APPENDIX 6-2

BAT BASELINE REPORT

Planning and Environmental Consultants

Bat Baseline Report

PROPOSED KNOCKSHANVO WIND FARM, CO. CLARE

DOCUMENT DETAILS

Client:	**FutureEnergy Ireland (FEI)**
Project Title:	**Proposed Knockshanvo Wind Farm**
Project Number:	**200513**
Document Title:	**Bat Baseline Report**
Document File Name:	**200513 – BBR F – 2024.08.19**
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Planning and Environmental Consultants

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1. INTRODUCTION

MKO was commissioned by Future Energy Ireland (FEI) to complete a baseline bat report of surveys undertaken at Knockshanvo and adjacent townlands, Co. Clare, in relation to a Proposed Wind Farm Development which will comprise up to 9 no. turbines.

This report provides details of the bat surveys undertaken at the Site including survey design, methods and results. The 2022 surveys, carried out in accordance with NatureScot, 2021[1], are supplemented by additional data derived from surveys undertaken on the Site in 2021 in accordance with SNH (2019) Guidelines. The report also includes details of the bat habitat appraisals undertaken along the proposed underground Grid Connection route and at turbine delivery route accommodation areas.

For the purposes of the EIAR:

- Where the 'Proposed Development' is referred to, this relates to all the project components described in detail in Chapter 4 of this EIAR i.e. Wind Farm Site and Grid Connection as detailed below.
- Where 'the Site' is referred to, this relates to the primary study area for the EIAR, as delineated by the EIAR Site Boundary in green as shown on Figure 1-1.
- Where the 'Wind Farm Site' is referred to, this refers to turbines and associated foundations and hard-standing areas, meteorological mast, site entrance, junction accommodation works, access roads, temporary transition compound and upgrades to roads along the turbine delivery route, temporary construction compounds, temporary transition compound, 110kV electrical substation, underground cabling, borrow pits, site drainage, tree felling, amenity works and all ancillary works.
- Where 'Grid Connection' is referred to, this refers to the underground 110kV electrical cabling and all associated site development works connecting the Wind Farm Site to the existing Ardnacrusha 110kV electrical substation.

1.1 Site Description

The Proposed Development Site is located within existing commercial forestry approximately 3 km south of Broadford, 3.5 km southeast from Kilkishen, and 4 km northeast from Sixmilebridge, Co. Clare (ITM Ref: 554468 669675).

The Site is accessed via local roads from the R465 Regional Road, which travels in a north-south direction between Broadford and Ardnacrusha, the R471 Regional Road which travels east-west between Sixmilebridge and Clonlara and the Crag Local Road, which travels in a northeast-southwest direction between Sixmilebridge and Broadford. The Site itself is served by a number of existing forestry roads.

The Proposed Development Site is partially used for commercial forestry. This land-use will continue in conjunction with the Proposed Development. Land use in the surroundings of the Site include conifer plantation forestry and agriculture.

A Site location is presented in Figure 1-1.

1.2 Purpose of the Report

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

The purpose of this report is to provide baseline ecological information in relation to bats at the Proposed Development Site. Details of surveys carried out in 2022 and 2024 are presented, including methodology, results and assessment of activity levels. The 2021 survey results are provided as supplementary data in **Appendix 2**. An impact assessment has been produced based on the findings of the baseline surveys and is included within the EIAR Biodiversity Chapter which will accompany the Proposed Development's planning application.

1.3 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. The fourth edition, published in September 2023, has maintained this change. Prior to the publication of the BCT guidelines, Natural England's *Bat and Onshore Wind Turbines: Interim Guidance* provided a pragmatic interpretation of the EUROBATS recommendations, as applied to onshore wind energy facilities in the UK (Natural England, 2014). In addition, the Chartered Institute of Ecology and Environmental Management (CIEEM) publishes advice on best practice as well as updates on the current state of knowledge in *the Technical Guidance Series* and in the quarterly publication *In Practice*.

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

The NIEA (NED) recently published *Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland* in August 2021 (as amended May 2022).

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 provided in this report is in accordance with NatureScot 2021 Guidance.

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).

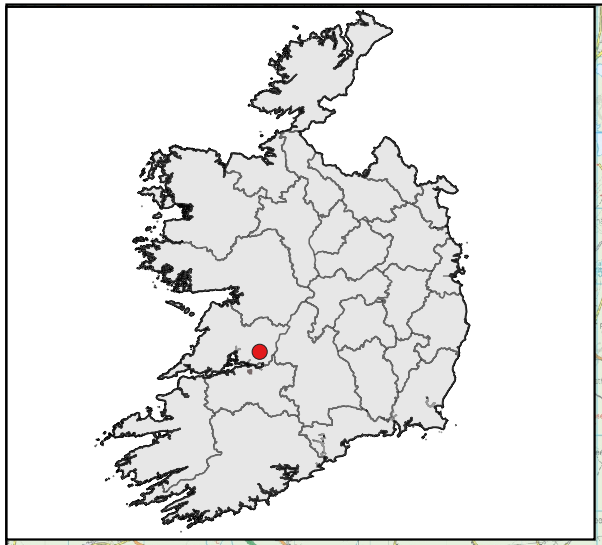
All Irish bats are protected under European legislation, namely the Habitats Directive (92/43/EEC)(as amended). All Irish species are listed under Annex IV of the Directive, requiring strict protection for individuals, their breeding sites and resting places. The lesser horseshoe bat (*Rhinolophus hipposideros*) 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).

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	



Map Legend

- EIAR Site Boundary
- Site Location

Drawing Title

EIAR Site Location

Project Title	Knockshanvo Wind Farm
Drawn By: SD	Checked By: EOS
Project No.: 200513	Drawing No.: Figure 1-1
Scale: 1:100,000	Date: 2024-08-09

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2. METHODS

2.1 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 Site and the surrounding region. The results of the desk study including sources of information utilised are provided in Section 3.1.

2.1.1 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. The most recent search examined bat presence and roost records within a 10 km radius of a central point within the Wind Farm Site (Grid Ref: R 54514 69645) (BCI 2012, Hundt 2012, NatureScot 2021).

Available bat records were provided by Bat Conservation Ireland on 19/05/2023. Results from the National Biodiversity Data Centre were also reviewed for bat species present within the relevant 10km grid squares of the Proposed Development.

The NPWS maintains all lesser horseshoe bat roost monitoring datasets and roost locations. As the Proposed Development is within the known distribution range of lesser horseshoe bat, the NPWS were consulted to provide any records of lesser horseshoe roosts within 10km of the Proposed Development. An information request was sent to the NPWS scientific data unit requesting records from the Rare and Protected Species Database on the 23rd March 2023. A response was received on the 12th April 2023.

2.1.2 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).

2.1.3 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 Wind Farm Site (BCI 2012, Hundt, 2012, NatureScot 2021). This included European designated sites, i.e. SACs, and nationally designated sites, i.e. NHAs and pNHAs.

2.1.4 Landscape Features

2.1.4.1 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 Site 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.

2.1.4.2 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 Wind Farm Site (BCI, 2012) (last searched on the 10th May 2024). 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 10th May 2024).

2.1.4.3 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 Wind Farm Site 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 Site Boundary. 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.

2.2 Field Surveys

2.2.1 Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out throughout 2021 and 2022. During these surveys, habitats within the Site 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 provided a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories are divided into *High, Moderate, Low* and *Negligible*, and are described fully in **Appendix 1**. The updated suitability categories (Collins, 2023) are also included in Appendix 1.

A bat habitat appraisal was carried out within the Temporary Transition Compound on 11th January 2024 by Ryan Connors (BSc., MSc.). The landscape features on the site were visually assessed for the potential use as a bat roosting habitats and commuting/foraging habitats using a protocol set out in BCT *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (4th edn.) (Collins, 2023). Table 4.1 of the 2023 BCT Guidelines identifies a grading protocol for assessing commuting and foraging habitat for bats. The protocol is divided into five Suitability Categories: *High, Moderate, Low, Negligible* and *None*. Likewise, Table 4.2 and 6.2 of the guidelines identifies a protocol for categorising trees and their associated PRFs.

The ground-level tree assessment aimed to identify features of high value to roosting bats including knot holes, trunk hollows, splits/cracks in branches and areas of flaking bark. Additionally, signs indicating possible bat use, such as droppings, staining and scratching of bark along with other potential roost features (i.e. PRFs) identified by Andrews (2018). Accessible PRFs were closely inspected both internally and externally, using a torch and endoscope to detect any possible presence of bats.

Top-up surveys were conducted in 2023 and 2024 by MKO Ecologists to cover new areas proposed for biodiversity enhancement and as turbine delivery accommodation areas. Details of survey top-ups are presented in **Appendix 6-1** of the EIAR.

2.2.1.1 Roost Surveys

A search for roosts was undertaken within 200m plus the rotor radius (i.e. max. 90m) of the boundary of the Proposed Development footprint (NatureScot, 2021). The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. A search for structures and likely suitable roosting areas was first conducted during initial desktop studies of the Site. The Site was then first visited in 2021. Repeated visits were carried out in May, July and September 2022. A walkover was carried out and all structures and trees identified within the search buffer were assessed for their potential to support roosting bats (see **Appendix 1** for criteria in assessing roosting habitats, Collins 2016). The Site was revisited on the 27th September 2023 to assess any changes in the baseline since initial surveys were conducted. No changes were made to the assessments.

No structures containing potential suitable bat roosting features were identified within 200m plus the rotor radius (max. 90m) of the Proposed Development footprint. A number of structures and trees were identified within the rest of the Proposed Development Site and were visually assessed for their suitability to support bats. These are detailed in section 3.2.1. Potential roost features (PRFs) were subject to a roost assessment in line with Collins 2016 guidelines. This comprised a detailed inspection of the exterior and interior (if accessible) to look for evidence of bat use, including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises. The interior of structures was inspected with the use of torches and an endoscope.

Any potential tree roosts were examined from the ground 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 (PRFs) identified by Andrews (2018).

Further presence/absence surveys, in the form of emergence surveys, were carried out on structures identified as having potential to host roosting bats following best practice guidance (Collins, 2016), as detailed below. No further surveys were carried out on any trees identified as having roosting potential, but these were considered a likely roost resource for the local population of tree-dwelling species.

2.2.2 Manual Activity Surveys

Manual activity surveys comprised driven transects at dusk and an emergence survey at a potential roosting location. The surveys were undertaken in Spring, Summer and Autumn 2022. A dusk emergence survey was carried out on the 31st May 2022 on a derelict stable identified as having *Low* roosting potential (ITM Ref: 556883 669300). No other structures were subject to an emergence survey as the roost assessments identified *Negligible* potential for roosting. Table 3-1 summarises survey effort in relation to manual activity surveys. Transect routes are presented in Figure 2-1. The 2021 survey effort is detailed in **Appendix 2**.

Table 2-1 Survey Effort - Manual Activity Surveys

Date	Surveyors	Sunrise/ Sunset	Type	Weather	Driven (km)
31st May 2022	Shane Connolly and Laura McEntegart	21:49	Dusk Emergence and Transect	16˚C; Dry, Calm, 60% Cloud cover, No visible moon	3.8km
14th July 2022	Shane Connolly and Laura McEntegart	21:55	Transect	18˚C; Dry, Calm, 90% Cloud cover, No visible moon	15.7km
29th September 2022	Shane Connolly and Keith Costello	19:18	Transect	11˚C; Dry, Light breeze, 85% Cloud cover, No visible moon	20.7km
Total Survey Effort					**40.2km**

Transect Surveys

A series of representative routes were selected throughout the Proposed Development Site. The aim of these surveys was to observe bat species using the Site and gather any information on bat behaviour and important features used by bats to supplement the results of the ground level static surveys. No statistical data comparison was carried out for the transects due to the variety of length routes. The routes were prepared with reference to the proposed layout, desktop and walkover survey results as well as any health and safety considerations and any access limitations. As such, they generally followed existing roads and tracks. Due to the nature of the site, manual surveys were driven to connect areas with different accesses. The driven transects followed the methodology described by Roche *et al.* (2012).

Transects were driven by two surveyors, recording bats in real time. Standalone transect surveys were completed for approximately three 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.

Dusk Emergence Survey

The dusk emergence survey commenced 30 minutes before sunset and lasted until approximately one hour after sunset. It was followed by a transect survey. Surveyors were located east and west of the PRF to identify any emerging activity from the structure, and were each equipped with a Batlogger M bat detector.

2.2.3 Ground-level Static Surveys

Where developments have more than 10 turbines, NatureScot requires 1 detector per turbine up to 10 plus a third of additional turbines. Detectors were numbered utilising an initial indicative layout that included 9 turbines. A 10th detector was deployed in order to account for any possible layout changes. The detector locations achieved a good spatial spread in relation to the proposed turbines and sampled the range of available habitats.

Automated bat detectors were deployed at 10 no. locations for at least 10 nights in 2022 in spring (April-May), and at least 20 nights in summer (June-mid August) and autumn (mid-August-October) (NatureScot, 2021). Detector locations were based on indicative turbine locations and differ slightly to the final proposed layout. Figure 3-4 presents static detector locations in relation to the final proposed layout. Static detector locations are described in Table 2-2.

Table 2-2 Ground-level Static Detector Locations

ID	Location (ITM)	Habitat	Linear Feature within 50m	Associated Turbine
D01	553310 669446	Edge of pine and rough scrub	Stone wall, Scattered trees	T01
D01a	553430 669288	Edge of pine and rough scrub	Stone wall, Scattered trees	T01
D02	553209 670084	Edge of pine and rough scrub	Stone wall, Scattered trees	T02
D03	553805 669913	Young mixed tree plantation	Stone wall	T03
D03a	553651 669871	Edge of mixed tree plantation	Stone wall	T03
D04	556178 669419	Edge of conifer and felled trees	Stone wall	T04
D05	556662 670010	Edge of birch plantation and thorn bush	Stone wall, Scattered trees	T05
D06	556903 669609	Edge of mature conifer	Stone wall, Scattered trees	T06
D07	556720 669039	Edge of mature conifer	Stone wall, Scattered trees/hedgerow	T07
D08	558413 669803	Edge of mature conifer	Stone wall, Scrub	T08
D09	558781 669504	Edge of mature conifer	Stone wall, Scattered trees	T09
D10	552694 669535	Edge of mature conifer	Stone wall, Scattered trees	T01 & T02

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

Onsite weather monitoring was undertaken concurrently with static detector deployments. One Vantage Pro 2 (Davis Instruments, CA, UCS) was deployed each season and night-time hourly data was tracked remotely to ensure a sufficient number of nights (i.e., minimum 10 no.) with appropriate weather conditions were captured (i.e., dusk temperatures above 8˚C, wind speeds less than 5m/s and no or only very light rainfall). Table 2-3 summarises survey effort achieved in 2022 for each of the 10 no. detector locations.

Table 2-3 Survey Effort - Ground-level Static Surveys 2022

Season	Survey Period	Total Survey Nights per Detector Location	Nights with Appropriate Weather
Spring	16th May – 31st May 2022*	15	14
Summer*	14th July – 4th August 2022*	21	20
Autumn	9th September – 29th September 2022	20	20
Total survey effort		**55**	**54**

**Detector D05 in Spring only recorded data for six nights and was not redeployed. Summer Redeployment of D09 due to technical failure of equipment. Redeployed from 4th August – 16th August 2022 for 12 nights.*

Table 2-4 shows weather conditions recorded during deployments. Two days were considered having inappropriate weather conditions in spring, one day in Summer and no days in Autumn. All data were used for subsequent analysis.

*Table 2-4 Weather data collected during static deployments. * marks nights not meeting suitable survey parameters.*

Season	Date	Average of Wind Speed - m/s	Average of Rain Rate - mm/h	Temperature at sunset - °C
Spring	16/05/2022	3.48	0	13.9
	17/05/2022	1.53	2	10.9
	18/05/2022	0.53	0	10.7
	19/05/2022	1.88	0	12.5
	20/05/2022	0.28	0	11.4
	21/05/2022	1.43	0	14.1
	22/05/2022	0.51	1.43	11.9
	23/05/2022	0.42	0	10.7
	*24/05/2022	1.23	3.81	11.1
	25/05/2022	1.12	0.8	11.5
	26/05/2022	0.32	0	10.6
	27/05/2022	0.27	0	12.6
	28/05/2022	0.78	0	16.4
	29/05/2022	1.07	0	13.2
	30/05/2022	0.22	0	9.5
Summer	14/07/2022	0.09	0	15.3
	15/07/2022	0.04	0	16.6
	16/07/2022	1.07	0	18.2
	17/07/2022	0.53	0	22.1
	18/07/2022	0.39	0	23.1
	19/07/2022	0.58	0	15.4
	20/07/2022	0.09	0	14.6
	21/07/2022	0	0	15.1
	22/07/2022	1.48	1.11	15.3
	23/07/2022	0.14	1.22	17.1
	24/07/2022	0	0	14.2
	25/07/2022	0	0	14.2
	26/07/2022	0.04	0	14.5
	27/07/2022	0.41	0	13.9
	28/07/2022	0.71	0	15.6
	29/07/2022	0.99	0.6	16.6
	30/07/2022	0.42	1.11	16.8
	31/07/2022	0	0	13.9
	*01/08/2022	1.78	4.78	18.3
	02/08/2022	1.03	0.24	15.8
	03/08/2022	0	0	13.7
Autumn	09/09/2022	0	0	14.5
	10/09/2022	0.86	0.12	15.6

	11/09/2022	0.57	0	18.4
	12/09/2022	0.65	0	14.6
	13/09/2022	0	0	13.6
	14/09/2022	0	0	14.3
	15/09/2022	0	0	12.9
	16/09/2022	0	0	13.4
	17/09/2022	0	0	11.8
	18/09/2022	0	0	13.9
	19/09/2022	0	0	14.6
	20/09/2022	0.23	0	16.2
	21/09/2022	1.47	0	15.3
	22/09/2022	0	0	12.8
	23/09/2022	0	0	10.1
	24/09/2022	0.03	0	11.6
	25/09/2022	1.16	0	11.8
	26/09/2022	0.42	0	11
	27/09/2022	0.03	0	10.9
	28/09/2022	0	0	9.3

2.2.4 Bat Call Analysis

All recordings were later analysed using bat call analysis software Kaleidoscope Pro v.5.4.8 (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 and all data were 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 frequencies (peak frequency of maximum energy in search flight) of ~55 kHz and ~46 kHz respectively (Jones & van Parijs, 1993).

