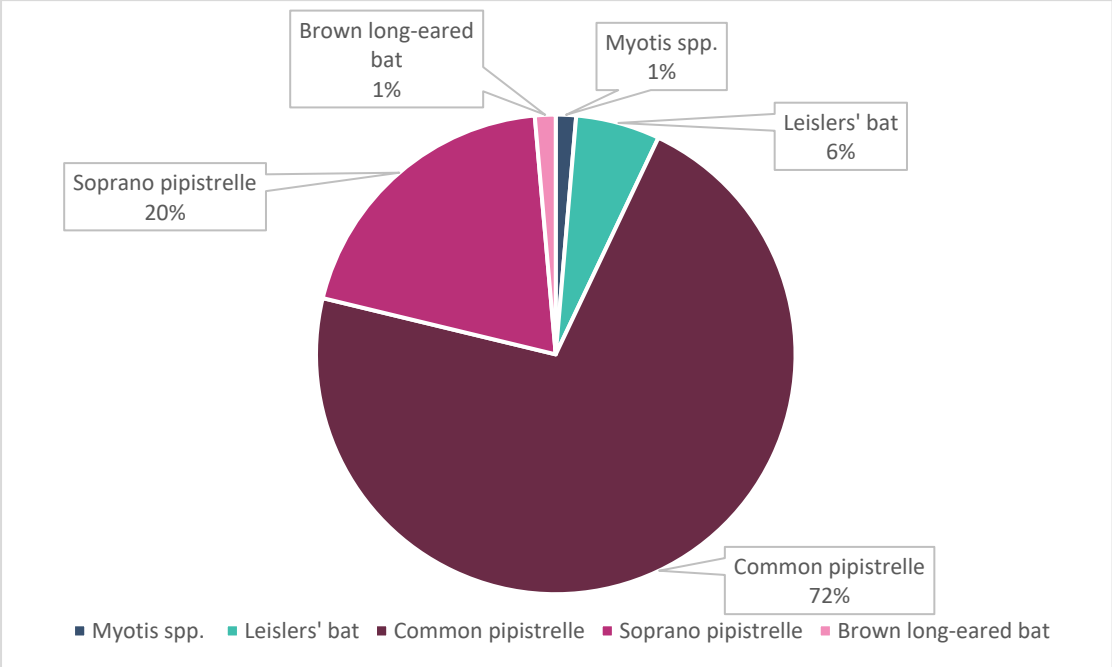

Plate 4-6 Static Detector Surveys: Species Composition Across All Deployments and all years (Total Bat Passes)

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 4-7 and Table 4-3 presents these results for each species.

In 2019, bat activity was dominated by Common pipistrelle across all seasons. Activity for Soprano pipistrelle, Leisler's bat, *Myotis* spp. and Brown long-eared bat was significantly lower across all seasons when compared to Common pipistrelle.

During 2020 bat activity in general was very low across all seasons. During spring, Brown long-eared bat had the highest activity followed by Common pipistrelle, Soprano pipistrelle, Leisler's bat. *Myotis spp.* had the lowest activity. During summer and autumn 2020, Leisler's bat dominated bat activity. In summer, Common pipistrelle had the second highest while *Myotis spp.* activity was significantly less. No other bat species were recorded during summer 2020. During autumn 2020, Common pipistrelle was the second highest recorded species after Leisler's bat, followed by Brown long-eared bat, Soprano pipistrelle and *Myotis spp.* species.

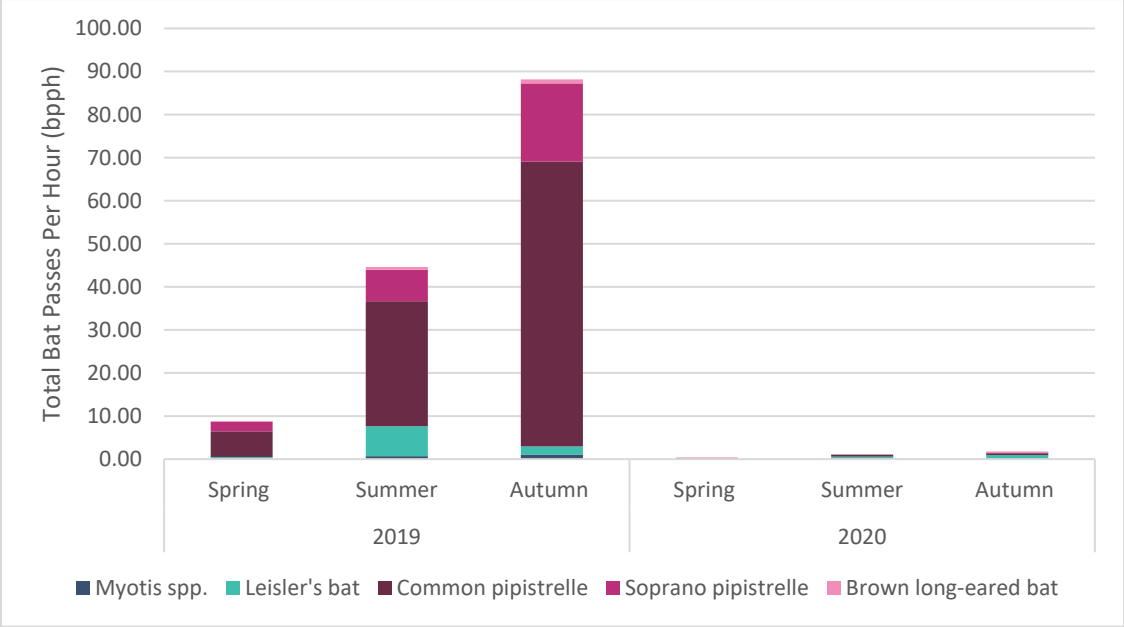

Plate 4-7 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

Table 4-5 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

	2019			2020		
	Spring	**Summer**	**Autumn**	**Spring**	**Summer**	**Autumn**
Total survey hours	**113.4**	**80.6**	**151.5**	**103.9**	**79.4**	**126.4**
Myotis spp.	0.19	0.69	1.08	0.03	0.04	0.02
Leisler's bat	0.32	6.95	1.86	0.04	0.53	0.92
Common pipistrelle	5.95	29.02	66.10	0.11	0.50	0.42
Soprano pipistrelle	2.21	7.32	18.19	0.09	0.00	0.20
Brown long-eared bat	0.19	0.63	0.93	0.15	0.00	0.21

The Nightly Pass Rate (i.e. total bat passes per hour, per night) was used to determine typical bat activity at the proposed 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).

Plates 4-8 illustrates the Median Nightly Pass Rate per species per deployment in 2019 and 2020. Zero data, when a species was not detected on a night, was also included.