Plate 2-1 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. Were multiple species were recorded within the same recording, rarer or less recorded species were prioritised over common species.

Consideration was given to the fact that species such as Brown long-eared bats and Lesser horseshoe bats are known to have quiet and very directional echolocation calls, which are difficult to record and are likely to cause an underrepresentation of these species in the data collected, in comparison to "louder" species (i.e. Leisler's bats). Standardised equipment methods, including the use of omni-

directional microphones, ensure data collection is uniform across the Site and data are comparable despite this limitation.

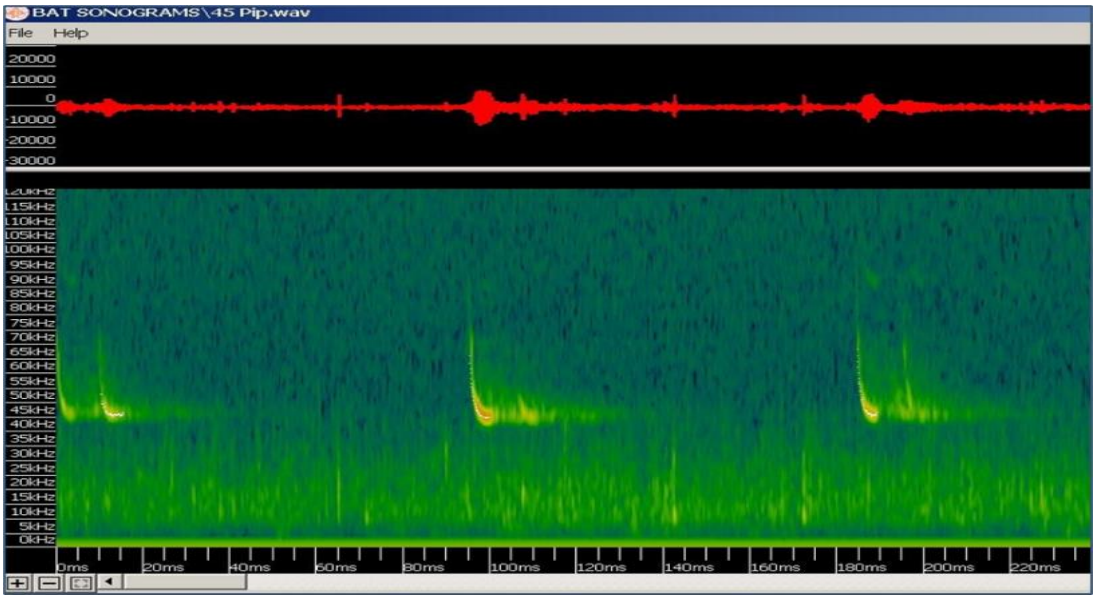

Plate 2-1 Sonogram of Echolocation Pulses of Common pipistrelle (Peak Frequency 45kHz)

Drawing Title
2022 Survey Effort

Project Title
Knockshanvo Wind Farm

Drawn By	Checked By
DC	SF
Project No.	Drawing No.
200513	Fig. 2-1
Scale	Date
1:40,000	16/08/2024

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2.2.5 Assessment of Bat Activity Levels

The online database tool Ecobat (mammal.org.uk) is recommended by NatureScot 2021 to assess bat activity levels within a Proposed Development Site. 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 2-5 defines bat activity levels as they relate to Ecobat percentile values (NatureScot, 2021).

Table 2-5 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

Ecobat was unavailable for a cross-site analysis of 2022 data as the platform has been undergoing maintenance since late 2022 with no proposed timeline of a relaunch. Therefore, data were assessed on a site-specific basis.

Following preliminary analysis and manual verification using Kaleidoscope Pro, statistical analysis and visualisation was performed using RStudio (version 2023.12.1+402.) and R[1] (version 4.3.3). RStudio, an integrated development environment for the R programming language, was employed for data cleaning, exploration, and data visualisation. The 'ggplot2' R package was particularly instrumental in creating the data visualisations shown in the results section. Data was standardised into bat pass rates, calculated as bat passes per hour (total bat passes / night length) to account for seasonal changes in night length (Matthews et al. 2016). 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). During all calculations, data was rounded to at least three decimal places. When visualising the bat pass rates per season, survey effort was defined as detector hours (sum of recorded hours across all detectors). This was defined to circumvent any issues arising from differences in survey effort between detectors in a season.

The methodology used to assess activity levels across the Site was adapted from Mathews *et al.* (2016), where activity ranges of pipistrelle species were defined using an average of maximum nightly pass rates (in total passes during the survey period) across the site, divided into tertiles. Widespread pipistrelle species' activity ranges were determined using an average of maximum nightly pass rates (total passes during the survey period) across the Proposed development site, divided into quartiles. The same process was applied to Leisler's bats. For all other species groups maximum nightly pass rate (bpph) recorded across the Site divided into quartiles was used. Activity levels were assessed separately for widespread pipistrelle species (*Pipistrellus pipistrellus, Pipistrellus pygmaeus*), noctules (*Nyctalus leisleri*), *Myotis* spp. and rare or hard to record species (*Plecotus auritus, Pipistrellus nathusii*). Median and maximum nightly activity (bpph) at each detector location were then categorized as Low, Medium, or High for each recorded season. Any figure below 25% of the maximum/average maximum nightly pass rate was considered Low activity, while figures above 75% were classified as High. Values falling between these two quartiles were defined as Medium. To prevent skewing the activity threshold towards high levels, any evident outliers recorded across the detectors were excluded. Table 2-6 presents activity ranges per species group identified.

Table 2-6 Site-specific Activity Level Categories based on Maximum Bat Passes per Hour (bpph)

Assessment Level	Activity Threshold as Bat Passes per Hour (bpph) for Bat Species			
	Pipistrellus spp.	*Nyctalus* spp.	*Myotis* spp.	Other groups
Low	< 12.5	< 10.9	< 7	< 2.8

Medium	12.5 – 37.4	10.9 – 32.8	7 – 21	2.8 – 11.23
High	37.4 <	32.8 <	21 <	11.23 <

Based on experience gained surveying a large number of development sites, the calculated activity thresholds were considerably high for all species surveyed. Thresholds were therefore adapted to more representative levels for conifer plantation/woodland habitats (Table 2-7).

Table 2-7 Adapted Activity Level Categories

Assessment Level	Activity Threshold as Bat Passes per Hour (bpph) for Bat Species			
	Pipistrellus spp.	*Nyctalus* spp.	*Myotis* spp.	Other groups
Low	< 5.5	< 4	< 1	< 0.5
Medium	5.5 – 16	4 - 12	1 – 3	0.5 – 2.5
High	16 <	12 <	3 <	2.5 <

2.3 Statement of Authority

MKO employs a dedicated bat unit within its Ecology team, specialised in scoping, carrying out, and reporting on bat surveys, as well as producing impact assessments in relation to bats. MKO ecologists have relevant academic qualifications and are qualified in undertaking surveys to the levels required. MKO's Ecology team holds an open bat derogation licence from NPWS. The licence is intended for professionals carrying out surveys with the potential to disturb roosting bats (i.e. roost inspections). Graduate and seasonal ecologist staff is covered under the licence under condition of being accompanied by more experienced colleagues.

Scope development and project management was overseen by Aoife Joyce and John Hynes. Bat surveys were initially conducted by MKO ecologists Laura McEntegart, Keith Costello and Shane Connolly. Top-up surveys were conducted by Sara Fissolo and Ryan Connors. Data analysis was undertaken, and results were compiled by Shane Connolly and Laura McEntegart. The baseline report was collated by Sara Fissolo. Staff's roles and relevant training are presented in Table 2-8 below.

Table 2-8 Staff roles, qualifications and training

Staff	Role	Training
John Hynes (B.Sc., M.Sc., MCIEEM)	Ecology Director	B.Sc. in Environmental Science from National University of Ireland, Galway (2010). M. Sc. Applied Ecology, University College Cork (2011). Full member of the Chartered Institute of Ecology and Environmental Management. Extensive experience regarding Habitats Directive Assessment and EIS preparation of a number of Windfarm developments, of construction supervision and monitoring of development sites, and dealing with statutory ecological consultees in Ireland over past 12 years.
Aoife Joyce (B.Sc., M.Sc.)	Project Director	B.Sc. (Hons) Environmental Science, University of Galway, Ireland. M.Sc. (Hons) Agribioscience, University of Galway, Ireland. Advanced Bat Survey Techniques – Trapping, biometrics, handling (BCI), Bat Impacts and Mitigation (CIEEM), Bat Tree Roost Identification and Endoscope Training (BCI), Bats in Heritage Structures (BCI), Bats and Lighting (BCI).
Sara Fissolo (B.Sc.)	Project Ecologist	B.Sc. (Hons) Ecology and Environmental Biology, University College Cork, Ireland. Advanced Bat Survey Techniques (BCI), Bat Impacts and Mitigation (CIEEM), Bats in Heritage Structures (BCI), Bat Care (BCT), Bats and Lighting (BCI), Kaleidoscope Pro Analysis (Wildlife Acoustics).
Ryan Connors (B.Sc., M.Sc.)	Bat Ecologist	B.Sc. (Hons) Zoology, University College Galway, Ireland. M.Sc. (Hons) Conservation Behaviour, Atlantic Technological University, Galway, Ireland. Surveying Trees for Bats (BRTS), Structure & Tree Inspection (Internal), Manual Transect Survey (Internal), Bat Habitat Appraisal (Internal), Emergence and Re-Entry Surveys (Internal), Kaleidoscope Pro Analysis

		(Internal), Winter Tree Identification (Internal), Wintering Bird Surveying (Internal).
Laura McEntegart (B.Sc.)	Ecologist	B.Sc. (Hons) Botany and Plant Science, National university of Ireland, Galway Bat Handling Training Course (BCI), Bats: Assessing the Impact of Development on Bats, Mitigation & Enhancement - (CIEEM), Kaleidoscope Pro Analysis (Wildlife Acoustics). Endoscope Training (Internal), Emergence and Re-Entry Surveys (Internal) Structure & Tree Inspection (Internal), Manual Transect Survey (Internal), Bat Habitat Appraisal (Internal).
Keith Costello (B.Sc.)	Ecologist	BSc Environmental Science, National University of Ireland, Galway Kaleidoscope Pro Analysis (Wildlife Acoustics), Endoscope Training (Internal), Emergence and Re-Entry Surveys (Internal), Structure & Tree Inspection (Internal), Manual Transect Survey (Internal), Bat Habitat Appraisal (Internal)
Shane Connolly (B.Sc.)	Graduate Ecologist	B.Sc. (Hons) in Botany from National University of Ireland, Galway. Kaleidoscope Pro Analysis (Wildlife Acoustics), Endoscope Training (Internal), Emergence and Re-Entry Surveys (Internal) Structure & Tree Inspection (Internal), Manual Transect Survey (Internal), Bat Habitat Appraisal (Internal).

3. RESULTS

3.1 Desk Study

3.1.1 Bat Records

Bat Conservation Ireland Database

Available bat records were provided by Bat Conservation Ireland on 19/05/2023. A large number of observations have been recorded within 10km: 37 roosts, four transects and 44 ad-hoc observations. Eight of Ireland's nine resident bat species were recorded within 10 km of the Proposed Development. No records of Nathusius' pipistrelle were found. The results of the database search are provided in Table 3-1. All data was considered for the assessment, however due to the large number of records, only roost data is presented below.

Table 3-1 National Bat Database of Ireland Records within 10km of Proposed Development

Record	*Species*	Location Name: IG
Roost	*Rhinolophus hipposideros*	Private: R5272, R4967, R4768, R4969, R5170, R5069, R4477, R4768, R4777, R4768, R4968, R4872, R4764, R5070, R4866, R4774, R5066, R4666, R4479, R5071, R4973, R4872, R4673, R4676, R4964, R4968, R5172, R4766, R4576.
	Rhinolophus hipposideros	Cave: Dane's Hole, Drumminakela, Kilkishen: R5307
	Rhinolophus hipposideros	Cave: Ratty River Cave, Ballymulcashel: R4806
	Nyctalus leisleri	Private: R6163
	Pipistrellus spp. (45kHz/55kHz)	Private
	Rhinolophus hipposideros,Pipistrellus pygmaeus,Myotis natterreri	Private: R4972
	Unidentified bat	Knockalisheen Road Tree roost: R5630759767
	Plecotus auritus,Pipistrellus spp. (45kHz/55kHz)	Private: R4769
	Plecotus auritus	Private: R4763
	Myotis spp., *Plecotus auritus*, *Rhinolophus hipposideros*	Private: R5876

Available bat records within 10km of aTemporary Transition Compound (IG Ref: R 46807 52575) were provided by Bat Conservation Ireland on 27/03/2024. A large number of observations have been recorded within 10km: 54 roosts, six transects and 254 ad-hoc observations. All nine of Ireland's resident bat species were recorded within 10 km of the Temporary Transition Compound. The results of the database search are provided in Table 3-2. As above, roost records only are included.

Table 3-2 National Bat Database of Ireland Records within 10km of Temporary Transition Compound

Record	Species	IG	Location/Name
Roost	Unidentified bat	R4745	Adare, County Limerick
	Myotis nattereri	R5148	Patrickswell, County Limerick
	Unidentified bat	R4146	County Limerick
	Pipistrellus spp. (45kHz/55kHz)	R4556	
	Pipistrellus spp. (45kHz/55kHz)	R3755	County Limerick
	Pipistrellus spp. (45kHz/55kHz)	R4453	
	Rhinolophus hipposideros, *Plecotus auritus*	R4744	Adare Manor Estate,County Limerick
	Myotis nattereri	R4344	Adare, Co. Limerick
	Pipistrellus spp. (45kHz/55kHz)	R3750	Askeaton County Limerick
	Pipistrellus spp. (45kHz/55kHz)	R3846	Cappagh, County Limerick
	Plecotus auritus	R3945	
	Plecotus auritus	R4248	County Limerick

	Pipistrellus spp. (45kHz/55kHz)	R4455	County Limerick
	Rhinolophus hipposideros,*Plecotus auritus*,*Pipistrellus* spp. (45kHz/55kHz)	R3749	Ballyengland Upper, Askeaton, Co. Limerick
	Pipistrellus spp. (45kHz/55kHz)	R4843	County Limerick
	Plecotus auritus	R4357	
	Pipistrellus pygmaeus	R5545	County Limerick
	Plecotus auritus	R4753	Kildimo, County Limerick
	Pipistrellus spp. (45kHz/55kHz)	R4048	County Limerick
	Plecotus auritus,*Rhinolophus hipposideros*	R4247	Hollywood House Road, Currahchase, County Limerick
	Rhinolophus hipposideros,*Pipistrellus pygmaeus*	R4700	Adare, Co. Limerick
	Pipistrellus spp. (45kHz/55kHz)	R4746	Adare, Co.Limerick
	Pipistrellus spp. (45kHz/55kHz)	R4354	County Limerick
	Rhinolophus hipposideros	R4354	Dromore, Pallaskenry, Co. Limerick
	Plecotus auritus	R4700	Adare, Co. Limerick
	Rhinolophus hipposideros	R4300	Adare, Co. Limerick
	Rhinolophus hipposideros,*Plecotus auritus*	R4245	Adare, Co. Limerick
	Rhinolophus hipposideros	R4135	Curragh Chase, Co. Limerick
	Pipistrellus spp. (45kHz/55kHz)	R4250	County Limerick
	Unidentified bat	R5630	Knockalisheen RoadBallygrennan,Co. Limerick
	Pipistrellus spp. (45kHz/55kHz)	R4653	
	Rhinolophus hipposideros	R4745	Adare, Co. Limerick
	Pipistrellus pygmaeus	R5353	DromdarrigMungretCo. Limerick
	Plecotus auritus	R4048	County Limerick
	Pipistrellus spp. (45kHz/55kHz)	R4247	County Limerick
	Unidentified bat	R5242	County Limerick
	Pipistrellus pygmaeus,*Plecotus auritus*	R5353	DromdarrigMungretCo. Limerick
	Pipistrellus spp. (45kHz/55kHz),Unidentified bat	R4948	County Limerick
	Unidentified bat,*Plecotus auritus*	R4148	Hollywood House Road, County Limerick
	Plecotus auritus	R4643	Graigue wood, County Limerick
	Plecotus auritus	R4453	
	Rhinolophus hipposideros	R4744	AdareCo. Limerick
	Unidentified bat	R4146	
	Unidentified bat	R4256	
	Unidentified bat	R5148	Patrickswell, County Limerick
	Plecotus auritus	R4148	Curraghchase, County Limerick
	Rhinolophus hipposideros	R4149	Curragh Chase House, Curragh Chase, Co. Limerick
	Rhinolophus hipposideros	R4354	Pallaskenry, Co. Limerick
	Plecotus auritus, Pipistrellus spp. (45kHz/55kHz)	R4156	County Limerick
	Rhinolophus hipposideros	R4150	Stonehall, Kilbreedy, Co. Limerick
	Unidentified bat, *Plecotus auritus*	R4050	County Limerick
	Unidentified bat	R5242	County Limerick
	Plecotus auritus	R4700	Adare, Co. Limerick
	Rhinolophus hipposideros	R4151	Co. Limerick

National Parks and Wildlife Service – Lesser Horseshoe Roost Records

A sensitive information request was sent to the NPWS scientific data unit requesting records, including winter-specific records, from the Rare and Protected Species Database on the 23rd March 2023. A response was received on the 12th April 2023. The search yielded a number of lesser horseshoe bat roosts within 5km of the site, of which two are associated with Designated Sites. All reported roosting sites are located to the north-west and west of the Proposed Development Site. The specific location of these records is not included within the report.

A similar request was sent to the NPWS relating to the temporary transition compound on the 22nd February 2024. A response was received on the 26th February 2024. This search yielded two lesser horseshoe bat roosts within 5km of the Compound, neither of which are associated with Designated Sites. Both reported roosting sites are located to the north-west of the Temporary Transition Compound.

Any SAC that has lesser horseshoe bat as a qualifying interest will also have a "Conservation Objective". This aims to manage and protect the qualifying interest. Achieving Favourable Conservation Status (FCS) is the overall objective to be reached for all Annex I habitat types and Annex II species of European Community interest listed in the Habitats Directive 92/43/EEC (European Commission, 2013) (NPWS, 2018). It is defined in positive terms such that a habitat type or species must be prospering and have good prospects of continuing to do so.