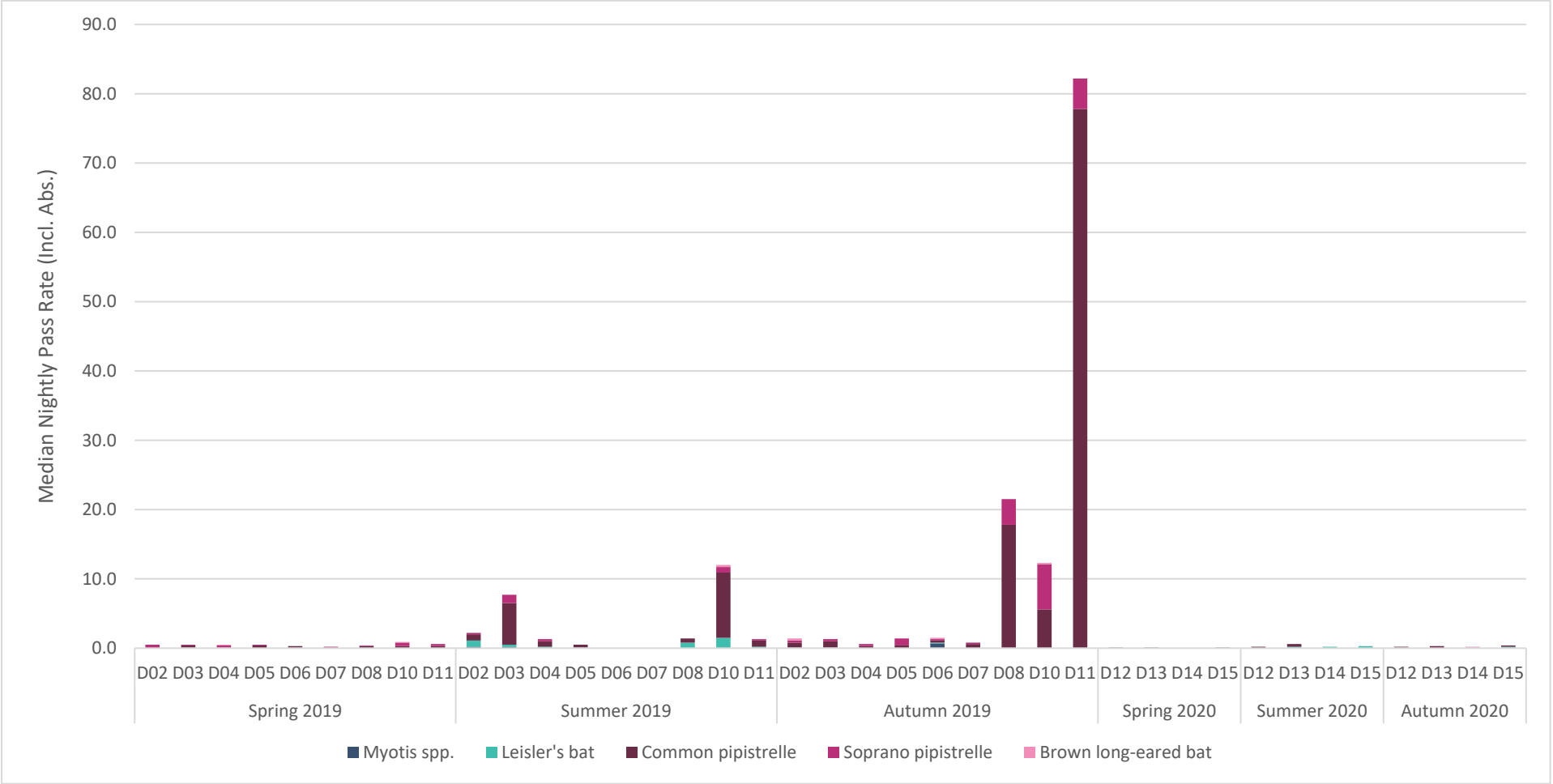

Plate 4-8 2019 and 2020 Static Detector Surveys: Median Nightly Pass Rate (Bat Passes Per Hour) Including Absences, Per Detector Per Survey Period.

Bat activity at D11 during the 2019 autumn period was significantly higher than all other detectors. D08 and D10 also had more activity than all other detectors in autumn 2019. Similarly, in summer 2019, D10 showed the highest bat activity level compared to all other detectors. D03 also had elevated levels of bat activity in summer 2019, when compared to other detector locations. Bat activity in spring 2019 was low across all detectors.

Overall, 2020 bat activity was significantly lower than 2019. Habitat features during the 2020 surveys included more open and exposed areas when compared to habitats surrounding proposed 2019 turbine locations which comprised more sheltered habitats in the form of plantation forestry. The median nightly pass rate was slightly higher in summer and autumn across all detectors in 2020 when compared to spring 2020.

Bat activity levels were objectively assessed against a reference dataset using Ecobat. Table 4-4 presents the results of Ecobat analysis for each species per season on a site-level. **Appendix 3** provides these results per detector.

Peaks in Median bat activity levels were *Moderate to High* for Common pipistrelle, Soprano pipistrelle and Leisler's bat across all seasons in 2019. In 2020, median activity for Common pipistrelle varied between *Low* and *High* activity across all seasons. Median activity for Soprano pipistrelle peaked at *Moderate to High* in 2020 and median Leisler's bat activity peaked at *Moderate.* Median activity for *Myotis spp.* varied from *Nil* to *Low* in 2019 and *Low* to *Low-Moderate* in 2020 across all seasons. Brown long-eared bat had median activity rates of *Low* to *Moderate* in 2019 and *Nil* to *Low* in 2020 across the various seasons.

Max bat activity for Common pipistrelle, Soprano pipistrelle and Leisler's bat peaked at *High* activity during at least one season across 2019 and 2020. Max bat activity for *Myotis spp.* varied from *Nil* to *Moderate -High* in 2019 and *Low* to *Low-Moderate* in 2020. Max bat activity for Brown long-eared bat varied from *Moderate* to *High* in 2019 and *Low-Moderate* to *Moderate-High* in 2020.

Table 4-6 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 2019						
Spring	53	Moderate	97	High	51	4635
Summer	75	Moderate-High	99	High	67	5847
Autumn	84	High	100	High	98	3563
Common pipistrelle 2020						
Spring	12	Low	12	Low	11	1676
Summer	7	Low	63	Moderate-High	22	6461
Autumn	84	High	100	High	98	4561
Soprano pipistrelle 2019						
Spring	53	Moderate	87	High	53	6106
Summer	59	Moderate	97	High	51	7713
Autumn	77	Moderate-High	99	High	98	5481
Soprano pipistrelle 2020						
Spring	12	Low	37	Low-Moderate	8	1754
Summer	-	Nil	-	Nil	-	-
Autumn	77	Moderate-High	99	High	98	6945
Leisler's bat 2019						

Survey Period	Median Percentile	Median Bat Activity	Max Percentile	Max Bat Activity	Nights Recorded	Ref Range
Spring	41	Moderate	78	Moderate-High	9	2749
Summer	68	Moderate-High	96	High	55	2939
Autumn	58	Moderate	97	High	48	1607
Leisler's bat 2020						
Spring	12	Low	37	Low-Moderate	3	1388
Summer	51	Moderate	67	Moderate-High	13	3638
Autumn	58	Moderate	97	High	31	2236
***Myotis* spp. 2019**						
Spring	10	Low	53	Moderate	13	2379
Summer	5	Low	78	Moderate-High	21	2268
Autumn	-	Nil	-	Nil	-	-
***Myotis* spp. 2020**						
Spring	12	Low	12	Low	3	1280
Summer	23	Low-Moderate	38	Low-Moderate	2	2701
Autumn	14	Low	14	Low	3	2893
Brown long-eared bat 2019						
Spring	10	Low	41	Moderate	16	867
Summer	22	Low-Moderate	64	Moderate-High	24	682
Autumn	46	Moderate	81	High	55	1081
Brown long-eared bat 2020						
Spring	12	Low	37	Low-Moderate	15	436
Summer	-	Nil	-	Nil	-	-
Autumn	14	Low	64	Moderate-High	17	1162

4.5.5 Surveys at Height 2019

Simultaneous surveying at ground level and at height was undertaken using an SM3 static bat detector. One U1 microphone was attached at height during the construction of the meteorological mast while another U1 microphone was placed 2m from ground level.

In 2019, 36 nights of simultaneous bat monitoring at ground level and at height was achieved. In total, 151 bat passes were recorded with bat activity higher at ground level (93%) compared to activity at height (7%) (Plate 4-9). Only Leisler's bat (n=7) and Common pipistrelle (n=3) were recorded at height. Mast-1 to Mast-2 represents deployment efforts. Plate 4-9 provides a summary of these results.