Research has shown that lesser horseshoe bats normally forage in woodlands/scrub within 2.5km of their roosts (Bontadina *et al.,* 2002); therefore, a 2.5km zone is considered an appropriate distance to foraging areas (NPWS, 2018). Habitat areas within 2.5km of known roosts are important for supporting bat populations.

The Proposed Development Site is located within 2.5km of two lesser horseshoe designated SACs, Ratty River Cave SAC [002316] and Danes Hole, Poulanecka SAC [000030]. In addition, seven roosts, including two large summer roosts of which at least one maternity roost, were recorded within 2.5km of the Site and provided as confidential records by NPWS. Other roosting sites located within 2.5km of Knockshanvo Wind Farm include day roosts and transitional roosts.

The Temporary Transition Compound is located within 10 km of the lesser horseshoe designated Curraghchase Woods SAC [000174]. However, the two roosts to the north-west of the Compound, including one hibernation/satellite roost and one night roost are situated beyond the 2.5 km foraging zone of this population.

No roost records or significant suitable roosting habitat, including hibernacula, for this species was recorded on the Site of the Proposed Development.

National Biodiversity Data Centre

The National Bat Database of Ireland was searched for records of bat activity and roosts within a 10 km radius of the Proposed Development was made on the 27th of January 2022. The search yielded records for six bat species within 10km. Table 3-3 lists the bat species recorded within the hectads which pertain to the Wind Farm Site (R56 and R57).

Table 3-3 NBDC Bat Records within 10km of Proposed Development

Grid Square	Species	Database	Designation
R56	Brown long-eared bat *Plecotus auritus*	National Bat Database of Ireland	HD Annex IV, WA
R56 and R57	Daubenton's bat *Myotis daubentonii*	National Bat Database of Ireland	HD Annex IV, WA
R56 and R57	Lesser horseshoe bat *Rhinolophus hipposideros*	National Bat Database of Ireland	HD Annex IV, WA
R56 and R57	Leisler's bat *Nyctalus leisleri*	National Bat Database of Ireland	HD Annex IV, WA
R57	Common pipistrelle *Pipistrellus pipistrellus*	National Bat Database of Ireland	HD Annex IV, WA
R56 and R57	Soprano pipistrelle *Pipistrellus pygmaeus*	National Bat Database of Ireland	HD Annex IV, WA

The National Bat Database of Ireland was also searched for records of bat activity and roosts within a 10km radius of the proposed Temporary Transition Compound (last search 05/03/2024). Hectads R44, R45, R54 and R55 fall within this radius. Eight of Ireland's nine resident bat species were recorded

within 10km of the compound. Table 3-4 lists the bat species recorded within the hectads which pertain to the temporary transition compound.

Table 3-4 NBDC Bat Records within 10km of the proposed Temporary Transition Compound.

R44, R45, R54	Brown Long-eared Bat (*Plecotus auritus*)	National Bat Database of Ireland	HD Annex IV, WA
R44, R45, R54, R55	Daubenton's Bat *(Myotis daubentonii)*	National Bat Database of Ireland	HD Annex IV, WA
R44, R45, R55	Lesser Horseshoe Bat (*Rhinolophus hipposideros*)	National Lesser Horseshoe Bat Database	HD Annex II & IV, WA
R44, R45, R54, R55	Lesser Noctule (*Nyctalus leisleri*)	National Bat Database of Ireland	HD Annex IV, WA
R44	Nathusius's Pipistrelle (Pipistrellus nathusii)	National Bat Database of Ireland	HD Annex IV, WA
R44, R54	Natterer's Bat *(Myotis nattereri)*	National Bat Database of Ireland	HD Annex IV, WA
R44, R45, R54, R55	Common Pipistrelle (*Pipistrellus pipistrellus*)	National Bat Database of Ireland	HD Annex IV, WA
R44, R45, R54, R55	Soprano Pipistrelle (*Pipistrellus pygmaeus*)	National Bat Database of Ireland	HD Annex IV, WA

3.1.2 Bat Species Range

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

The Proposed Development Site is located outside the current known range for Nathusius' pipistrelle. The Site lies within, but at the edge of the current known range for Natterer's bat and outside, but at the edge of the known range of the Whiskered bat.

3.1.3 Designated Sites

Within Ireland, the Lesser horseshoe bat is the only bat species requiring the designation of Special Areas of Conservation (SACs) and the Proposed Development Site is situated within 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 all SACs, NHAs and pNHAs within a 10 km radius of the Wind Farm Site found five sites designated for the conservation of bats (Table 3-5). No information on number of roosting bats is publicly available.

Table 3-5 Designated Sites in the vicinity of the Proposed Development

Designated Site	Bat species of interest	Description	Distance to Site Boundary
Danes hole, Poulnalecka SAC [000030] & pNHA	Lesser Horseshoe Bat *(Rhinolophus hipposideros)*	Winter hibernation site and a mating site of the Lesser Horseshoe Bat. A nearby summer roost for the bat and the commuting routes between the two are also included.	Approx 0.5km
Ratty River Cave SAC [002316]	Lesser Horseshoe Bat *(Rhinolophus hipposideros)*	Winter hibernation site and a mating site of the Lesser Horseshoe Bat.	Approx. 2.5km
Kilkishen House SAC [002319]	Lesser Horseshoe Bat *(Rhinolophus hipposideros)*	Winter hibernation site and a mating site of the Lesser Horseshoe Bat.	Approx. 3.7km

Cloonara House (000028)	Leisler's Bat (*Nyctalus leisleri)*	Summer nursery of International Importance.	Approx. 7.1km
Castleconnel (Domestic Dwelling) (000433)	Bats.	No site synopsis available.	Approx. 9.0km

3.1.4 Landscape Features and Habitat Suitability

A review of mapping and photographs provided insight into the habitats and landscape features present at the Proposed Development Site. In summary, the primary land use within the Wind Farm Site is conifer plantation.

A review of the GSI online mapper did not indicate the possible presence of any subterranean sites within the site. However, a spring was identified approximately 5km North of the Wind Farm Site (Table 3-6). This location has been fully avoided by the Proposed Development. A search of the National Monuments Database did not reveal the presence of any manmade subterranean areas within the Site.

A search of the UBSS Cave Database for the Republic of Ireland found caves within the Wind Farm Site or within 10km of the EIAR Site Boundary.

Table 3-6 Subterranean Sites

Class	Location (ITM)	Description	Distance from site
Cave	Townland: Ballymulcashel Grid Ref (ITM): E148006 N168411	Limestone cave	Approximately 2.5km

A review of the NBDC bat landscape map provided a habitat suitability index of 30.56 (orange) and 40.89 (red). This indicates that the Proposed Development area has high habitat suitability for bat species.

3.2 Overview of the Site and Bat Habitat Appraisal

The Proposed Development Site consists primarily of conifer plantation (WD4), and clearfell (WS5), with small areas of wet heath (HH3), cutover bog (PB4) and upland blanket bog (PB2) also found.

With regards to foraging and commuting bats, the conifer habitats within the Site provide suitable foraging and commuting grounds for bat species. A lack of artificial light pollution and good connectivity with the wider landscape, which primarily consist of agricultural lands lined by treelines and hedgerows, provide *High* suitability for foraging and commuting bats. While the forestry site is primarily planted with commercial conifer species, an area including mature deciduous trees was identified. These trees are located along the central area of the site, approximately 260m south of proposed Turbine 6 (ITM Ref: 556950 669299, Plate 3-1).

The peatland habitats within the Site are less relevant to commuting bat species but can provide some prey diversity suitable to foraging bats. Overall, peatland habitats were assigned *Low* potential for bats.

With regards to roosting bats, the Proposed Development Site is comprised primarily of commercial conifer forestry and in general does not provide significant suitable roosting opportunities for bats. However, a number of potential roosting features, including structures and broadleaved trees, were identified within the Site and have been assessed in Section 3.2.1 below.

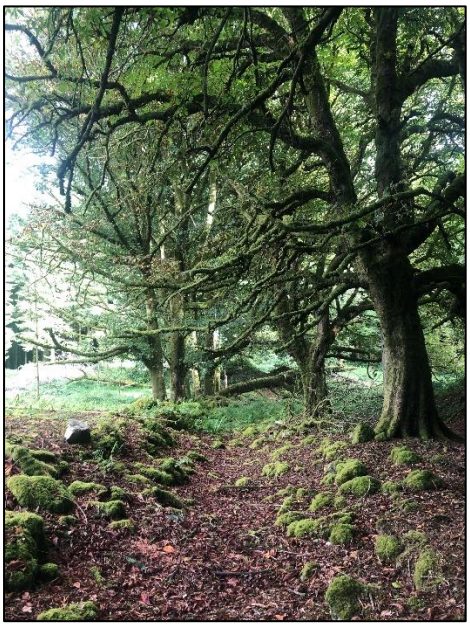

Plate 3-1 Broadleaved area in proximity of proposed Turbine 6.

Existing water-crossings along Underground Grid Connection Route

A bat roost suitability assessment was carried out on existing water crossing structures located along the proposed Grid Connection route. Of seven water crossings found along the route, five consist of culverts beneath the existing road and were assigned Negligible roosting potential. Two bridges were identified along the route (Table 3-7). Watercourse crossing 2 consists of small HDPE bridge with Negligible potential. Water-crossing 3 consists of a stone bridge over the Blackwater River which occurs as a depositing/lowland river (FW2) at this location. Water levels were high at the time of survey with a fast flow. Bankside vegetation consists of treelines (WL2) of ash (*Fraxinus excelsior)* with bramble and willow scrub.

Table 3-7 Water crossings along the Grid Connection route

Crossing ID	ITM	Existing Structure	EPA watercourse reference	Roost Suitability (Collins 2016)[2]
Bridge 01	558345 665650	Stone bridge (with cement and pointing)	BLACKWATER (CLARE)_010	Low
Bridge 02	558308 667280	Bridge	MOUNTRICE_010	Negligible

Turbine Delivery Route Accommodation Areas

The delivery of turbines along this route will require over-run works (which will require gravelling and hardstand creation) and over-sail works (which will require vegetation removal or trimming). The habitats within these areas are described below.

The north-most oversail area along the R465 road will require trimming of approx. 65m of a hedgerow (WL1) consisting of hazel (*Corylus avellana)* and bramble (*Rubus fruticosus agg.*). Further south, the oversail area is approx. 55m in length and consists of a stone wall (BL1) with associated bramble scrub

[2] *A new edition of the BCT Guidelines (Collins, 2023) was published after the site visits were undertaken and was taken into consideration when undertaking this assessment. The assessment and scope of surveys were considered appropriate for the structures identified above.*

(WS1), ivy (*Hedera hibernica),* bracken (*Pteridium aquilinum)* and hard fern (*Blechnum spicant).* There is also one small sycamore tree (*Acer pseudoplatanus),* and two ash (*Fraxinus excelsior)* (Plate 3-2). Further south, the oversail area consists of a hedgerow (WL1) of hawthorn (*Crataegus monogyna),* bramble, nettle (*Urtica dioica),* with immature sycamore and ash (Plate 3-3). These areas border improved agricultural grasslands (GA1). These areas were assessed on the 26th September 2023 for their suitability to foraging, commuting and roosting bats. No trees with suitable roosting potential were identified in the two areas. The sections of linear habitat to be cleared were assigned *Low* potential for commuting and foraging.

Plate 3-2 Vegetation within turbine delivery route oversail area.

Plate 3-3 Vegetation within turbine delivery route oversail area.

An area of 1.2 ha of agricultural land in Co. Limerick is proposed to accommodate a Temporary Transition Compound. The Temporary Transition Compound consists of four distinct broadleaf treelines, with an additional three mature sycamore trees in the centre of the site. Out of the initial 30 trees identified as having potential to host roosting bats, 9 were flagged for further assessment (FAR), and 21 displayed visible PRFs. Trees with dense ivy cover that might obscure PRFs were categorized as requiring further assessment (FAR). Among the 21 trees with visible PRFs, 15 were accessible from the ground and underwent an endoscopic inspection. 5 were assessed as having PRF-M suitability, 10 were categorized as PRF-I. The remaining 6, that could not be accessed, were simply labelled as PRF (Plates 3-4 – 3-11).

With regard to foraging and commuting bats, areas of grassland habitats within the compound were assessed as having *Low* suitability.

The mature treelines and hedgerows present show potential for foraging and commuting bats. These features were assessed as having *High* suitability, i.e. Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by bats for flight-paths as it is well connected to the wider landscape. The Site is also close to and connected to known roosts. Figure 3-1 provides the results of the tree assessment.

Plate 3-4 Southern Mature Treeline

Plate 3-5 Standalone Mature Sycamores

Plate 3-6 Eastern Mature Treeline

Plate 3-7 Ash tree with large wound

Plate 3-8 Ash tree with bacterial canker

Plate 3-9 Hazard beam present in southeast of site.

Plate 3-10 Fluting in standalone sycamore

Plate 3-11 Deep crack in trunk of tree

Drawing Title
Bat habitat appraisal of transition compound area

Project Title
Knockshanvo WF

Drawn By	Checked By
RC	RW
Project No.	Drawing No.
200513	Figure 3-1
Scale	Date
1:3,000	2024-08-20

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3.2.2 Roost Surveys

Following the search for roosts in 2021 and 2022, a number of structures and trees were identified within the Wind Farm Site and were visually assessed for their suitability to support bats. No structures containing potential suitable bat roosting features were identified within 200m plus the rotor radius (max. 90m) of the Proposed Development footprint. Potential roost features and their assessment are presented in Figure 3-2.

3.2.2.1 Buildings

Four buildings were identified within the Proposed Development Site, comprising of one corrugated iron shed, an ESB building, an old block built stable and an unused cow shed. The buildings and any associated structures were subject to detailed internal and external inspections by a licensed ecologist on the 14th and 21st of June 2021. The aim was to compile information on actual and potential access points and roosting locations.

Interior access was gained to all structures except the ESB building on Site which was surrounded by fencing with limited access. A daytime inspection of the buildings found no signs of bats.

Corrugated Shed

The corrugated shed (ITM Ref: 552188 670286) also contained a small wooden shed as well as a dilapidated caravan. The main structure consisted of a single storey galvanised steel shed with a corrugated iron roof and no separate attic space. There was underfelt lining on the roof, but no soft insulation. Suitable access points for bats were identified through an open door and under the facia, with potential roosting locations available under the felt, however the building was relatively bright during the day. A daytime inspection of this building found no signs of bats. (Plate 3-12 to 3-15). The shed was assigned a *Negligible* roosting potential.

Plate 3-12 Galvanised Shed

Plate 3-13 Galvanised Shed Interior

Plate 3-14 Galvanised Shed Interior

Plate 3-15 Galvanised Shed Interior Felt and Beams

Stone Cow Shed

The small cow shed (ITM Ref: 556883 669300) was located in proximity of the corrugated shed. It was a stonewall constructed shed, with a collapsed roof of corrugated iron, no lining, or insulation. The shed was dark, surrounded by forestry and partly covered in ivy. There was limited lighting inside, with some entering through gaps in the stone wall and corrugated iron roof. The shed presents suitable access points, however limited roosting suitability due to being very low to the ground and exposed to the elements. A daytime inspection of this building found no signs of bats. (Plate 3-16 & 3-17). It was assigned a *Negligible* roosting potential.

Plate 3-16 Cow Shed Exterior

Plate 3-17 Cow Shed Interior

Stable

An unused Stable (ITM Ref: 556883 669300, Plates 3-18 – 3-20) was also inspected. The stable was built with block and presented a partially collapsed corrugated iron roof. It was a single storey structure with no separate attic space. No lining or insulation were present in the interior and the gap in the roof allowed for significant natural light. Suitable access points were available through an open doorway and gaps in the roofing that has collapsed. Potential roosting locations for crevice dwelling bats were identified along exposed roof beams and between cavities in the block wall. A daytime inspection of this building found no signs of bats. It was assigned a *Low* roosting potential.

An emergence survey was conducted on 31st May 2022 on the stable. Two bats were observed emerging from it approximately half an hour after sunset: both bats were not picked up by the detector, so it was not possible to confirm a species ID, however it is likely to have been soprano pipistrelle as this was the only species recorded before and after the emergence was observed. The survey was stopped one hour after sunset due to poor visibility and continued as a transect.

Plate 3-18 Block and Galvanised Sheet Roof Stable Front Exterior

Plate 3-19 Stable Interior

Plate 3-20 Stable Exterior, Roof

ESB Building

The ESB Building (ITM Ref: 553187 669226) was a small blockwall constructed building, with a tar sheet covered roof surrounded by and is surrounded by 10ft high green wrought iron fencing and located beside a stone Cóillte roadway. There was no exterior lighting. The only window was filled in with cement and blocks. No holes in the block wall or gaps in the roof were identified for potential bat access. The interior of the structure was not accessible for inspection. An accompanying shed to the west of the main ESB building presented small gaps between the galvanised sheet roof and the walls as it can provide cover, however they were not considered suitable for roosting. A daytime inspection of these buildings found no signs of bats (Plate 3-21). The were assigned *Negligible* roosting potential.

Plate 3-21 ESB Buildings and Tower

3.2.2.2 Trees

The majority of the trees located within the Proposed Development Site consists of commercial conifer plantation stock with *Negligible* roosting potential.

A deciduous tree line located to the southeast of the Site was found to contain a number of mature trees with potential roosting features (ITM Ref: 556889 669131). The trees are located just off a track within the Site south of proposed turbine T6. Within the treeline, an oak, ash and birch tree with PRFs visible from the ground level were identified as having some potential for roosting bats. It is intended that the trees will not be affected by the Proposed Development.

A mature Ash tree (ITM Ref: 556889 669131) had some potentially suitable knot holes and lifting of bark. There may be more features not visible from ground given the age of the tree. These features present potential for opportunistic use by crevice-dwelling species and as such the tree was assigned a low roost suitability (Plate 3-22). A Birch tree (ITM Ref: 556885 669178) has some potentially suitable knot holes and a sizable cavity approximately halfway up the trunk. This tree has *Moderate* roost suitability. (Plate 3-23). The mature Oak tree has some potentially suitable knot holes and lifting of bark as well as a sizable cavity approximately halfway up the trunk. This tree was assigned Moderate roost suitability (Grid Ref: 556902 669203, Plate 3-24).