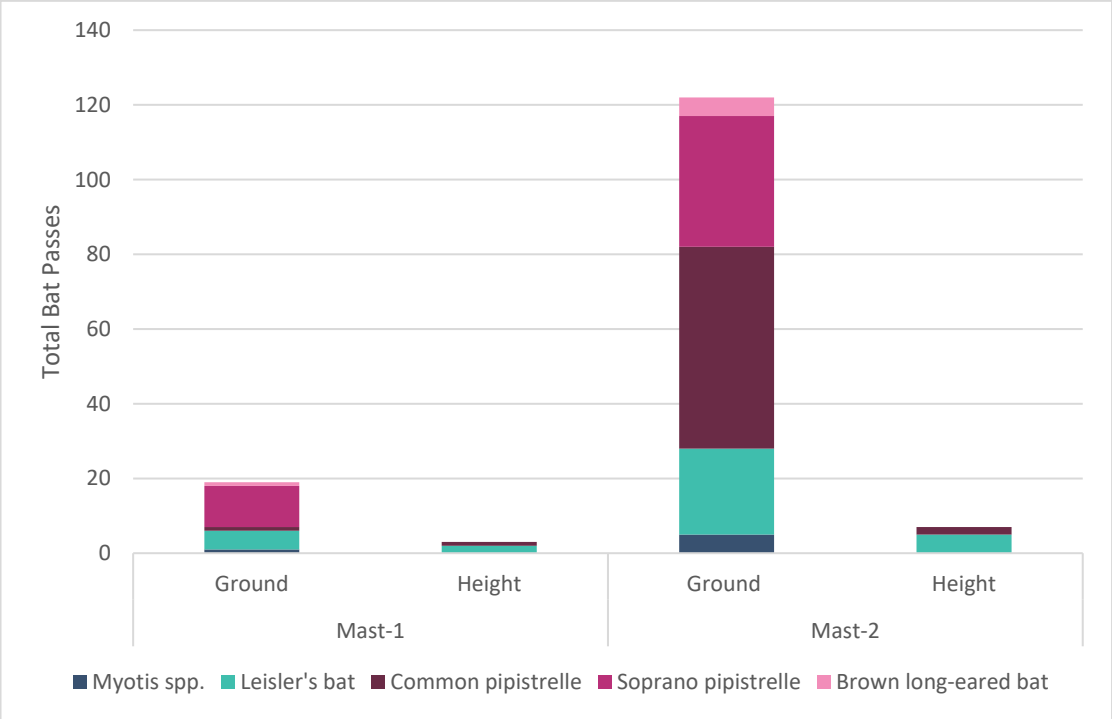

Plate 4-9 Surveys at Height: Species Composition Per Microphone Per Deployment

Table 4-7 presents met mast monitoring as total bat passes. All individual bat records arising from static detector monitoring are appended to this report as **Appendix 4.**

Table 4-7 Static Detector Surveys at Height: 2019 Total Bat Passes

	Mast-1		Mast-2	
	Ground level	At Height	Ground level	At Height
Myotis spp.	1	-	5	-
Leisler's bat	5	2	23	5
Common pipistrelle	1	1	54	2
Soprano pipistrelle	11	-	35	-
Brown long-eared bat	1	-	5	-
Total	**19**	**3**	**122**	**7**

4.6 Importance of Bat Population Recorded at the Site

Ecological evaluation within this section follows a methodology that is set out in Chapter three 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. No bat roosts were identified within the footprint of the proposed development. Bats as an Ecological Receptor have been assigned ***Local Importance (Higher value)*** on the basis that the habitats within the EIAR Study Area are utilized by a regularly occurring bat population of Local Importance.

Two bat roosts of ***Local Importance*** were identified within the EIAR Study Area. Four bats were identified leaving the derelict two-storey roosting site in Spring and ten bats were observed emerging in Summer. Evidence of bat use was identified in the second derelict structure. No roosting site of National Importance (i.e. site greater than 100 individuals) was recorded within the site. The identified roosts have been avoided by the Proposed Development.

5. RISK AND IMPACT ASSESSMENT

- This risk and impact assessment has been undertaken in accordance with NatureScot Guidance. As per the NatureScot Guidance, 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 EIAR 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	Two low value roosts identified within the EIAR Study Area. The habitats within the site provide potential suitable foraging habitat for bats and is connected to the wider landscape by blocks of woodland, rivers and mature headgerows. However, 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 15 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). Some other wind energy developments within 5km. 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 commercial coniferous forestry with smaller areas of upland peatland habitats. 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 (15 turbines) with other wind energy developments within 5km.

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

For the purpose of this report the assessment of collision risk is divided into 2019 and 2020. This is due to two different years of surveys. 2019 deals with the assessment of turbines 1-11 and 16. 2020 deals with the assessment of turbines 12-15.

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

- Leisler's bat,
- Common pipistrelle,
- Soprano 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 the 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* sp.,
- 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 3-2). Leisler's bats were recorded during activity surveys across the proposed site.

When assessed in the context of the identified site risk and in line with Table 3b (SNH, 2019), overall activity risk for Leisler's bat in 2019 was found to be ***Medium*** at typical activity levels across all three seasons in 2019. Peak activity levels were ***Medium*** in Spring and ***High*** in Summer and Autumn for Leisler's bat (See Table 5-2 below).

When assessed in the context of the identified site risk and in line with Table 3b (SNH, 2019), overall activity risk for Leisler's bat in 2020 was found to be ***Low*** at typical activity levels in Spring and ***Medium*** in Summer and Autumn in 2020. Peak activity levels were ***Medium*** in spring and summer and ***High*** in 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 commercial forestry, with young to mature forestry coverage and areas of clear fell with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is a **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 SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring 2019	Medium (3)	Moderate (3)	Typical Risk is Medium (9)	Moderate-High (4)	Peak Risk is Medium (12)
Summer 2019		Moderate-High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)
Autumn 2019		Moderate (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)
Spring 2020	Medium (3)	Low (1)	Typical Risk is Low (3)	Low-Moderate (2)	Peak Risk is Medium (6)
Summer 2020		Moderate (3)	Typical Risk is Medium (9)	Moderate-High (4)	Peak Risk is Hi Medium (12)
Autumn 2020		Moderate (3)	Typical Risk is Medium (9)	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. The results indicate that there were no detectors with High median Leisler's activity levels during any deployments in 2019 or 2020. Consequently, and in accordance with NatureScot 2021, no curtailment is proposed for Leisler's bat.

5.1.2.2 Soprano pipistrelle

This site is within the current range of the Soprano pipistrelle bat (NPWS, 2019). Soprano pipistrelles are classed as a common species of a medium population risk which have a high potential collision risk (Plate 3-2). Soprano pipistrelles were recorded during activity surveys across the proposed site.

When assessed in the context of the identified site risk and in line with Table 3b (SNH, 2019), overall activity risk for Soprano pipistrelle in 2019 was found to be ***Medium*** at moderate typical activity levels in Spring and summer and ***High*** in autumn. Peak activity levels were ***High*** across all three seasons for Soprano pipistrelle (See Table 5-3 below).

When assessed in the context of the identified site risk and in line with Table 3b (SNH, 2019), overall activity risk for Soprano pipistrelle in 2020 was found to be ***Low*** at typical activity levels in Spring, ***Nil*** in Summer and ***Medium*** in Autumn. Peak activity levels were ***Medium in*** spring, ***Low*** in summer and ***High*** in autumn for Soprano pipistrelle (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 commercial forestry, with young to mature forestry coverage and areas of clear fell 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 SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring 2019	Medium (3)	Moderate (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)
Summer 2019		Moderate (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)

Autumn 2019		Moderate-High (4)	Typical Risk is High (12)	High (5)	Peak Risk is High (15)
Spring 2020	Medium (3)	Low (1)	Typical Risk is low (3)	Low-Moderate (2)	Peak Risk is medium (6)
Summer 2020		Nil (0)	Typical Risk is low (0)	Nil (0)	Peak Risk is low (0)
Autumn 2020		Moderate-High (4)	Typical Risk is Medium (12)	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. Detectors D05, D08, D10 and D11 all registered nights with High levels of Soprano pipistrelle activity in Autumn 2019. These detectors correspond to Turbines T5, T6, T7, T8, T10 and T11 (Figure 3-1). Given that high median activity levels were recorded near Turbines 5, 6, 7, 8, 10 and 11, 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 6.1 below.

No other detectors recorded High levels of Soprano pipistrelle activity across any other season in 2019 or 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 3-2). Common pipistrelle were recorded during activity surveys across the proposed site.

When assessed in the context of the identified site risk and in line with Table 3b (SNH, 2019), overall activity risk for Common pipistrelle in 2019 was found to be ***Medium*** at typical activity levels in Spring and summer and ***High*** in autumn. Peak activity levels were ***High*** across all three seasons for Common pipistrelle (See Table 5-4 below).

When assessed in the context of the identified site risk and in line with Table 3b (SNH, 2019), overall activity risk for Soprano pipistrelle in 2020 was found to be ***Low*** at typical activity levels in Spring and Summer and ***High*** in Autumn. Peak activity levels were ***Low*** in spring, ***Medium*** in summer and ***High*** autumn for Common pipistrelle (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 commercial forestry, with young to mature forestry coverage and areas of clear fell 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 SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring 2019	Medium (3)	Moderate (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)
Summer 2019		Moderate-High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)

Autumn 2019		High (5)	Typical Risk is High (15)	High (5)	Peak Risk is High (15)
Spring 2020	Medium (3)	Low (1)	Typical Risk is low (4)	Low (1)	Peak Risk is low (4)
Summer 2020		Low (1)	Typical Risk is low (4)	Moderate-High (4)	Peak Risk is Medium (12)
Autumn 2020		High (5)	Typical Risk is High (15)	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. Detector D03 and D10 registered nights with High levels of Common pipistrelle activity in summer 2019 and D03, D08, D10 and D11 all registered nights with High levels of Common pipistrelle activity in Autumn 2019. These detectors correspond to Turbines T3, T5, T6, T10 and T11 (Figure 3-1). Given that high median activity levels were recorded near Turbines 3, 5, 6, and 11, 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 6.1 below.

No other detectors recorded High levels of Common pipistrelle activity across any other season in 2019 or 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 upland commercial forestry, with young to mature forestry coverage and areas of clear fell with low levels of bat activity recorded during the static detector surveys as well as the walked and driven transects undertaken.

However, following per detector Ecobat analysis, detectors D03, D05, D08, D10 and D11 showed high median activity levels across at least one season for Common/Soprano pipistrelle (Table 5-5). Taking a precautionary approach and given the potential for high collision risk was recorded at median activity levels at detectors D03, D05, D08, D10 and D11, 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 SNH (2019) Guidance and based on the site-specific data. This will involve curtailment during periods with high Common and Soprano pipistrelle activity (i.e. Summer at T3 and Autumn at T5, T6, T8 and T11), with simultaneous activity monitoring taking place. Turbines will be curtailed during the weather conditions most suitable for bat activity at the site, see Section 6.1.1.2 "Determining curtailment" below. Proposed curtailment and monitoring is outlined in section 6.1 below.

Table 5-5 Ecobat Results High Median Bat Activity Per Detector 2019 and 2020

Survey Period	Nights Recorded	Detector ID	Corresponding Turbine	Median Bat Activity	Median Bat Activity Level	Max Bat Activity	Max Bat Activity Level
SOPRANO PIPISTRELLE							
Autumn 2019	11	D05	T7/T8	84	High	88	High
Autumn 2019	12	D08	T10/11	94	High	99	High
Autumn 2019	14	D10	T6	96	High	99	High
Autumn 2019	6	D11	T5	95	High	96	High

COMMON PIPISTRELLE							
Summer 2019	10	D03	T3	92	High	98	High
Summer 2019	12	D10	T6	94	High	98	High
Autumn 2019	12	D03	T3	82	High	91	High
Autumn 2019	12	D08	T10/11	98	High	100	High
Autumn 2019	14	D10	T6	95	High	98	High
Autumn 2019	6	D11	T5	100	High	100	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 Conifer plantation with small areas of Wet heath, Cutover bog and Wet grassland.

A total of 80.5 hectares of forestry will be permanently felled within and around the footprint of the Proposed Development. The felling of trees 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.

Chapter 4, Figure 4-21 shows the extent of the areas to be felled as part of the Proposed Development. It should be noted that forestry on the site of the Proposed Development was originally planted as a commercial crop and will be felled in the future should the proposed renewable energy development proceed or not. The felling of forestry will have a positive effect by opening up large areas of former closed canopy commercial forestry i.e. there will be more linear forestry edge habitat created. This will have a positive impact on bats as it will provide more commuting and foraging opportunities. Overall, the proposed works will retain areas of linear forestry edge habitats. The majority of turbines will be located in key-holed conifer forestry with no resulting loss of linear features.

Where upgrades to existing roads and site tracks are proposed, there may be some requirement for road widening to facilitate the initial construction phase. Proposed turbine accommodation works to the north of the site will result in the loss of approximately 75 linear metres of hedgerow. Any areas of hedgerow loss, to accommodate the delivery of turbines, will be replaced within the site with species indigenous to the area. Approximately 270 linear metres of hedgerow planting is proposed, which will result in a net gain in linear habitat features within the site. Hedgerow removal will result in a short term effect, with connectivity re-established within approximately 2-5 years. No permanent loss of, or damage to, commuting or foraging habitats is anticipated as a result of the turbine delivery or cable routes and there will be no net loss of linear landscape features for commuting and foraging bats. The proposed replanting area is shown in Appendix 6-4, Biodiversity Management and Enhancement Plan, Figure 2.

The Proposed Development, including the creation of new road infrastructure, amenity walkway and underground cable route will provide a positive change with the creation of additional available areas of linear landscape features that may be utilised by bats for commuting or foraging.

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

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 predominantly located within a conifer plantation with small areas of wet heath, cutover bog and wet grassland. The trees in the plantation do not provide potential roosting habitat of significance for bats.

Two derelict structures were identified within the EIAR Study Area and were subjected to dusk activity surveys. While a small number of bats were observed flying in and out of these buildings during the roost surveys only one was identified as an active bat roost. These structures and the surrounding linear habitat features will be retained as part of the Proposed Development; thus, no loss of roosting habitat is anticipated.

The underground cabling will connect from the Proposed Development site to the existing Trillick substation located in the townland of Ballynahone, predominately following proposed and existing roads and tracks measuring approximately 8km. There will be no requirement to fell trees/forestry as part of the underground cable route. Therefore, there will be no loss of tree roosting habitat associated with these works.

Horizontal Directional Drilling (HDD) is proposed for Bridges 1, 2, 3 and 5 and no loss of roosting habitat is anticipated. Bridges 4 and 6 will require bridge deck replacement. However, no bats were observed, and no evidence of bat use was identified within the bridges.