In addition, a wooded area including mature deciduous trees was also identified south of proposed turbine T06, in proximity to the stable and derelict sheds described above. A small number of trees, including horse chestnuts and ash, present *Moderate* and *High* PRFs in the form of knot holes, wounds and transverse snaps (Plate 3-25). The surrounding area and roadside also present a number of immature and semi-mature deciduous trees with *Negligible* roosting potential which are likely to provide suitable foraging grounds.

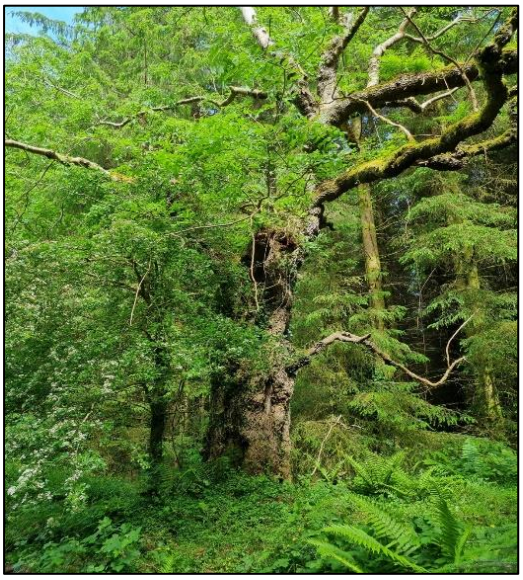


Plate 3-22 Mature Ash Tree

Plate 3-23 Mature Birch Tree

Plate 3-24 Mature Oak Tree

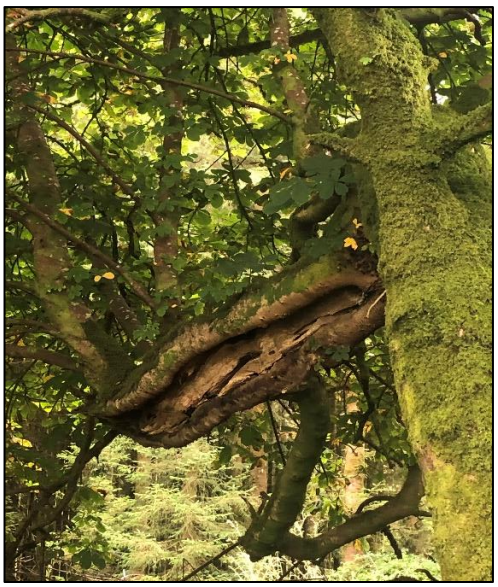
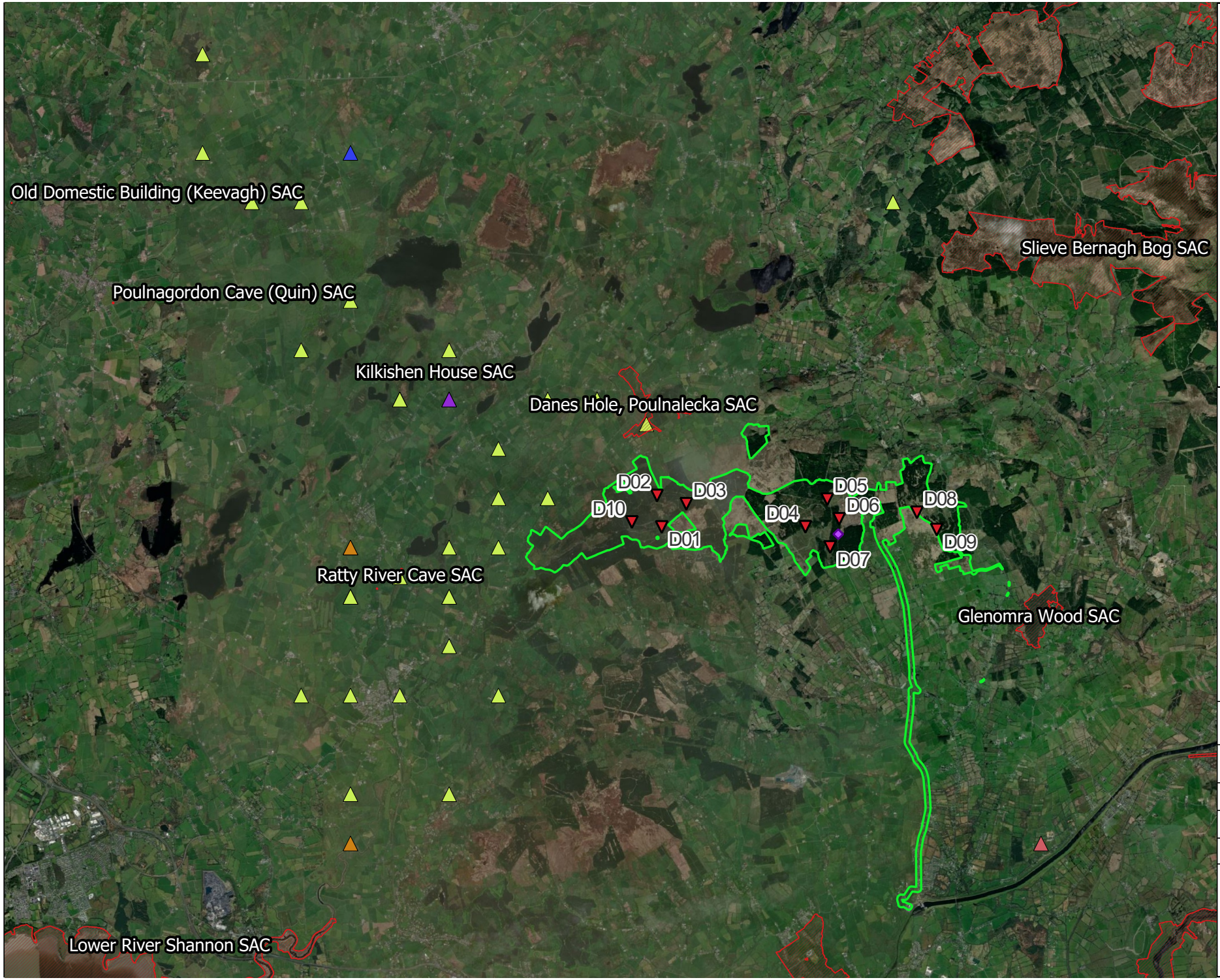


Plate 3-25 Transverse snap with High Roosting Potential.



Map Legend

- EIAR Site Boundary
- Special Area of Conservation
- Spring Detectors 2022
- Soprano Pipistrelle Roost

BCI Roost Records

- Myotis natterreri
- Myotis spp.
- Nyctalus leisleri
- Pipistrellus pygmaeus
- Pipistrellus spp.
- Plecotus auritus
- Rhinolophus hipposideros
- Unidentified bat

N

Drawing Title
Roost Records

Project Title
Knockshanvo Wind Farm

Drawn By	Checked By
DC	SF
Project No.	Drawing No.
200513	Fig. 3-2
Scale	Date
1:100,000	16/08/2024

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3.3 Manual Activity Surveys

Manual activity surveys were undertaken in the form of driven transects in Spring, Summer and Autumn 2022. Bat activity was recorded on all surveys. In general, Common pipistrelle (n=410) was recorded most frequently, followed by Soprano pipistrelle (n=172). Instances of *Myotis* spp. (n=12) and Leisler's bat (n=10) were less frequent. No Lesser horseshoe bats were recorded during the surveys. Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort).

Plate 3-26 presents results for individual species per survey period. Figures 3-2 – 3-4 present the spatial distribution of bat activity across the surveys. Species composition was similar between Spring and Summer, with less diversity recorded in Autumn. Higher bat activity levels were recorded in Summer for all species, with the exception of higher Leisler's bat activity being recorded in Spring.

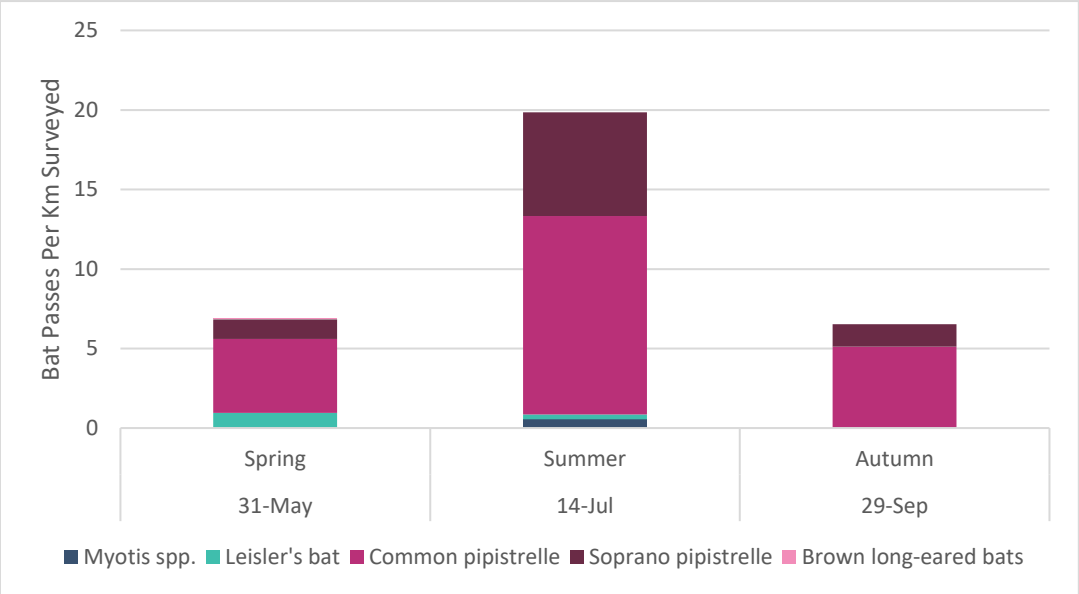
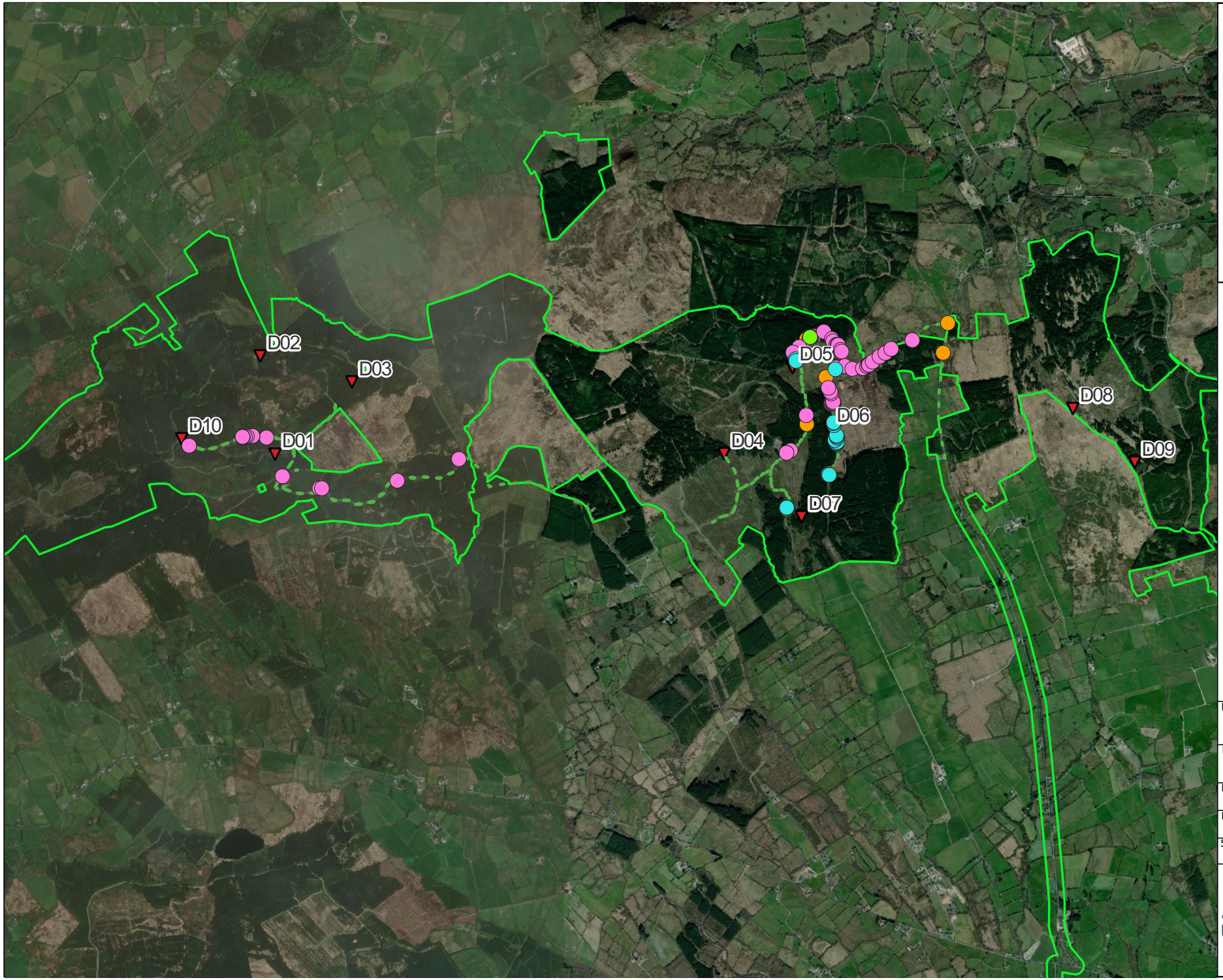


Plate 3-26 2022 Transect Results - Species Composition Per Survey Period

The Spring transect survey was conducted on the 31st May 2022 following an emergence survey conducted on the block stable located in between D06 and D07. The manual activity survey followed existing tracks in proximity of proposed turbines T06, T05, T07 and T04, in the central area of the site, then connected to the eastern side of the Site in proximity of T01 and T03. During the transect survey carried out, high activity was recorded in proximity of detectors D06 and D05. Figure 3-3 shows spatial distribution of bat calls for the Spring manual survey.

The Summer transect was conducted on the 14th July. It started in the eastern section of the site, in proximity of T01 and T03, then connected to the central area of the site. As for spring, the majority of activity, was recorded in proximity of T06 and T05, and consisted primarily in pipistrelle species, with a small number of *Myotis* spp. and Leisler's bat passes recorded. Figure 3-4 shows spatial distribution of bat calls for the Summer manual survey.

In Autumn, the transect started again east of the site, in proximity of T01 and T10, then covered T03 and T02, and moved to the centre of the Site again, covering T05 and T04. Activity in Autumn was recorded sporadically across the site, with the majority of activity picked up to the east of T10. Only Leisler's bats and pipistrelles were recorded. Figure 3-5 shows spatial distribution of bat calls for the Autumn manual survey.



Map Legend

EIAR Site Boundary

Static Detector Locations

2022 Spring Transect Route

Species

Leisler's bat

Common pipistrelle

Soprano pipistrelle

Brown long-eared bat

N

Drawing Title

2022 Spring Transect Results

Project Title

Knockshanvo Wind Farm

Drawn By	Checked By
DC	SF
Project No.	Drawing No.
200513	Fig. 3-3
Scale	Date
1:32,000	16/08/2024

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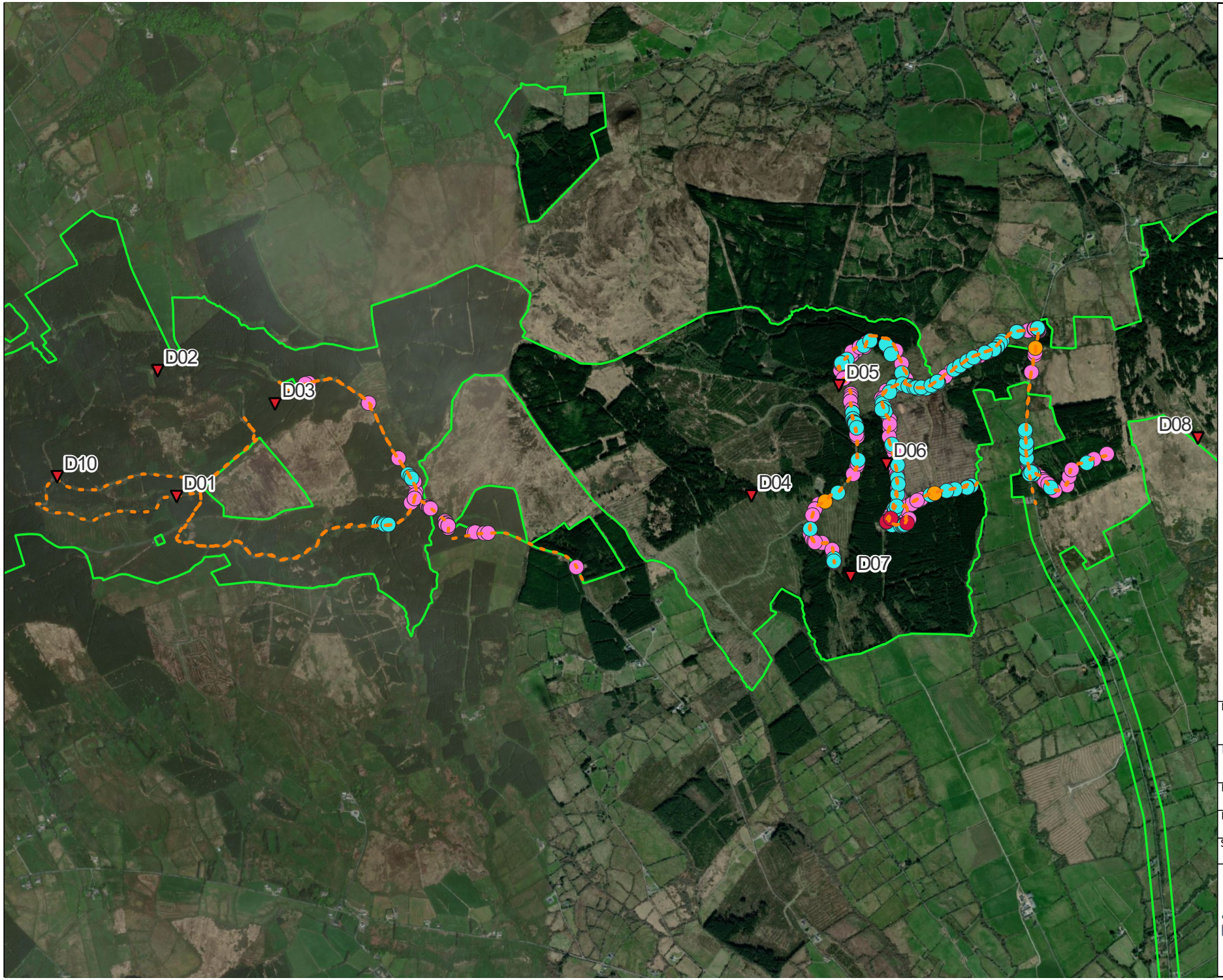

Map Legend

EIAR Site Boundary

Static Detector Locations

2022 Summer Transect Route

Species

Myotis spp.

Leisler's bat

Common pipistrelle

Soprano pipistrelle

N

Drawing Title: 2022 Summer Transect Results

Project Title: Knockshanvo Wind Farm

Drawn By	Checked By
DC	SF
Project No.	Drawing No.
200513	Fig. 3-4
Scale	Date
1:25,000	16/08/2024

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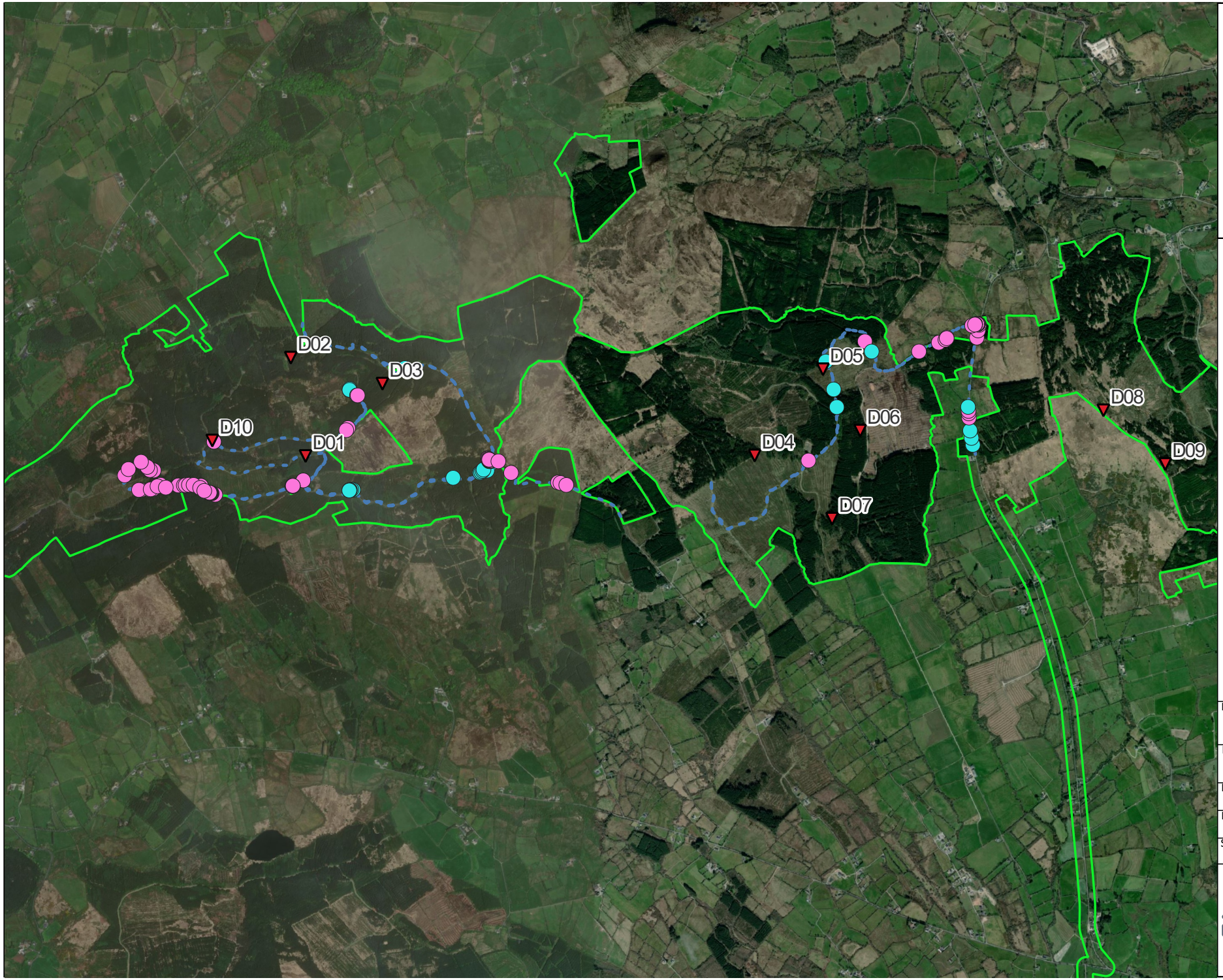

Map Legend

EIAR Site Boundary

Static Detector Locations

2022 Autumn Transect Route

Species

Common pipistrelle

Soprano pipistrelle

N

Drawing Title
2022 Autumn Transect Results

Project Title
Knockshanvo Wind Farm

Drawn By	Checked By
DC	SF
Project No.	Drawing No.
200513	Fig. 3-5
Scale	Date
1:32,000	16/08/2024

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3.4 Ground-level Static Surveys

In total, 155,355 bat passes were recorded across all deployments. In general, Common pipistrelle (n=104,169) occurred most frequently, followed by Soprano pipistrelle (n=30,201), Leisler's bat (n=11,294) and *Myotis spp.* (n=7,029). Instances of Brown long-eared bat (n=1,556) and Lesser horseshoe bat (n=1,098) were significantly less. Nathusius' pipistrelle (n=8) was rare. Plate 3-27 presents relative species composition across all ground-level static detector surveys.

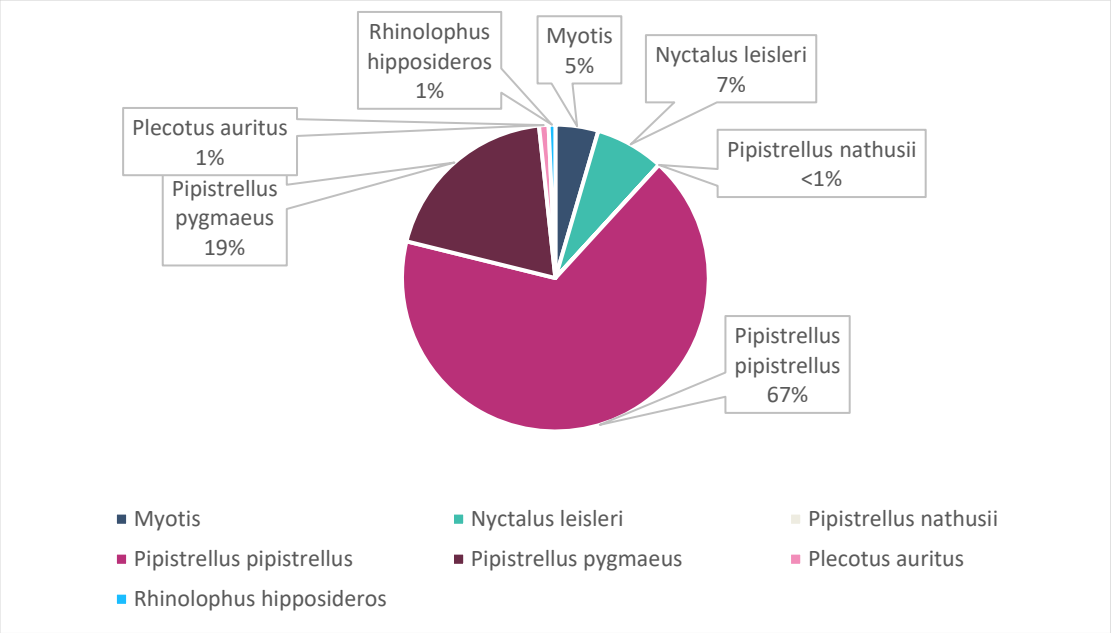

Plate 3-27 Total Species Composition recorded in 2022

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. Summer recorded the highest levels of activity for all species with the exception of Lesser horseshoe bats, which were more often recorded in Autumn. Species composition remained generally similar across deployments.

The Nightly Pass Rate (i.e. bat passes per hour, per night) was used to determine typical bat activity at the Proposed Development site. Activity is often variable between survey nights. Therefore, the median Nightly Pass Rate was used as the most appropriate measure of bat activity (Lintott & Mathews, 2018). Plate 3-28 illustrates the median Nightly Pass Rate per species per deployment at each detector. Activity by least recorded species is also reported in Plate 3-29 for clarity. Zero data, when a species was not detected on a night, was also included. Differences in activity between nights and per-detector are further discussed below.

Activity levels varied between detector locations and across seasons (Plate 3-30 & 3-31). Detector D06 showed higher diversity in Spring, and higher activity levels during Summer and Autumn, than other locations. The detector was located near an area characterised by linear broadleaved features and woodland patches, where higher activity levels were also observed during transect surveys. D07 recorded the highest activity in Spring. In general, the central area of the site, including detectors D04 to D07 collected the majority of the data recorded.

Species composition did not significantly fluctuate in terms of nightly activity, whereas activity levels varied throughout the deployment, and particularly reduced during rainy weather conditions (Plate 3-30)

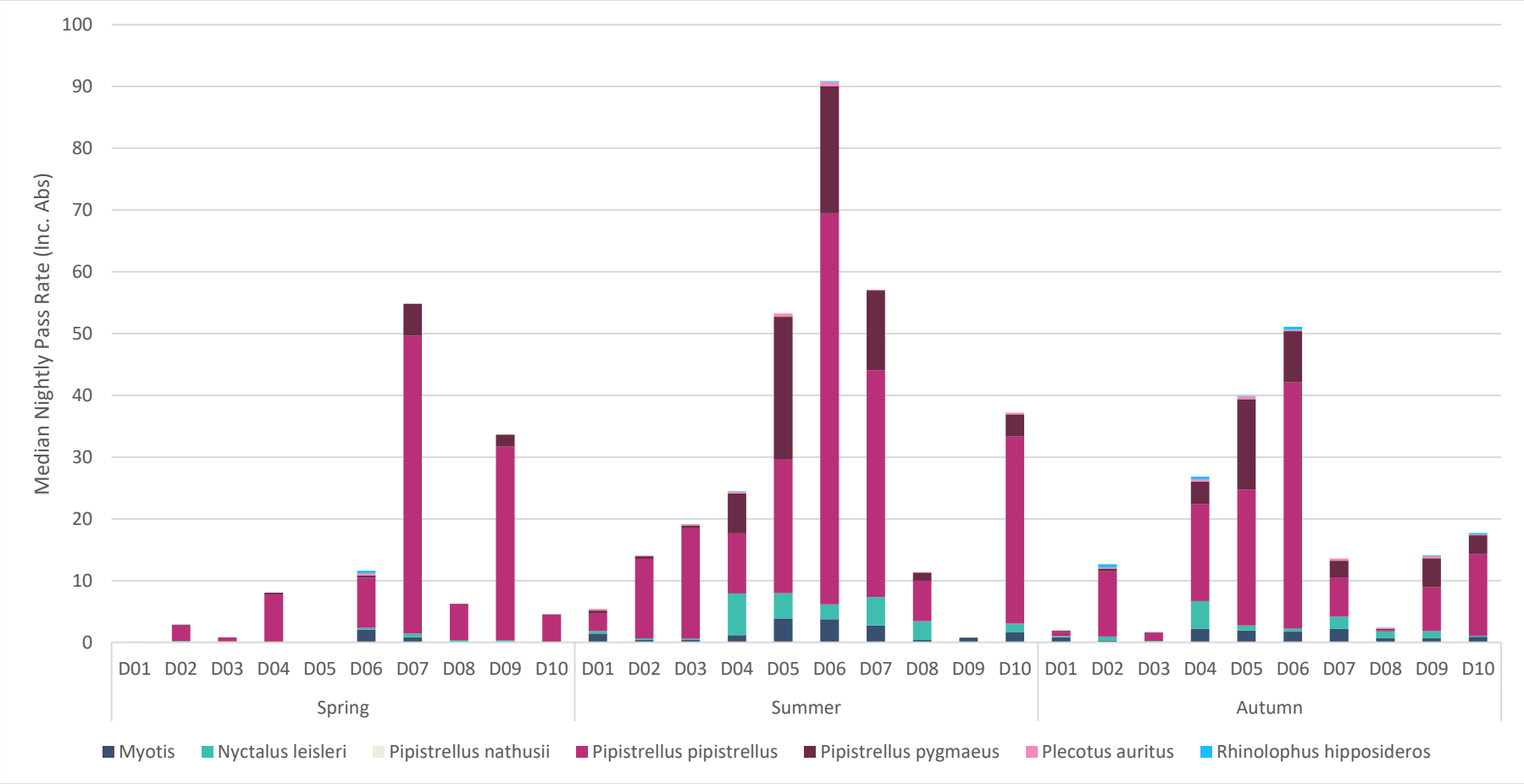

Plate 3-28 Species Composition per Detector, across all Seasons.

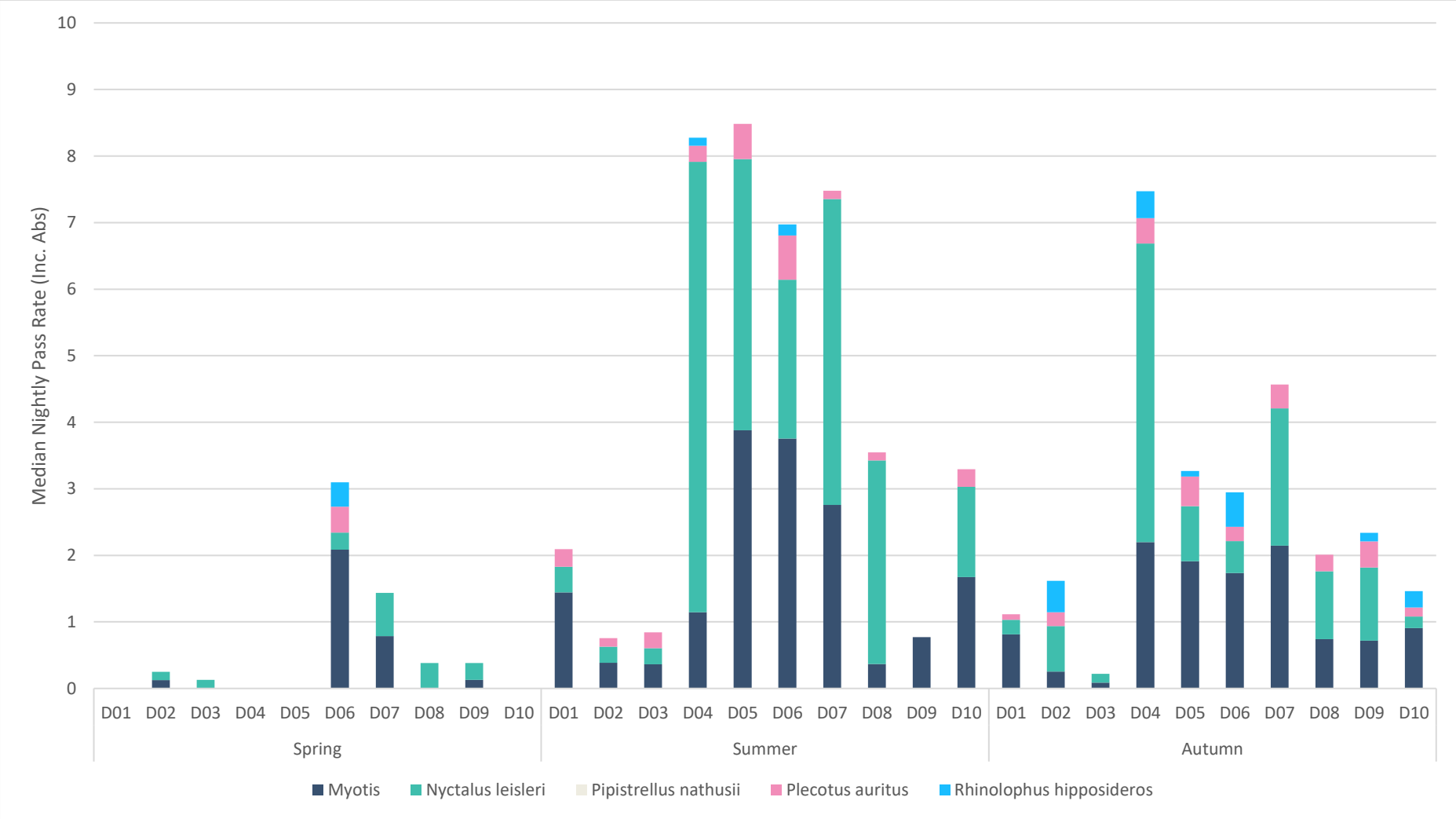

Plate 3-29 Species Composition per Detector, across all Seasons, without common and soprano pipistrelle.