Bridge 4 contained some Potential Roost Features (PRFs); however, works will be confined to the bridge deck surface. Although there was no evidence of bat use, the presence of PRFs has the potential to result in temporary disturbance as a results of bridge deck works at Bridge 4. Bridge 6 was assessed as having *Negligible* suitability for roosting bats. Therefore, no loss of roosting habitat or disturbance is anticipated.

Consequently, there is some potential for disturbance at Bridge 4 as a result of the proposed grid cable route.

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

5.4 Displacement of Individuals or Populations

The Proposed Development is predominantly located in Conifer plantation with small areas of wet heath, cutover bog and wet grassland. 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 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 a conifer plantation with small areas of wet heath and cutover bog, 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.

6.1.1 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 an upland conifer plantation with low levels of bat activity recorded during the static detector surveys as well as walked and driven transects undertaken.

However, following per detector Ecobat analysis, detectors D03 (i.e. Turbine 3), D05 (i.e. Turbine 8), D08 (i.e. Turbine 11), D10 (i.e. Turbine 6) and D11 (i.e. Turbine 5) showed high median activity levels across at least one season (Table 5-5). 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. Summer at T6, and Autumn at T3, T5, T6, T8 and T11), 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 6-1 below.

Table 6-1 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 3	No	Yes	Yes
Turbine 5	No	No	Yes
Turbine 6	No	Yes	Yes
Turbine 7	No	No	Yes
Turbine 8	No	No	Yes
Turbine 10	No	No	Yes
Turbine 11	No	No	Yes

6.1.2 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.

6.1.2.1 Monitoring Year 1

6.1.2.1.1 *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)

6.1.2.1.2 *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.

6.1.2.2 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.

6.1.2.3 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 6-2.

Table 6-2 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.

6.2 Standard Best Practice Measures

6.2.1 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).

6.2.2 Lighting Restrictions

Whilst there is a requirement for aviation lighting on the turbines, lighting in general throughout the development has been minimised and the applicant commits to not using LED lighting.

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 study area 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 6.1, 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 will be implemented to avoid any such impacts.

6.2.3 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 6.1.

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 in the range of 173m maximum to 162m minimum; rotor diameter in the range of 140m maximum to 132m minimum and hub height of 107m maximum to 96m minimum.

This mitigation measure is included within the forestry felling calculation outlined in Chapter 4, Section 4.3.10 of the EIAR and shown in Figure 4-12, and assumes the largest rotor diameter (140m) and the minimum hub height (96m), therefore providing the maximum tip height of 173m, and also detailing the maximum forestry buffer that would be required, as this can only be based on the longest blade being placed on the lowest hub height (any other combination could only be based on a shorter rotor diameter or higher hub height which would therefore result in a reduction in the buffer requirement). The worst-case scenario has therefore been considered in the bat impact assessment. Figure 4-21, Chapter 4 shows the extent of the area to be removed as part of the overall felling requirement. These vegetation-free areas will be maintained during the operational life of the Proposed Development.

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. i.e. (below) **b** = 69.3m (in the example given in Plate 6-1)

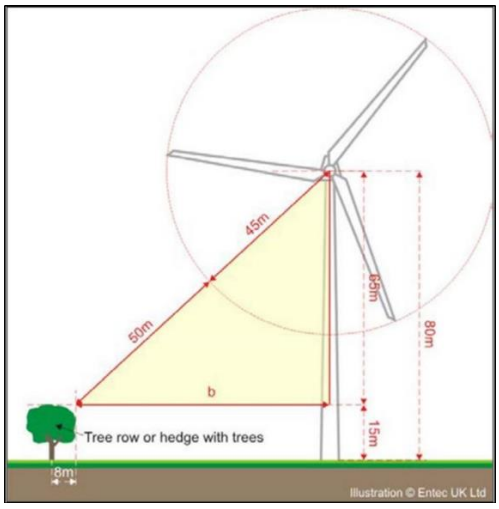

Plate 6-1 Calculate buffer distances (Natural England, 2014).

6.2.4 Proposed Replanting

Road widening works associated with the Proposed Development at the northern site entrance will result in the direct loss of approximately 75 liner metres of hedgerow habitat.

This habitat is widespread and common within the local farmland to the west and the permanent loss of this section of low, highly managed hedgerow is not considered to have a significant effect greater than that on a local geographical scale. It is not considered significant in EIA terms. Removal of the hedge will not cause any significant fragmentation of habitat connectivity within the landscape given the adjacent Polinamack and Crana Rivers, which are both lined with trees.

To compensate for the loss of linear hedgerow to facilitate the Proposed Development, approximately 270 linear metres of new replacement hedgerow planting will be carried out adjacent to the area of hedgerow removal. This will result in a net gain of linear habitat features within the site. Tree species planted in these locations will be of a similar composition to those occurring on site and will be native and of local provenance. Rowan and hawthorn are proposed for replanting. The proposed replanting area near the northern site entrance is shown in Appendix 6-4, Biodiversity Management and Enhancement Plan, Figure 2.

Hedgerow removal will result in a short-term effect, with connectivity re-established within approximately 2-5 years Following implementation of mitigation, no potential for significant effect exists at any geographic scale. The planting of additional hedgerow will serve to enhance the hedgerow habitat within the site and create new commuting and foraging opportunities for bats.

6.2.5 Confirmatory Pre-construction Bridge Survey

No evidence of bats was recorded at any water crossing. However, to account for changes between the completion of the surveys in 2021 and construction works, it is recommended that confirmatory pre-construction surveys are undertaken. The requirement for a pre-construction survey comes from *NRA Guidelines For The Treatment Of Bats during The Construction of National Road Schemes*. The function of the survey is to assess any changes to the baseline conditions of the water crossings that may have occurred between the surveys and construction stage. The measure does not represent a lacuna in the assessment and is in accordance with industry best practice.

The proposed underground cable route will involve 6 no. bridge crossings including 5 no. horizontal directional drilling (HDD) crossings and 1 no. bridge deck replacement works. The proposed underground cable route will also cross 5 no. culvert crossings. It is proposed to cross existing culverts using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert. The locations of the bridges and culverts are shown on the site layout drawings included in Chapter 4, Appendix 4-1.

HDD beneath the waterway and bridge foundations is proposed for Bridges no. 1, 2, 3, 5 and 6. No works are proposed for the underside of these bridges and no bats or evidence of bat use was identified during the inspection survey. Therefore, no significant effects on local bat populations are anticipated.

Bridge 4 will require replacement of the bridge deck surfaces. Although no evidence of bat use was identified, Bridge 4 was assessed as having *Moderate* potential for roosting bats (Table 4-4). Construction and operation of the Proposed Development will result in increased human activity and noise along the underground cable route. Therefore, the potential for disturbance to bats requires consideration. However, Bridge 4 is located along a busy local road and it is likely that bats have become accustomed to some level of disturbance. In the absence of appropriate design, the proposed underground cable works has the potential to disturb bats through noise production and illumination of roosting, commuting and foraging areas.

Following the precautionary principle, a pre-construction survey will be undertaken by a qualified ecologist prior to any works on Bridge 4, to ensure there are no roosting bats present. The requirement for a pre-construction survey does not represent a lacuna in the survey assessment but is fully in line with industry best practice. The function of this survey will be to assess any changes in baseline environment since the time of undertaking the survey in June 2021.

If bats are found to be roosting in Bridge 4, a bat derogation licence will be obtained, and further mitigation prescribed by a licenced ecologist.

A minimum of 2 bat boxes will be erected at Bridge 4 to provide new roosting opportunities for bats.

With the implementation of the prescribed mitigation measures, no significant effects are predicted.

6.2.6 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).

6.3 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 – 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).

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

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.