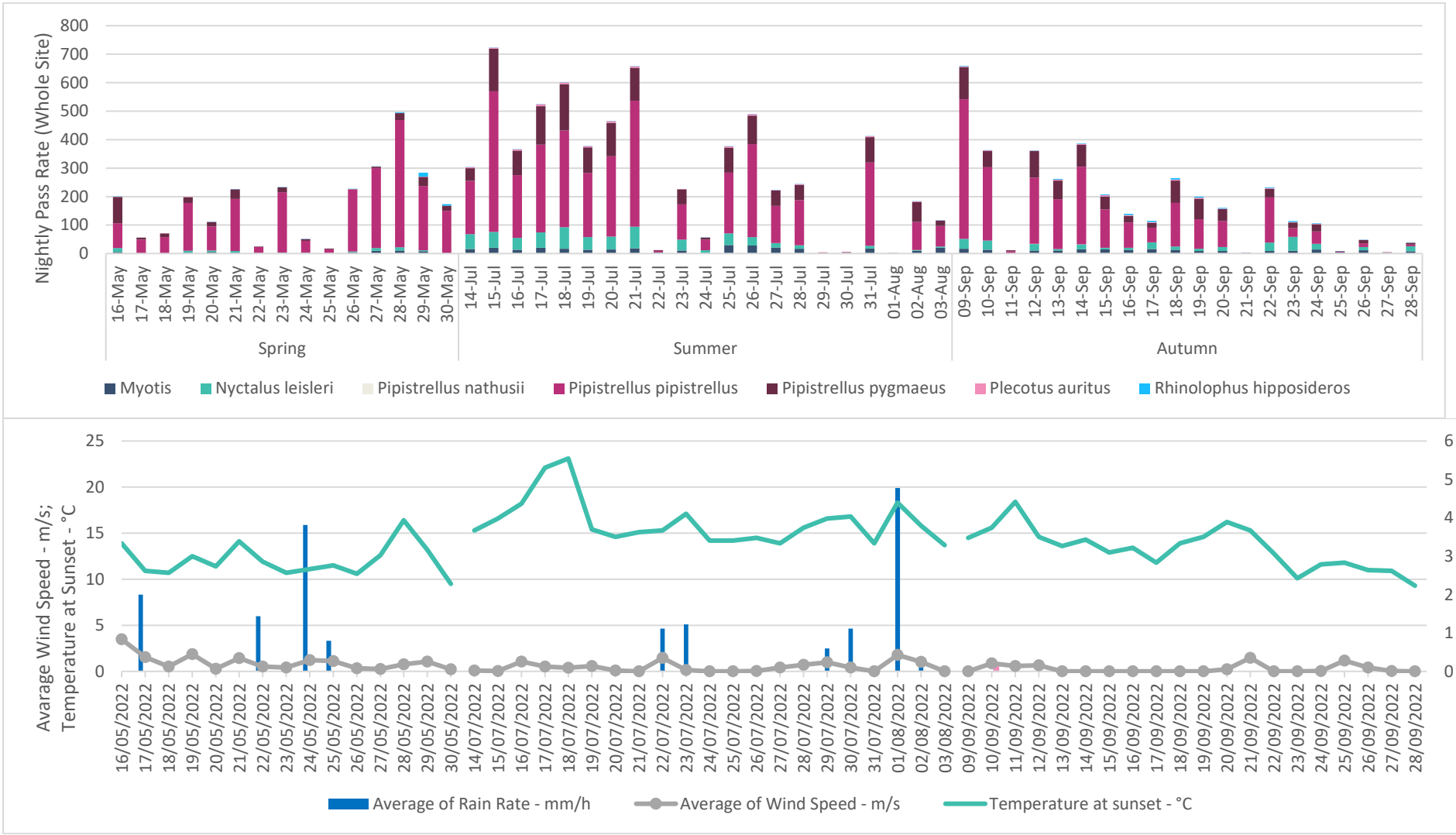

Plate 3-30 Nightly activity across the Site and Weather Conditions recorded.

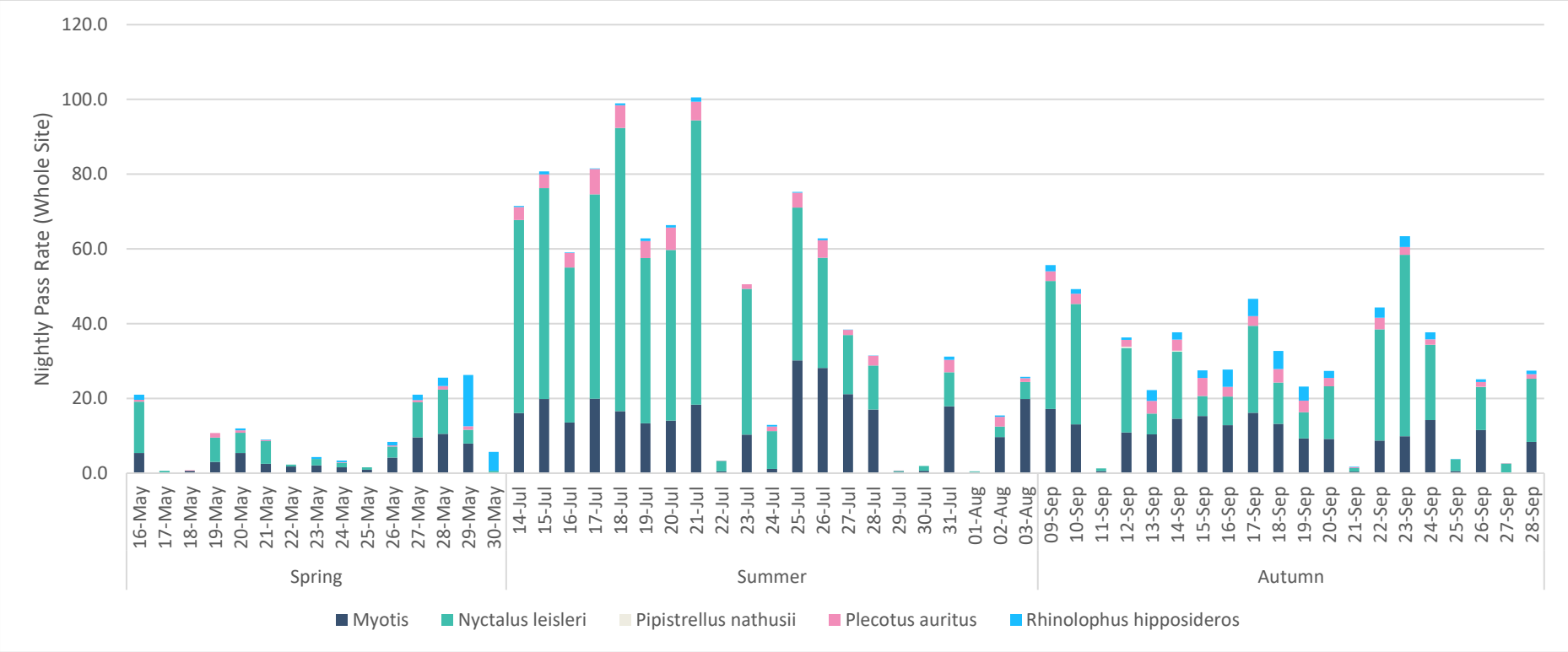

Plate 3-31 Nightly activity (median bat passes per hour) across the Site, without common and soprano pipistrelle.

Leisler's Bat

Leisler's bats were recorded regularly across the site, with passes recorded every night of the three seasonal deployments. Higher activity was recorded in Summer, in particular at detector D04, which recorded a median 6.7 passes per hour each night.

Lesser Horseshoe Bat

Lesser horseshoe bat passes were detected across the Site during static detector surveys, for a total amount of 1,098 bat passes in 2022.

The species occurred at almost all static detector locations across the site, but higher activity was recorded within the central and western areas of the site. Figure 3-6 shows the numbers of passes recorded at each detector across the three surveys seasons.

Lesser horseshoe activity was higher in Autumn, accounting for 66% of all Lesser horseshoe bat passes in 2022. In the autumn period of 2022, activity occurred at 9 out of 10 locations. Plate 3-32 illustrates activity pattern for this species across the different survey seasons, adjusted to bat passes per hour.

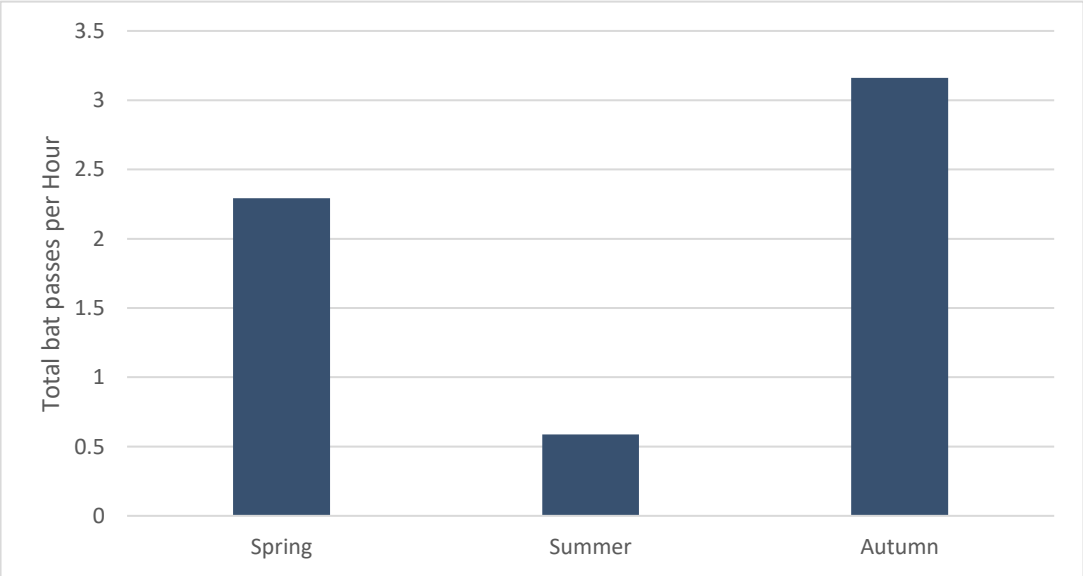

Plate 3-32 Lesser Horseshoe Total Bat Passes per Hour Across Different Survey Seasons.

Nathusius' Pipistrelle Bat

The Proposed Development Site is located outside this species' current known range (Article 17); however, a small number of passes were recorded across the Site in Autumn, at detectors D04 (n=1), D05 (n=6) and D08 (n=1).

Woodland Species

Myotis spp. and Brown long-eared bats are positively associated with woodlands and, while conifer plantations habitats like the ones present on Site might not provide ideal roosting habitat for these species, they provide suitable foraging grounds. Activity by these species was regularly occurring during each season, with less activity recorded in Spring than Summer and Autumn. Higher activity was particularly associated with the centre of the site, by D05 and D06.

Map Legend

- EIAR Site Boundary
- Static Detector Location
- Lesser Horseshoe Passes
- Special Area of Conservation (SAC)

SAC Designated Roosts and 2.5km Buffers

- Summer roost
- Winter roost

N

Drawing Title
Lesser horseshoe bat records (2022)

Project Title
Knockshanvo Wind Farm

Drawn By	Checked By
DC	SF
Project No.	Drawing No.
200513	Fig. 3-6
Scale	Date
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4. DISCUSSION

4.1 Assessment of Bat Activity Levels

The Proposed Development is predominantly a commercial conifer forestry site providing suitable commuting and foraging habitats for bats. While commercial forestry does not usually provide significant suitable habitat for bat species, habitats surrounding the Site provide high habitat diversity and features likely to attract bats to the forestry itself. The Site is considered of significance to bats as it was found to provide commuting corridors along forestry edges between more suitable surrounding habitats for a large number of species. Higher foraging activity was observed in more diverse habitats within the Site, in particular in proximity of detector D06, which is located in the vicinity of deciduous treelines and woodland. Some of the trees identified south of this area also have the potential to provide a roosting resource for tree dwelling bat species.

Details on activity assessment per detector are presented below. Table 4-1 show the results of the site-level assessment. Activity was assessed as Low, Medium or High based on the methodology described in section 2.2.5. The activity levels identified inform the impact assessment included in Chapter 6 of the EIAR, together with the results of the desktop study, habitat appraisal and roost assessment, and with consideration of 2021 survey results.

4.1.1 Adapted Site-specific Ranges

Low, Medium and High activity levels were assigned to median and maximum pass rates (bpph) identified during Spring, Summer and Autumn at the detectors deployed across the Site as adapted from Mathews *et al.* (2016). Where no median activity at a detector is reported, no data was recorded for that species throughout the deployment.

Leisler's bat

Leisler's bat activity was generally Low, with High activity peaks recorded in Summer at D04, D05, D06, D07 and D08, and at D04, D06 and D07 in Autumn. Leisler's bat are considered to be a species at high-risk of collision due to their higher altitude of flying, particularly at the height of wind turbine sweep areas. Ireland is considered a stronghold for the species, which is relatively rare in other areas of Europe: adaptive risk mitigation measures and monitoring at height is particularly important for this species. No monitoring at height was possible pre-construction due to lack of available infrastructure, but will be strongly recommended for post-construction monitoring, to confirm that low levels recorded in spring are due to lack of activity and not activity at height. A comparison of data collected at height vs. data collected at ground level will also allow for a better understanding of Site use by the species, which during transect surveys was primarily recorded commuting across the site.

Pipistrelle species

Common pipistrelle bat activity was generally High throughout the Proposed Development site. This species recorded High median activity in Spring at D07 and D09, in Summer at D03, D05, D06, D07 and D10 and, in Autumn at D05 and D06 D05. Soprano pipistrelle was recorded at High median activity levels only in Summer at D05 and D06. High peak activity levels were widespread in summer across the site. A small number of Nathusius' pipistrelle passes was recorded. While activity was very low within the site, this is outside the known range for the species and thus makes the local population particularly vulnerable.

These species are considered at high-risk of collision with wind turbines. Soprano and Common pipistrelles were observed commuting and foraging along forestry edges, with multiple bats occasionally

recorded at once. The few Nathusius' passes recorded did not include foraging behaviour, but they mostly occurred with other pipistrelle species and thus can be assumed to be using the Site in the same manner. A small Soprano pipistrelle roost was identified in a derelict stable within the Site approximately 260m south of turbine T06, and while no other suitable roosting structure was identified within the site, a number of *Moderate* or *High* potential trees were found to provide a suitable roosting resource for these species. The creation of buffers around turbines will be proposed to discourage commuting and foraging activity in close proximity of turbines, in addition to collision risk mitigations and adaptive monitoring.

Woodland Species

While relatively low in comparison to other species, on a site-specific level, *Myotis* spp. recorded High median activity in Summer at D05 and D06, with High maximum activity throughout the site. High peak activity levels were also recorded in Spring and Autumn, with the highest activity recorded at D06 in Autumn for these species.

Brown long-eared bat activity was generally Low but regular throughout the site. Relatively high activity levels for this species were recorded at D05 and D06 in Spring and Summer, and at D09 in Summer only.

Myotis spp. bats and brown long-eared bats are not considered to be at high risk of collision with wind turbines, as they tend to commute and forage at low altitudes in proximity of linear features and within woodland environments. The Site provides suitable foraging and commuting habitat but has little roosting potential, limited to the few broadleaved trees already mentioned above. Activity was higher in areas associated with woodland diversity. The creation of buffers which will be proposed around the turbines is thought to further limit potential for impact.

Lesser Horseshoe Bat

Activity levels for this species were generally Low across the survey period, with median activity levels reaching Medium numbers for this species only in Autumn, at detector D06. Highest activity levels, considered High for this species, were recorded at D04 in Spring. This detector, and detector D06, also recorded High peak activity levels in Autumn.

Spring and Autumn are transitional periods for bats, as individuals leave their hibernation sites and occupy transitional roost in preparation for the maternity season in Spring, and leave the maternity roosts, disperse and prepare for hibernation in Autumn. As there are records of a number of roosts, including transitional, maternity and hibernation roosts located to the north and west of the site, it is likely that this species utilises the conifer plantation as foraging and commuting grounds to and from these roosts and, likely, other unreported locations. No Lesser horseshoe bat roosts were identified within the Proposed Development Site. Higher numbers of passes were recorded along the central and western sections of the site, in line with the locations of known roosts outside of the Proposed Development Site, which have been presented in Figure 3-6.

Table 4-1 Assessment of Activity Levels. Low, Moderate, High

Species	Season	Bat activity (bpph)	D01	D02	D03	D04	D05	D06	D07	D08	D09*	D10
Myotis sp.	Spring	Median	0.00	0.13	0.00	0.00	0.00	2.09	0.79	0.00	0.13	0.00
		Maximum	1.05	2.08	5.64	1.83	7.24	12.76	5.28	0.26	1.19	0.13
	Summer	Median	1.44	0.39	0.36	1.14	3.88	3.75	2.76	0.37	0.77*	1.67
		Maximum	3.48	5.28	7.58	3.48	9.42	5.59	7.65	1.02	10.05	2.57
	Autumn	Median	0.81	0.25	0.09	2.20	1.91	1.73	2.15	0.74	0.72	0.91
		Maximum	2.23	1.14	0.44	5.23	6.39	28.10	6.15	1.75	1.91	2.24
Leisler's bat	Spring	Median	0.00	0.12	0.13	0.00	0.00	0.26	0.65	0.38	0.26	0.00
		Maximum	0.37	3.93	3.01	2.94	2.11	3.07	7.24	2.50	1.82	0.66
	Summer	Median	0.38	0.24	0.24	6.77	4.07	2.39	4.60	3.06	0.00*	1.36
		Maximum	7.37	4.01	7.76	26.43	19.28	43.70	22.25	12.07	3.43	5.56
	Autumn	Median	0.22	0.68	0.13	4.49	0.83	0.48	2.06	1.02	1.10	0.17
		Maximum	1.83	5.70	2.75	39.83	2.29	20.86	19.46	4.31	6.01	2.39
Nathusius' pipistrelle	Spring	Median	-	-	-	-	-	-	-	-	-	-
		Maximum	-	-	-	-	-	-	-	-	-	-
	Summer	Median	-	-	-	-	-	-	-	-	-	-
		Maximum	-	-	-	-	-	-	-	-	-	-
	Autumn	Median	-	-	-	0.00	0.00	-	-	0.00	-	-
		Maximum	-	-	-	0.09	0.36	-	-	0.08	-	-
Common pipistrelle	Spring	Median	0.13		0.66	7.80	0.00	8.11	48.27	5.88	31.33	4.56
		Maximum	16.38		76.05	134.26	15.92	58.95	159.00	29.75	134.99	52.11
	Summer	Median	2.93		17.91	9.75	21.65	63.32	36.72	6.57	0.00*	30.29
		Maximum	44.36	131.13	114.83	65.42	49.74	106.12	89.08	36.98	70.27	98.05
	Autumn	Median	0.69	10.60	1.34	15.67	21.97	39.90	6.31	0.18	7.15	13.23
		Maximum	12.57	88.35	62.39	96.49	117.80	128.67	38.99	3.71	107.75	83.39
Soprano pipistrelle	Spring	Median	0.00	0.12	0.00	0.26	0.00	0.39	5.12	0.00	1.93	0.00
		Maximum	0.13	11.36	0.26	18.49	7.11	20.39	92.27	1.01	8.19	0.13
	Summer	Median	0.40	0.36	0.40	6.45	23.11	20.62	12.90	1.28	0.00*	3.58
		Maximum	13.20	9.83	19.66	49.34	67.52	48.32	59.91	19.92	28.38	25.13
	Autumn	Median	0.13	0.44	0.09	3.70	14.68	8.26	2.71	0.22	4.63	3.03
		Maximum	5.32	2.52	0.73	31.28	55.35	27.09	11.82	1.83	24.35	28.29
Brown long-eared bat	Spring	Median	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00
		Maximum	0.13	0.49	0.39	0.25	0.66	2.77	0.25	0.13	0.38	0.13
	Summer	Median	0.26	0.13	0.24	0.24	0.53	0.67	0.13	0.12	0.00*	0.26
		Maximum	1.29	0.77	1.70	1.48	2.17	2.77	0.65	1.43	3.94	2.24
	Autumn	Median	0.08	0.21	0.00	0.38	0.45	0.22	0.36	0.25	0.39	0.13
		Maximum	0.35	0.71	0.43	0.97	1.42	0.79	0.93	0.92	1.93	0.76
Lesser horseshoe bat	Spring	Median	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00
		Maximum	0.53	0.86	0.53	11.23	0.26	2.64	0.49	0.00	0.00	0.40
	Summer	Median	0.00	0.00	0.00	0.12	0.00	0.17	0.00	0.00	0.00*	0.00
		Maximum	0.26	0.13	0.24	0.52	0.13	0.81	0.12	0.51	0.35	0.38
	Autumn	Median	0.00	0.47	0.00	0.41	0.08	0.52	0.00	0.00	0.13	0.25
		Maximum	0.18	1.67	0.78	3.30	0.62	5.80	0.36	0.00	0.43	1.16

4.2 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 1976-2022. 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 Site are utilized by a regularly occurring bat population of Local Importance.

The Proposed Development Site is located in proximity of two European Sites designated for the protection of Lesser horseshoe bats. This species has been recorded foraging and commuting across the site, with activity peaks considered high during transitional periods in Autumn and Spring. The populations associated with the designated roosts are likely to utilise the Site as it is within or in close proximity of their core foraging ranges (2.5km); therefore, the Lesser horseshoe population recorded on the Site has been assigned ***International Importance***.

A small Soprano pipistrelle bat roost has been identified within the Proposed Development Site. In addition, a number of structures with limited potential to host roosting bats and no evidence of use by bats have been identified, as well as a small number of trees thought to provide potential roost resources. None of these will be affected by the Proposed Development at construction or operational phase.

4.3 Limitations

A comprehensive suite of bat surveys were undertaken at the Proposed Development site. The surveys undertaken in 2022, in accordance with NatureScot and BCT Guidance, provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the Proposed Development on bats receptors.

Access limitations can relate to static deployments and roost inspections:

- No significant access issues were encountered with the Site during static deployments, as the detectors were deployment where intended.
- It was not possible to gain interior access to one potential roosting feature, the ESB building, however a thorough assessment of the exterior was carried out and did not identify bat signs or potential access into the structure. All other structures identified within the Site boundary were accessed.

Survey limitations can relate to survey coverage, data storage, equipment failure or deployment-related incidents:

- Good survey coverage of the Site has been achieved, with ten detectors being deployed in close proximity to turbine locations covering the range of habitats present at the site. Weather monitoring on Site was carried out for all seasonal deployments and no limitations related to weather were encountered.
- Spatial coverage of the large Site was obtained during the manual surveys, with the exception of the eastern section of the site. The static data was considered sufficient to cover this area. One roost emergence survey terminated 1 hour after sunset due to lack of visibility in the dark forestry environment. This is earlier than recommended by guidance. Bats were observed

emerging half an hour after sunset. There was limited potential for other crevice dwelling species to be present and the dark environment likely provided early emerging conditions. Lesser horseshoe bats are a late emerging species (~30 mins post-sunset) which had the potential to not be picked up emerging within the survey timeframe, however bats of this species roost visibly and would have been observed within the fully accessible shed prior to the survey commencing. No significant limitations were identified.

- MKO employs data storage redundancy methods to ensure no data is lost from the field to final analysis - no data was lost in Knockshanvo. However, SD card corruption can prevent data from being collected during deployments - SD corruption was reported for Detector D05 in Spring and D09 in Summer 2022. Detector D09 was re-deployed to make up for missing data and sufficient coverage was achieved for this location. Lack of data for detector D05 in Spring is not considered to provide a significant limitation, as the data collected provides a solid understanding of activity at this detector, with Summer and Autumn being fully compliant with Guidance.
- Bat detector's microphones are checked before every season to ensure they have good sensitivity for data collection, and detectors' software updates are installed as soon as they become available - no issues related to equipment were encountered during the surveys.
- Incidents during deployments, such as tampering or livestock interference, can prevent data from being collected effectively - no incidents were reported during the surveys.

Activity assessment limitations can relate to data analysis procedures and a lack of standardised and Ireland-based assessment methods:

- MKO's data analysis methods include manually checking of 100% of bat passes identified by Auto ID Software, as well as noise and no ID files. Where multiple species, or multiple individuals of the same species, are identified within the same call, only one is reported, prioritising hard to detect species. This is due to the large volumes of data collected. While this method is likely to introduce a bias, it is not believed to affect the overall conclusions of the assessment, as only commonly recorded species might be underreported.
- No activity threshold currently exists for Irish bat species to objectively assess bat activity within a certain habitat, and no standardised assessment method has been proposed across the country. Ecobat software recommended by existing guidelines was not available for use at the time of the assessment, as under maintenance. A site-specific method was used, based on literature (as described in section 2.2.5) and MKO experience surveying habitats similar to those present within the site.
- While the last bat surveys for the Proposed Wind Farm were carried out in 2022 and are therefore considered out of date according to existing guidance, the Site has been visited by MKO ecologists in 2023 and 2024, and no significant changes in the baseline environment were identified to justify repeated surveys.

No significant limitations in the scope, scale or context of the assessment have been identified.

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APPENDIX 1

BAT HABITAT SUITABILITY APPRAISAL

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)

Potential Suitability	Description	
	Roosting Habitats in Structures	**Potential Flight- Paths 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 conditions[a] 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 hibernation[b]). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.[c]	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 habitat. 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[a] 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	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.	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, treelined watercourses and grazed parkland. Site is close to and connected to known roosts.

a) For example, in terms of temperature, humidity, height above ground, light levels or levels of disturbance.
b) 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).
c) Categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

Updated guidelines for assessing the potential suitability of a site for bats, based on the presence of habitat features (taken from Collins, 2023)

Potential Suitability	Description	
	Roosting Habitats in Structures	**Potential Flight- Paths and Foraging Habitats**
None	No habitat features on site likely to be used by any roosting bats at any time of the year. (i.e. a complete absence of crevices/ suitable shelter at all ground/ underground levels).	No habitat features on site likely to be used by any commuting or foraging bats at any time of the year (i.e. no habitats that provide continuous lines of shade/protection for flight-lines or generate/shelter insect populations available to foraging bats).
Negligible[a]	Negligible habitat features on site likely to be used by roosting bats; however, a small element of uncertainty remains as bats can use small and apparently unsuitable features on occasion.	No obvious habitat features on site likely to be used as flight-paths or by foraging bats; however, a small element of uncertainty remains in order to account for non-standard bat behaviour.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically at any time of the year. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions[b] 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 and not a classic cool/stable hibernation site but could be used by individual hibernating bats[c].	Habitat that could be used by small numbers of bats as flight-paths such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. 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 with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions[b] and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only, such as maternity and hibernation - the categorisation described in this table is 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 flight-paths 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 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[b], and surrounding habitat. These structures have the potential to support high conservation status which is established after presence is confirmed.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by bats for flight-paths 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.

a) Negligible is defined as 'so small or unimportant as to be not worth considering, insignificant'. This category may be used where there are places that a bat could roost or forage (due to one attribute) but it is unlikely that they actually would (due to another attribute).

b) For example, in terms of temperature, humidity, height above ground level, light levels or levels of disturbance.

c) Evidence from the Netherlands shows mass swarming events of common pipistrelle bats in the autumn followed by mass hibernation in a diverse range of building types in urban environments (Korsten et al., 2016 and Jansen et al., 2022). Common pipistrelle swarming has been observed in the UK (Bell, 2022 and Tomlinson, 2020) and winter hibernation of numbers of this species has been detected at Seaton Delaval Hall in Northumberland (National Trust, 2018). This phenomenon requires some research in the UK, but ecologists should be aware of the potential for larger numbers of this species to be present during the autumn and winter in prominent buildings in the landscape, urban or otherwise.

BCT Protocol for categorising the suitability of trees for bats (Collins, 2023).

Assessment	Description
NONE	Either no PRFs in the tree or highly unlikely to be any
FAR	Further assessment required to establish if PRFs are present in the tree
PRF	A tree with at least one PRF present

BCT Guidance for categorising suitability of PRFs for bats (Collins, 2023).

Assessment	Description
PRF-I	PRF is only suitable for individual bats or very small numbers of bats either due to size or lack of suitable surrounding habitats.
PRF-M	PRF is suitable for multiple bats and may therefore be used by a maternity colony

APPENDIX 2

2021 RESULTS

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1. INTRODUCTION

Bat surveys undertaken in 2022 within the Site Boundary of proposed Knockshanvo Wind Farm, in accordance with NatureScot (2021) Guidance, form the core dataset for the assessment of effects on bats which will be provided in the EIAR.

This appendix provides supplementary data that was derived from bat activity surveys undertaken on the Site in 2021, which were designed in accordance with Scottish Natural Heritage Guidance (SNH, 2019).

The following surveys were undertaken in 2021:

- Bat Habitat Suitability Appraisal
- Roost Inspection Surveys
- Manual Transect Surveys
- Ground-level Static Surveys

The scope and results are provided in the sections below.

2. METHODOLOGY

2.1 Roost Surveys

A search for roosts was undertaken within 200m plus the rotor radius (i.e. max 90m) of the boundary 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 April, June and August 2021. A walkover was carried out and structures and trees were assessed for their potential to support roosting bats (see **Appendix 1** of the baseline report for criteria in assessing roosting habitats).

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

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

2.2 Manual Activity Surveys

Manual activity surveys comprised walked transects at dusk. A series of representative transect routes were selected throughout the proposed wind farm 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. Table 2-1 summarises survey effort in relation to walked transects. Transect routes are presented in Figure 2-1.

Transects were walked by two surveyors, recording bats in real time. Dusk surveys commenced 30 minutes before sunset and were completed for 3 hours after sunset. 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 2021.

Table 2-1 2021 Survey Effort - Manual Activity Surveys

Date	Surveyors	Sunset/ Sunrise	Type	Weather	Transect (km)
15th April 2021	Cathal Bergin and Tim Murphy	20:29	Dusk	7-9°C, dry, calm. No cloud cover	5.8
14th June 2021	Laura McEntegart and Tim Murphy	22:00	Dusk	8-13°C, dry, calm. Little cloud cover	11.5
25th August 2021	Cathal Bergin and Laura McEntegart	20:05	Dusk	20-22°C, dry, calm. Little cloud cover	5.8
Total 2021 Survey Effort					**23.1km**

2.3 Ground-level Static Surveys

Where developments have more than 10 turbines, SNH (2019) requires 1 detector per turbine up to 10 plus a third of additional turbines. Given that 16 turbines were initially proposed 12 detectors were deployed to ensure compliance with SNH guidance. Detectors were numbered utilising an initial indicative layout that included 16 turbines. The extent of the Proposed Development changed through the design process, and the number of turbines reduced to 9. The detector locations achieved a good spatial spread in relation to the proposed turbines and sampled the range of available habitats.

Automated bat detectors were deployed at 12 no. locations for at least 10 nights in 2021 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 differed slightly between season to adapt to changing layouts. One full spectrum detector was also deployed west of the site to further assess activity along potential commuting routes during summer and autumn. No proposed turbines were located in its vicinity.

Figure 2-1 presents 2021 static detector locations. Static detector locations are described in Table 2-2.

Table 2-2 2021 Ground-level Static Detector Locations

ID	Location (ITM)	Habitat	Linear Feature within 50m
D01	553047 669509	Edge of pine and rough scrub	Stone wall, Scattered trees
D02	554205 669258	Edge of mature conifer	Stone wall, Scattered trees
D03 Spring	554380 669764	Young mixed tree plantation	Stone wall
D03 Summer and Autumn	554232 670013	Young mixed tree plantation	n/a
D04 Spring	553834 669683	Felled forestry	n/a
D04 Summer and Autumn	552033 669337	Edge of conifer and felled trees	Stone wall
D05	553319 670439	Edge of birch plantation and thorn bush	Stone wall, Scattered trees
D06	555840 669438	Edge of mature conifer	Stone wall, Scattered trees
D07	555844 670149	Edge of mature conifer	Stone wall, Scattered trees/hedgerow
D08	556890 669306	Edge of mature conifer	Stone wall, Scrub
D09	556890 669306	Edge of mature conifer	Stone wall, Scattered trees
D10	557054 669040	Edge of mature conifer	Stone wall, Scattered trees
D11	559044 669570	Edge of mature conifer and cut plantation	Scrub
D12	558097 669565	Area between two conifer strands	Stone wall, Scattered trees/hedgerow
D13 Summer & Autumn	551475 669014	Edge of mature conifer	Edge of mature conifer

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

Onsite weather monitoring was undertaken concurrently with static detector deployments. One Vantage Pro 2 (Davis Instruments, CA, UCS) was deployed each season and night-time hourly data was tracked remotely to ensure a sufficient number of nights (i.e., minimum 10 no.) with appropriate weather conditions were captured (i.e., dusk temperatures above 8˚C, wind speeds less than 5m/s and no or only very light rainfall). Table 2-3 summarises survey effort achieved in 2021 for each of the 12 no. detector locations.

Table 2-3 Survey Effort - Ground-level Static Surveys 2021

Season	Survey Period	Total Survey Nights per Detector Location	Nights with Appropriate Weather
Spring	15th April 2021 – 4th May 2021	19	12
Summer	14th June – 28th June 2021	14	12
Autumn*	25th August – 8th September 2021	14	10
Total Survey Effort		**47**	**34**

*2021 Autumn D04 and D08 were redeployed due to having full SD cards. D06 was redeployed from 8th September – 13th September due to a technical failure.

2.3.1 Bat Call Analysis

All recordings from 2021 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 Wind Farm Site. Bat species were identified using established call parameters, to create site-specific custom classifiers. All identified calls were also manually verified.

Map Legend

- EIAR Site Boundary
- Spring Detector Locations 2021
- Summer Detector Locations 2021

2021 Transect Routes

- Autumn 2021 Transect
- Summer 2021 Transect
- Spring 2021 Transect

N

Drawing Title	2021 Survey Effort
Project Title	Knockshanvo WF
Drawn By: DC	Checked By: SF
Project No.: 200513	Drawing No.: 2-1
Scale: 1:40,000	Date: 19.08.2024

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3. RESULTS

3.1 Roost Surveys

Following the search for roosts in 2021, no structures containing potential suitable bat roost features were identified within 200m plus the rotor radius (i.e max 90m) of the Proposed Development footprint. Four structures were identified within the wider site. These included a corrugated iron shed with nearby small stone outbuilding, an ESB building and an overgrown shelter.

The structures were subject to detailed internal (where possible) and external inspections by a licensed ecologist on the 14th and 21st of June 2021. Trees within the site were also assessed for roosting potential. Further details of the structures and trees are presented within the baseline report.

3.2 Manual Transects

Manual transects were undertaken in Spring, Summer and Autumn 2021. Bat activity was recorded on all surveys. In general, Common pipistrelle (n=345) was recorded most frequently, followed by Soprano pipistrelle (n=63) and Leisler's bat (n=11). Instances of *Myotis spp.* (n=5), and lesser horseshoe bat (n=2) were less frequent. However, species composition and activity levels varied significantly between surveys. Species composition across all manual surveys is presented in Plate 3-1.

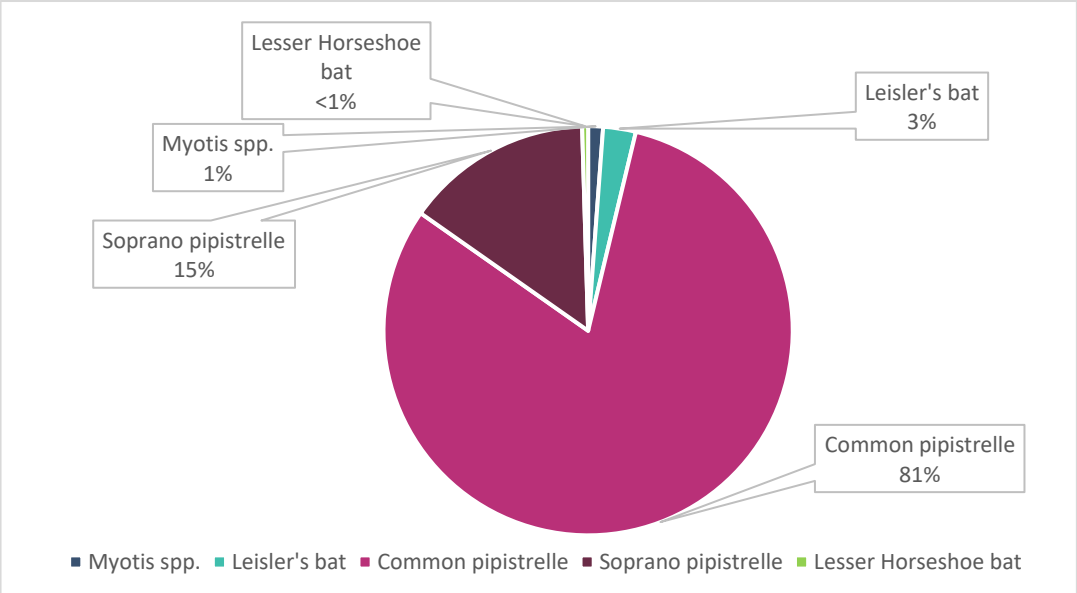

Plate 3-1 2021 Species Composition for Manual Transects, Spring, Summer, Autumn

Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort). Plate 3-2 presents results for individual species per survey period. Figures 3-1 – 3-3 present the spatial distribution of bat activity across the surveys. Two Lesser horseshoe bat passes were recorded in Spring in proximity of detector D08, which was located near an area of mixed woodland and deciduous treelines. The passes were recorded approximately 2 hours after sunset.