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Appendix 3 – Glenard 2019 and 2020 Ecobat Per Detector Results

Summary tables are provided 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 Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Glenard 2019							
Spring	-	2749	D02	-	Nil	-	Nil
Spring	1	2749	D03	64	Moderate - High	64	Moderate - High
Spring	-	2749	D04	-	Nil	-	Nil
Spring	2	2749	D05	26	Low - Moderate	41	Moderate
Spring	-	2749	D06	-	Nil	-	Nil
Spring	-	2749	D07	-	Nil	-	Nil
Spring	-	2749	D08	-	Nil	-	Nil
Spring	3	2749	D10	41	Moderate	73	Moderate - High
Spring	3	2749	D11	60	Moderate	78	Moderate - High
Glenard 2020							
Spring	-	1388	D12	-	Nil	-	Nil
Spring	2	1388	D13	12	Low	12	Low
Spring	1	1388	D14	37	Low - Moderate	37	Low - Moderate
Spring	-	1388	D15	-	Nil	-	Nil
Glenard 2019							
Summer	10	2939	D02	68	Moderate - High	83	High
Summer	7	2939	D03	38	Low - Moderate	83	High
Summer	6	2939	D04	45	Moderate	76	Moderate - High
Summer	5	2939	D05	38	Low - Moderate	71	Moderate - High
Summer	-	2939	D06	-	Nil	-	Nil
Summer	-	2939	D07	-	Nil	-	Nil
Summer	9	2939	D08	71	Moderate - High	90	High
Summer	11	2939	D10	79	Moderate - High	96	High
Summer	7	2939	D11	59	Moderate	75	Moderate - High
Glenard 2020							
Summer	5	3638	D12	7	Low	63	Moderate - High
Summer	2	3638	D13	59	Moderate	67	Moderate - High
Summer	3	3638	D14	63	Moderate - High	63	Moderate - High
Summer	3	3638	D15	51	Moderate	63	Moderate - High
Glenard 2019							
Autumn	4	1607	D02	66	Moderate - High	79	Moderate - High
Autumn	3	1607	D03	58	Moderate	58	Moderate

Autumn	3	1607	D04	46	Moderate	58	Moderate
Autumn	3	1607	D05	18	Low	74	Moderate - High
Autumn	7	1607	D06	66	Moderate - High	97	High
Autumn	4	1607	D07	66	Moderate - High	84	High
Autumn	3	1607	D08	66	Moderate - High	74	Moderate - High
Autumn	4	1607	D10	73	Moderate - High	92	High
Autumn	-	1607	D11	-	Nil	-	Nil
Glenard 2020							
Autumn	9	2236	D12	42	Moderate	73	Moderate - High
Autumn	9	2236	D13	56	Moderate	79	Moderate - High
Autumn	5	2236	D14	56	Moderate	56	Moderate
Autumn	12	2236	D15	42	Moderate	87	High

MYOTIS SPP.							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Glenard 2019							
Spring	2	2379	D02	10	Low	10	Low
Spring	6	2379	D03	47	Moderate	53	Moderate
Spring	-	2379	D04	-	Nil	-	Nil
Spring	-	2379	D05	-	Nil	-	Nil
Spring	2	2379	D06	26	Low - Moderate	41	Moderate
Spring	2	2379	D07	10	Low	10	Low
Spring	-	2379	D08	-	Nil	-	Nil
Spring	1	2379	D10	10	Low	10	Low
Spring	-	2379	D11	-	Nil	-	Nil
Glenard 2020							
Spring	-	1280	D12	-	Nil	-	Nil
Spring	2	1280	D13	12	Low	12	Low
Spring	1	1280	D14	12	Low	12	Low
Spring	-	1280	D15	-	Nil	-	Nil
Glenard 2019							
Summer	7	2268	D02	52	Moderate	68	Moderate - High
Summer	6	2268	D03	45	Moderate	78	Moderate - High
Summer	3	2268	D04	5	Low	5	Low
Summer	-	2268	D05	-	Nil	-	Nil
Summer	-	2268	D06	-	Nil	-	Nil
Summer	-	2268	D07	-	Nil	-	Nil
Summer	4	2268	D08	5	Low	38	Low - Moderate

Summer	-	2268	D10	-	Nil	-	Nil
Summer	1	2268	D11	5	Low	5	Low
Glenard 2020							
Summer	1	2701	D12	7	Low	7	Low
Summer	-	2701	D13	-	Nil	-	Nil
Summer	-	2701	D14	-	Nil	-	Nil
Summer	1	2701	D15	38	Low - Moderate	38	Low - Moderate
Glenard 2019							
Autumn	6	2522	D02	46	Moderate	58	Moderate
Autumn	8	2522	D03	18	Low	71	Moderate - High
Autumn	5	2522	D04	18	Low	46	Moderate
Autumn	4	2522	D05	18	Low	58	Moderate
Autumn	10	2522	D06	82	High	91	High
Autumn	3	2522	D07	18	Low	18	Low
Autumn	6	2522	D08	18	Low	46	Moderate
Autumn	5	2522	D10	58	Moderate	71	Moderate - High
Autumn	1	2522	D11	46	Moderate	46	Moderate
Glenard 2020							
Autumn	1	2893	D12	14	Low	14	Low
Autumn	-	2893	D13	-	Nil	-	Nil
Autumn	1	2893	D14	14	Low	14	Low
Autumn	1	2893	D15	14	Low	14	Low

SOPRANO PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity Level	Max Bat Activity	Max Bat Activity Level
Glenard 2019							
Spring	5	6106	D02	60	Moderate	78	Moderate - High
Spring	7	6106	D03	53	Moderate	81	High
Spring	4	6106	D04	51	Moderate	87	High
Spring	4	6106	D05	26	Low - Moderate	64	Moderate - High
Spring	1	6106	D06	10	Low	10	Low
Spring	3	6106	D07	10	Low	41	Moderate
Spring	6	6106	D08	47	Moderate	64	Moderate - High
Spring	11	6106	D10	64	Moderate - High	83	High
Spring	12	6106	D11	53	Moderate	79	Moderate - High
Glenard 2020							
Spring	1	1754	D12	12	Low	12	Low
Spring	3	1754	D13	12	Low	37	Low - Moderate

Spring	2	1754	D14	12	Low	12	Low
Spring	2	1754	D15	12	Low	12	Low
Glenard 2019							
Summer	9	7713	D02	5	Low	78	Moderate - High
Summer	10	7713	D03	78	Moderate - High	97	High
Summer	7	7713	D04	52	Moderate	76	Moderate - High
Summer	3	7713	D05	78	Moderate - High	86	High
Summer	-	7713	D06	-	Nil	-	Nil
Summer	-	7713	D07	-	Nil	-	Nil
Summer	3	7713	D08	38	Low - Moderate	85	High
Summer	10	7713	D10	72	Moderate - High	92	High
Summer	9	7713	D11	38	Low - Moderate	75	Moderate - High
Glenard 2020							
Summer	-	-	D12	-	Nil	-	Nil
Summer	-	-	D13	-	Nil	-	Nil
Summer	-	-	D14	-	Nil	-	Nil
Summer	-	-	D15	-	Nil	-	Nil
Glenard 2019							
Autumn	9	5781	D02	58	Moderate	86	High
Autumn	12	5781	D03	58	Moderate	84	High
Autumn	13	5781	D04	58	Moderate	84	High
Autumn	11	5781	D05	84	High	88	High
Autumn	10	5781	D06	62	Moderate - High	86	High
Autumn	11	5781	D07	46	Moderate	74	Moderate - High
Autumn	12	5781	D08	94	High	99	High
Autumn	14	5781	D10	96	High	99	High
Autumn	6	5781	D11	95	High	96	High
Glenard 2020							
Autumn	2	6945	D12	14	Low	14	Low
Autumn	2	6945	D13	14	Low	14	Low
Autumn	6	6945	D14	14	Low	56	Moderate
Autumn	6	6945	D15	42	Moderate	69	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
Glenard 2019							
Spring	1	4635	D02	73	Moderate - High	73	Moderate - High
Spring	9	4635	D03	64	Moderate - High	85	High

Spring	3	4635	D04	10	Low	68	Moderate - High
Spring	5	4635	D05	53	Moderate	53	Moderate
Spring	3	4635	D06	41	Moderate	41	Moderate
Spring	1	4635	D07	53	Moderate	53	Moderate
Spring	9	4635	D08	41	Moderate	71	Moderate - High
Spring	10	4635	D10	61	Moderate - High	97	High
Spring	10	4635	D11	41	Moderate	83	High
Glenard 2020							
Spring	3	1676	D12	12	Low	12	Low
Spring	3	1676	D13	12	Low	12	Low
Spring	4	1676	D14	12	Low	12	Low
Spring	1	1676	D15	12	Low	12	Low
Glenard 2019							
Summer	9	5847	D02	71	Moderate - High	91	High
Summer	10	5847	D03	92	High	98	High
Summer	10	5847	D04	66	Moderate - High	90	High
Summer	6	5847	D05	66	Moderate - High	99	High
Summer	-	5847	D06	-	Nil	-	Nil
Summer	-	5847	D07	-	Nil	-	Nil
Summer	9	5847	D08	64	Moderate - High	94	High
Summer	12	5847	D10	94	High	98	High
Summer	11	5847	D11	68	Moderate - High	85	High
Glenard 2020							
Summer	3	6461	D12	38	Low - Moderate	51	Moderate
Summer	2	6461	D13	7	Low	7	Low
Summer	10	6461	D14	7	Low	51	Moderate
Summer	7	6461	D15	38		63	Moderate - High
Glenard 2019							
Autumn	10	3563	D02	79	Moderate - High	91	High
Autumn	12	3563	D03	82	High	91	High
Autumn	12	3563	D04	58	Moderate	90	High
Autumn	11	3563	D05	66	Moderate - High	90	High
Autumn	9	3563	D06	77	Moderate - High	96	High
Autumn	12	3563	D07	77	Moderate - High	88	High
Autumn	12	3563	D08	98	High	100	High
Autumn	14	3563	D10	95	High	98	High
Autumn	6	3563	D11	100	High	100	High
Glenard 2020							
Autumn	7	4561	D12	14	Low	56	Moderate
Autumn	5	4561	D13	14	Low	56	Moderate
Autumn	6	4561	D14	14	Low	42	Moderate

Autumn	8	4561	D15	42	Moderate	79	Moderate - High

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
Glenard 2019							
Spring	-	867	D02	-	Nil	-	Nil
Spring	1	867	D03	10	Low	10	Low
Spring	3	867	D04	10	Low	10	Low
Spring	-	867	D05	-	Nil	-	Nil
Spring	-	867	D06	-	Nil	-	Nil
Spring	1	867	D07	41	Moderate	41	Moderate
Spring	3	867	D08	10	Low	41	Moderate
Spring	7	867	D10	10	Low	41	Moderate
Spring	1	867	D11	10	Low	10	Low
Glenard 2020							
Spring	4	436	D12	12	Low	12	Low
Spring	5	436	D13	12	Low	37	Low - Moderate
Spring	2	436	D14	12	Low	12	Low
Spring	4	436	D15	12	Low	12	Low
Glenard 2019							
Summer	4	682	D02	5	Low	52	Moderate
Summer	2	682	D03	22	Low - Moderate	38	Low - Moderate
Summer	5	682	D04	5	Low	64	Moderate - High
Summer	2	682	D05	5	Low	5	Low
Summer	-	682	D06	-	Nil	-	Nil
Summer	-	682	D07	-	Nil	-	Nil
Summer	1	682	D08	5	Low	5	Low
Summer	10	682	D10	45	Moderate	64	Moderate - High
Summer	-	682	D11	-	Nil	-	Nil
Glenard 2020							
Summer	-	-	D12	-	Nil	-	Nil
Summer	-	-	D13	-	Nil	-	Nil
Summer	-	-	D14	-	Nil	-	Nil
Summer	-	-	D15	-	Nil	-	Nil
Glenard 2019							
Autumn	8	1081	D02	66	Moderate - High	74	Moderate - High
Autumn	5	1081	D03	46	Moderate	58	Moderate
Autumn	6	1081	D04	32	Low - Moderate	58	Moderate

Autumn	4	1081	D05	32	Low - Moderate	71	Moderate - High
Autumn	9	1081	D06	66	Moderate - High	81	High
Autumn	2	1081	D07	32	Low - Moderate	46	Moderate
Autumn	6	1081	D08	38	Low - Moderate	58	Moderate
Autumn	12	1081	D10	52	Moderate	66	Moderate - High
Autumn	3	1081	D11	18	Low	18	Low
Glenard 2020							
Autumn	6	1162	D12	28	Low - Moderate	64	Moderate - High
Autumn	5	1162	D13	42	Moderate	56	Moderate
Autumn	3	1162	D14	14	Low	14	Low
Autumn	3	1162	D15	14	Low	14	Low

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Appendix 4 – Glenard Static Detector Survey at Height Results 2019

SURVEY AT HEIGHT RESULTS 2019

Date	Time	Mic. level	Species
12/08/2019	22:04:26	Height	Common pipistrelle
13/08/2019	23:51:30	Ground	Soprano pipistrelle
13/08/2019	02:47:34	Ground	Soprano pipistrelle
13/08/2019	23:44:31	Ground	Soprano pipistrelle
13/08/2019	23:28:48	Ground	Soprano pipistrelle
13/08/2019	02:17:53	Ground	Soprano pipistrelle
13/08/2019	00:07:41	Ground	Brown long-eared bat
15/08/2019	21:45:58	Height	Leisler's bat
15/08/2019	21:55:54	Height	Leisler's bat
15/08/2019	21:45:58	Ground	Leisler's bat
15/08/2019	21:55:54	Ground	Leisler's bat
18/08/2019	23:21:13	Ground	Soprano pipistrelle
19/08/2019	00:30:40	Ground	Myotis spp.
19/08/2019	21:54:14	Ground	Leisler's bat
19/08/2019	21:58:20	Ground	Leisler's bat
19/08/2019	21:54:29	Ground	Leisler's bat
19/08/2019	04:35:55	Ground	Soprano pipistrelle
20/08/2019	01:16:25	Ground	Soprano pipistrelle
20/08/2019	22:45:47	Ground	Soprano pipistrelle
20/08/2019	23:06:18	Ground	Soprano pipistrelle
20/08/2019	02:54:28	Ground	Soprano pipistrelle
21/08/2019	23:52:40	Ground	Common pipistrelle
04/09/2019	20:59:09	Ground	Leisler's bat
05/09/2019	05:51:58	Ground	Common pipistrelle
05/09/2019	05:52:00	Ground	Common pipistrelle
06/09/2019	23:33:11	Ground	Common pipistrelle
06/09/2019	05:35:12	Ground	Common pipistrelle
06/09/2019	03:44:06	Ground	Common pipistrelle
06/09/2019	23:15:21	Ground	Common pipistrelle
06/09/2019	23:33:06	Ground	Common pipistrelle
06/09/2019	00:38:23	Ground	Common pipistrelle
06/09/2019	05:37:04	Ground	Common pipistrelle
06/09/2019	23:17:48	Ground	Common pipistrelle
06/09/2019	05:37:01	Ground	Common pipistrelle
06/09/2019	21:48:44	Ground	Common pipistrelle
06/09/2019	04:39:54	Ground	Common pipistrelle
06/09/2019	05:35:27	Ground	Common pipistrelle

Date	Time	Mic. level	Species
06/09/2019	05:32:27	Ground	Common pipistrelle
06/09/2019	05:32:30	Ground	Common pipistrelle
06/09/2019	02:02:24	Ground	Common pipistrelle
06/09/2019	05:12:32	Ground	Common pipistrelle
07/09/2019	00:30:05	Ground	Myotis spp.
07/09/2019	21:38:43	Ground	Leisler's bat
07/09/2019	21:38:33	Ground	Leisler's bat
07/09/2019	22:16:28	Ground	Leisler's bat
07/09/2019	22:16:04	Ground	Leisler's bat
07/09/2019	22:16:19	Ground	Leisler's bat
07/09/2019	21:38:59	Ground	Leisler's bat
07/09/2019	22:16:23	Ground	Leisler's bat
07/09/2019	23:42:03	Ground	Common pipistrelle
07/09/2019	21:56:35	Ground	Common pipistrelle
07/09/2019	22:14:42	Ground	Common pipistrelle
07/09/2019	21:50:44	Ground	Soprano pipistrelle
08/09/2019	05:42:30	Height	Leisler's bat
08/09/2019	05:45:38	Height	Leisler's bat
08/09/2019	05:42:39	Ground	Leisler's bat
08/09/2019	05:43:42	Ground	Leisler's bat
08/09/2019	05:42:30	Ground	Leisler's bat
08/09/2019	05:47:10	Ground	Leisler's bat
08/09/2019	05:45:38	Ground	Leisler's bat
08/09/2019	05:46:30	Ground	Leisler's bat
08/09/2019	05:45:11	Ground	Leisler's bat
08/09/2019	05:46:22	Ground	Leisler's bat
08/09/2019	05:43:38	Ground	Leisler's bat
08/09/2019	05:46:18	Ground	Leisler's bat
08/09/2019	05:47:36	Ground	Leisler's bat
08/09/2019	23:38:31	Ground	Common pipistrelle
08/09/2019	23:11:08	Ground	Soprano pipistrelle
08/09/2019	21:43:39	Ground	Soprano pipistrelle
08/09/2019	22:14:51	Ground	Soprano pipistrelle
09/09/2019	23:04:29	Height	Leisler's bat
09/09/2019	22:19:26	Ground	Myotis spp.
09/09/2019	23:04:29	Ground	Leisler's bat
09/09/2019	03:28:02	Ground	Common pipistrelle

Date	Time	Mic. level	Species	Date	Time	Mic. level	Species
09/09/2019	02:38:20	Ground	Common pipistrelle	18/09/2019	01:51:43	Ground	Common pipistrelle
09/09/2019	21:24:07	Ground	Soprano pipistrelle	18/09/2019	22:25:34	Ground	Soprano pipistrelle
09/09/2019	02:52:49	Ground	Soprano pipistrelle	18/09/2019	03:57:06	Ground	Soprano pipistrelle
09/09/2019	21:11:58	Ground	Soprano pipistrelle	18/09/2019	22:31:45	Ground	Soprano pipistrelle
11/09/2019	01:37:53	Ground	Common pipistrelle	18/09/2019	21:00:03	Ground	Soprano pipistrelle
11/09/2019	21:40:45	Ground	Common pipistrelle	18/09/2019	01:18:58	Ground	Brown long-eared bat
11/09/2019	21:15:22	Ground	Common pipistrelle	18/09/2019	00:07:45	Ground	Brown long-eared bat
11/09/2019	03:52:50	Ground	Common pipistrelle	18/09/2019	22:16:57	Ground	Brown long-eared bat
11/09/2019	01:43:01	Ground	Common pipistrelle	19/09/2019	23:03:53	Ground	Myotis spp.
11/09/2019	22:14:28	Ground	Common pipistrelle	19/09/2019	20:31:36	Ground	Common pipistrelle
11/09/2019	22:59:15	Ground	Common pipistrelle	19/09/2019	20:46:24	Ground	Common pipistrelle
12/09/2019	22:41:58	Ground	Leisler's bat	19/09/2019	20:31:41	Ground	Common pipistrelle
12/09/2019	22:41:49	Ground	Leisler's bat	19/09/2019	20:46:21	Ground	Common pipistrelle
12/09/2019	21:57:34	Ground	Common pipistrelle	19/09/2019	21:37:31	Ground	Soprano pipistrelle
12/09/2019	21:40:27	Ground	Common pipistrelle	19/09/2019	03:38:29	Ground	Soprano pipistrelle
12/09/2019	22:37:31	Ground	Common pipistrelle	19/09/2019	22:02:30	Ground	Soprano pipistrelle
12/09/2019	21:40:22	Ground	Common pipistrelle	19/09/2019	02:23:01	Ground	Soprano pipistrelle
12/09/2019	21:40:03	Ground	Common pipistrelle	19/09/2019	02:22:58	Ground	Soprano pipistrelle
12/09/2019	22:58:12	Ground	Soprano pipistrelle	19/09/2019	21:44:41	Ground	Brown long-eared bat
17/09/2019	19:58:39	Height	Leisler's bat	20/09/2019	20:41:37	Ground	Soprano pipistrelle
17/09/2019	19:58:39	Ground	Leisler's bat	20/09/2019	02:50:04	Ground	Brown long-eared bat
17/09/2019	21:53:21	Ground	Common pipistrelle	21/09/2019	00:11:56	Ground	Soprano pipistrelle
17/09/2019	23:30:30	Ground	Soprano pipistrelle	22/09/2019	01:16:39	Ground	Common pipistrelle
17/09/2019	01:13:01	Ground	Soprano pipistrelle	22/09/2019	22:39:49	Ground	Soprano pipistrelle
17/09/2019	05:42:27	Ground	Soprano pipistrelle	22/09/2019	22:40:00	Ground	Soprano pipistrelle
17/09/2019	23:16:26	Ground	Soprano pipistrelle	22/09/2019	02:30:12	Ground	Soprano pipistrelle
17/09/2019	01:16:40	Ground	Soprano pipistrelle	22/09/2019	22:51:44	Ground	Soprano pipistrelle
17/09/2019	00:22:20	Ground	Soprano pipistrelle	22/09/2019	23:08:34	Ground	Soprano pipistrelle
17/09/2019	21:20:16	Ground	Soprano pipistrelle	23/09/2019	00:30:14	Ground	Common pipistrelle
17/09/2019	23:18:27	Ground	Soprano pipistrelle	24/09/2019	21:32:07	Height	Leisler's bat
18/09/2019	21:17:14	Ground	Myotis spp.	24/09/2019	02:32:23	Height	Common pipistrelle
18/09/2019	23:01:00	Ground	Myotis spp.	24/09/2019	02:32:32	Height	Common pipistrelle
18/09/2019	20:49:44	Ground	Common pipistrelle	24/09/2019	02:25:28	Ground	Common pipistrelle
18/09/2019	22:24:35	Ground	Common pipistrelle	24/09/2019	03:35:58	Ground	Common pipistrelle
18/09/2019	01:56:02	Ground	Common pipistrelle	24/09/2019	04:23:08	Ground	Common pipistrelle
18/09/2019	21:53:45	Ground	Common pipistrelle	24/09/2019	03:16:12	Ground	Soprano pipistrelle
18/09/2019	20:47:08	Ground	Common pipistrelle	24/09/2019	22:03:17	Ground	Soprano pipistrelle
18/09/2019	01:55:59	Ground	Common pipistrelle	24/09/2019	21:47:02	Ground	Soprano pipistrelle

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

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).