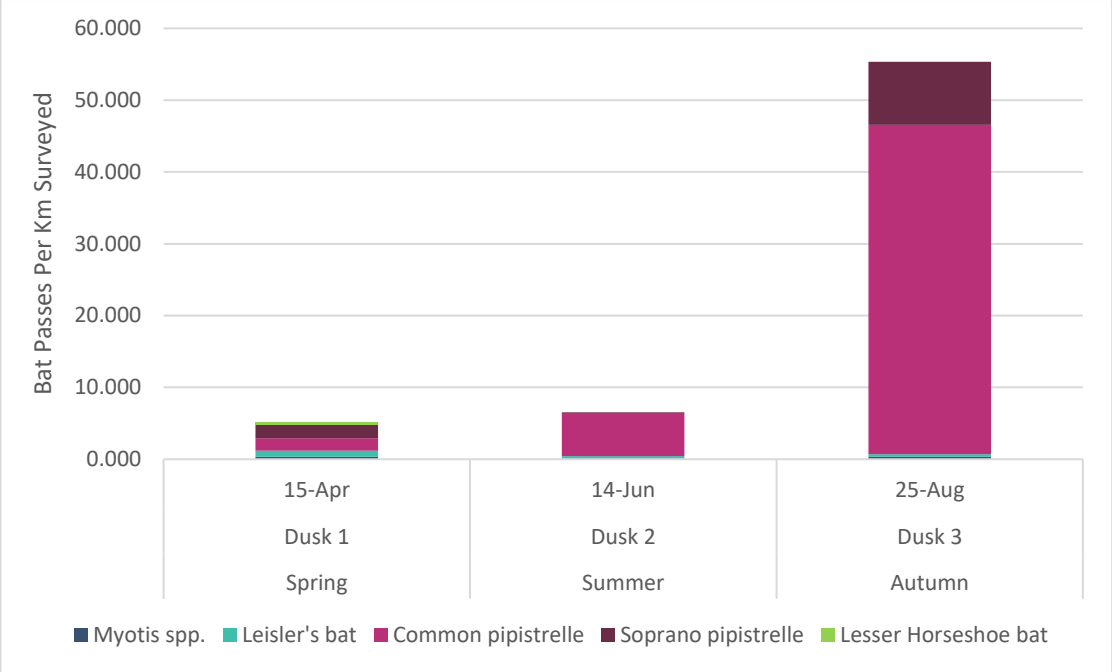

Plate 3-2 2021 Transect Results - Species Composition Per Survey Period

Map Legend

- EIAR Site Boundary
- Spring Detector Locations 2021
- Spring Transect

Bat Species

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

N

Drawing Title	Spring Manual Results
Project Title	Knockshanvo WF
Drawn By: DC	Checked By: SF
Project No.: 200513	Drawing No.: 3-1
Scale: 1:20,000	Date: 19.08.2024

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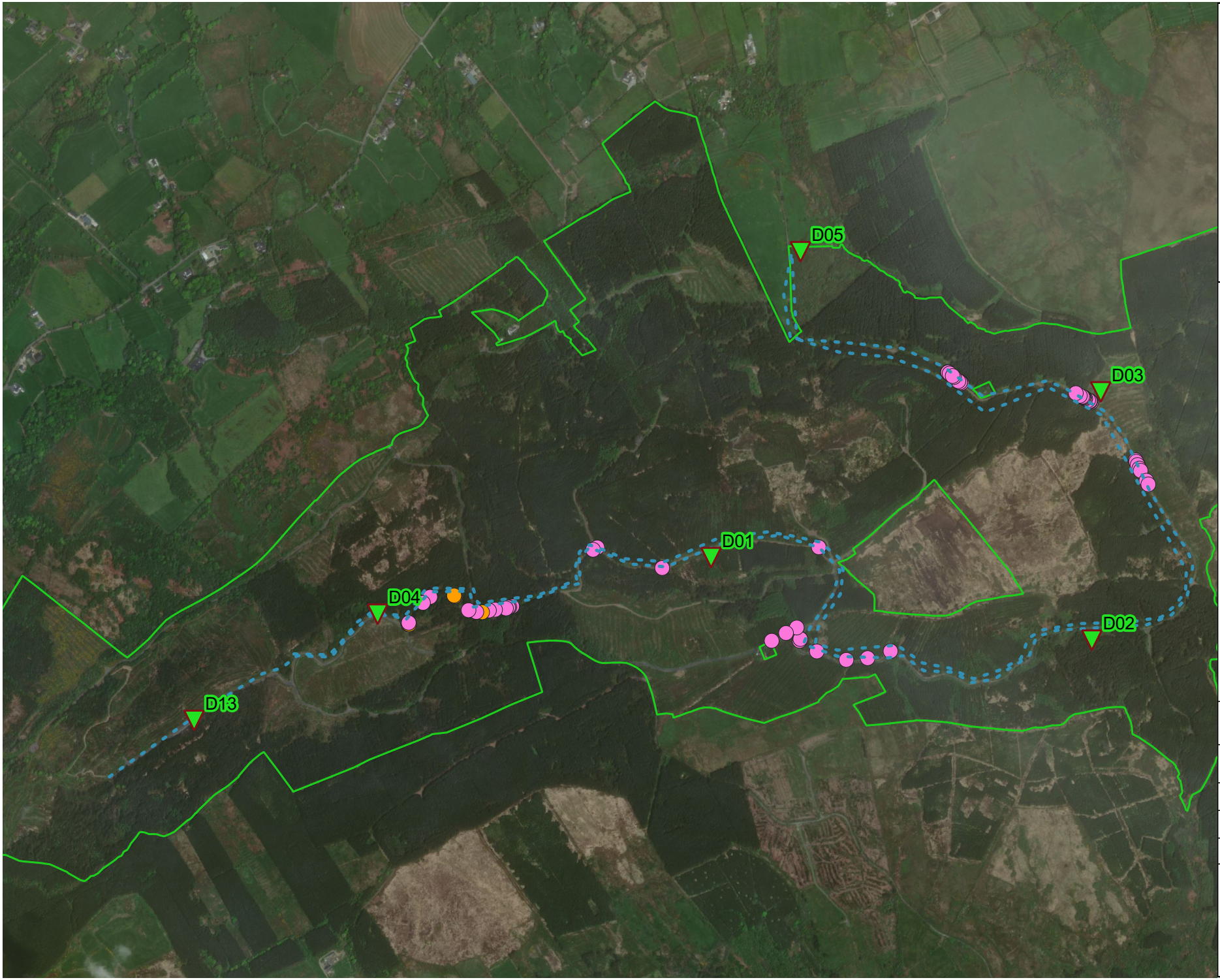

Map Legend

- EIAR Site Boundary
- Summer Detector Locations 2021
- Summer Transect

Bat Species

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title	Summer Manual Results
Project Title	Knockshanvo WF
Drawn By: DC	Checked By: SF
Project No.: 200513	Drawing No.: 3-2
Scale: 1:15,000	Date: 19.08.2024

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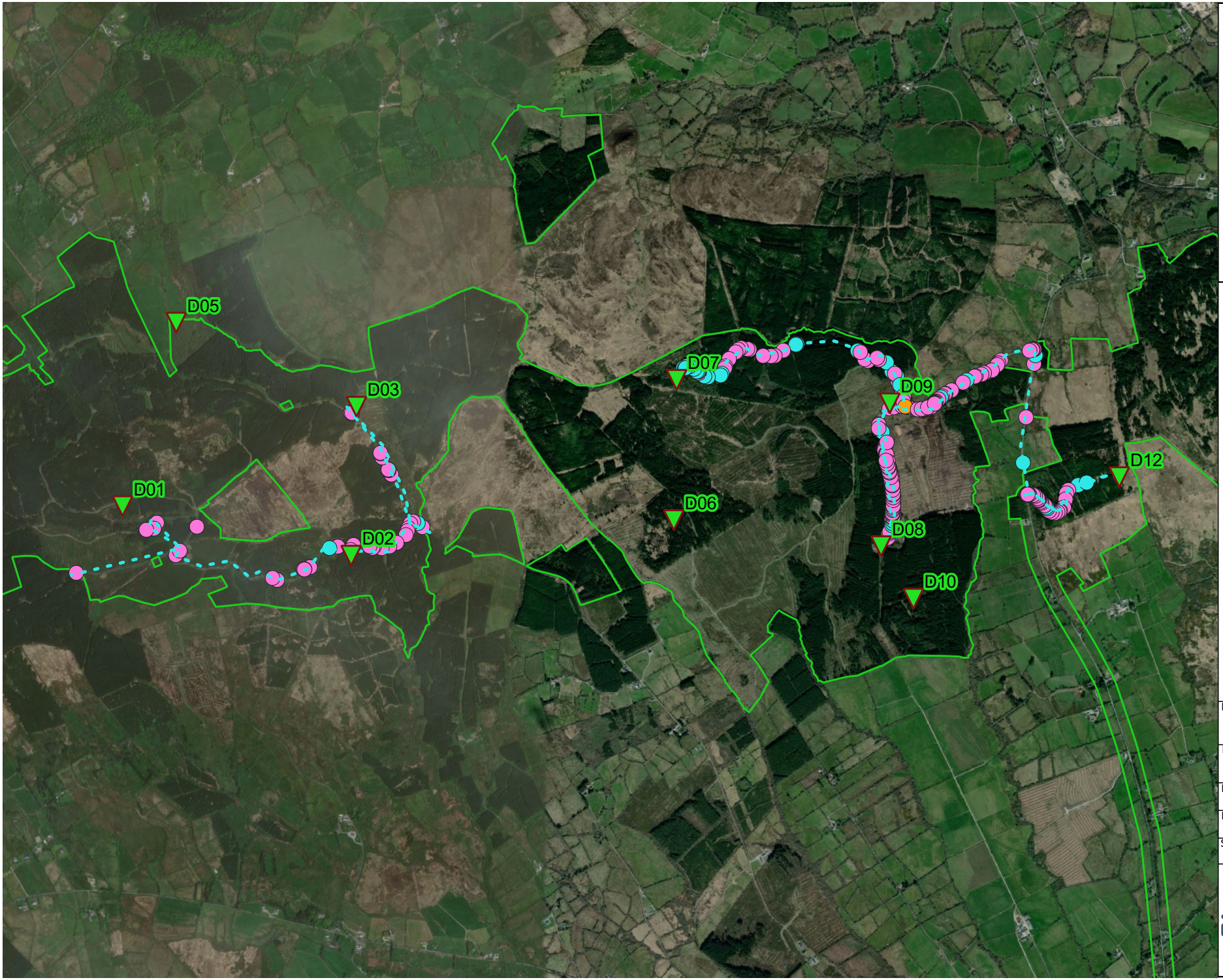

Map Legend

- EIAR Site Boundary
- Autumn Detector Locations 2021
- Autumn Transect

Bat Species

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title	Autumn Manual Results
Project Title	Knockshanvo WF
Drawn By: DC	Checked By: SF
Project No.: 200513	Drawing No.: 3-3
Scale: 1:25,000	Date: 19.08.2024

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3.3 Ground-level Static Surveys

In total, 131,171 bat passes were recorded across all deployments. In general, common pipistrelle (n=97,324) occurred most frequently, followed by soprano pipistrelle (n=21,333). Leisler's bat (n=5,644) and *Myotis sp.* (n=5,331) were recorded less frequently. Instances of brown long-eared bat (n=1,194) and lesser horseshoe bat (n=314) were significantly less. Nathusius' pipistrelle (n=1) was rare. Plate 3-3 presents relative species composition across all ground-level static detector surveys.

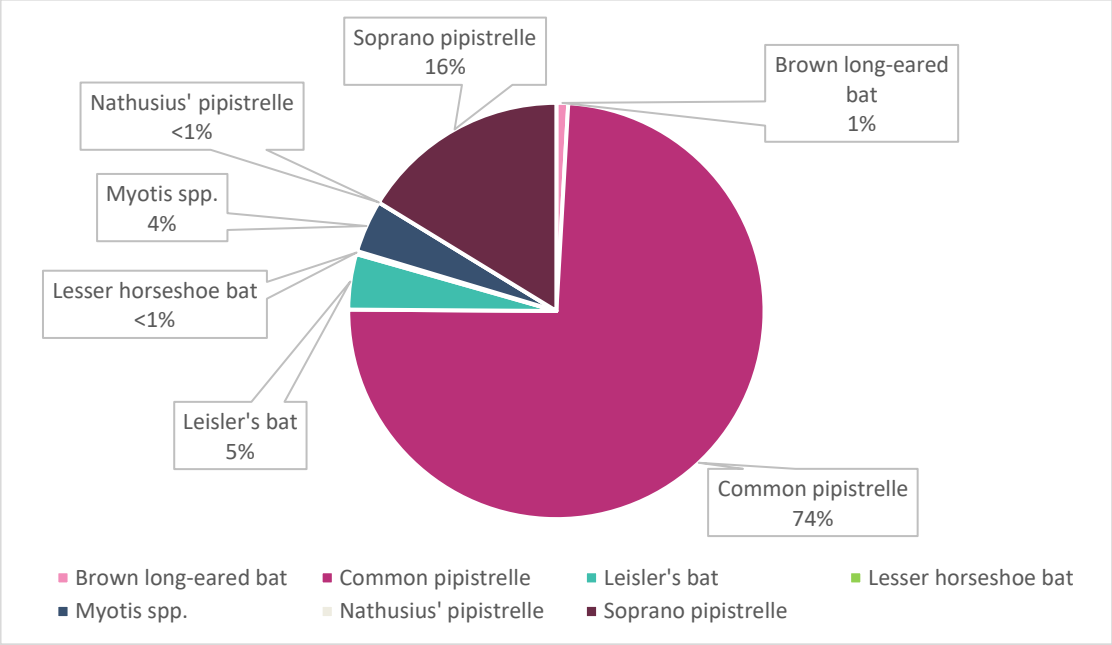

Plate 3-3 2021 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes)

Bat activity was calculated as total bat passes per hour (bpph) per season to account for any bias in survey effort, resulting from varying night lengths between seasons. Plate 3-4 and Table 3-1 present these results for each species. Bat activity was dominated by common pipistrelle in Spring, Summer and Autumn with Summer and Autumn levels for this species significantly higher than all other species. Soprano pipistrelle activity in Autumn was also higher than all other species but lower than common pipistrelle. Leisler's bat activity dropped off in Autumn while all other species increased during the Autumn season. Instances of *Myotis sp.* were less frequent with most activity recorded in Summer. Nathusius' pipistrelle was rare with only one pass recorded in Autumn.

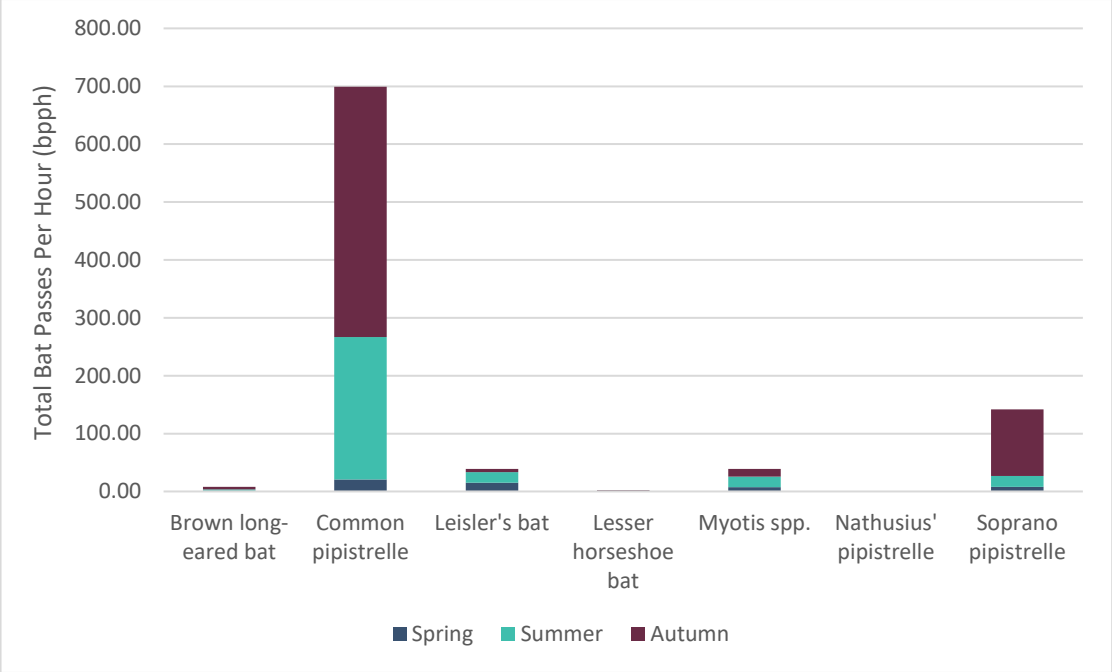

Plate 3-4 2021 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

Table 3-1 2021 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

	Spring	Summer	Autumn
Total Survey Hours	**189.2**	**106.8**	**155.2**
Brown long-eared bat	1.22	2.21	4.68
Common pipistrelle	20.95	245.54	432.58
Leisler's bat	15.14	18.53	5.16
Lesser horseshoe bat	0.38	0.81	1.01
Myotis spp.	7.24	18.25	13.16
Nathusius' pipistrelle	0.00	0.00	0.01
Soprano pipistrelle	7.79	18.88	114.97

Analysis of the detector recordings also highlighted the total bat passes per detector. Species composition per detector is shown in Plate 3-5. Activity varied across each deployment with typically higher activity occurring in Summer and Autumn. Activity in Autumn at most detector locations was significantly higher than other seasons. Detector D06 in Autumn was redeployed due to a technical failure and recorded data for a total 5 nights. D04 and D08 in Autumn were also redeployed due to having full SD cards. The below graph demonstrates that while common and soprano pipistrelle species were the most commonly recorded species across the site, species composition varied between detector locations and across seasons. The westernmost detector, D13, recorded the majority of Lesser Horseshoe bat passes.

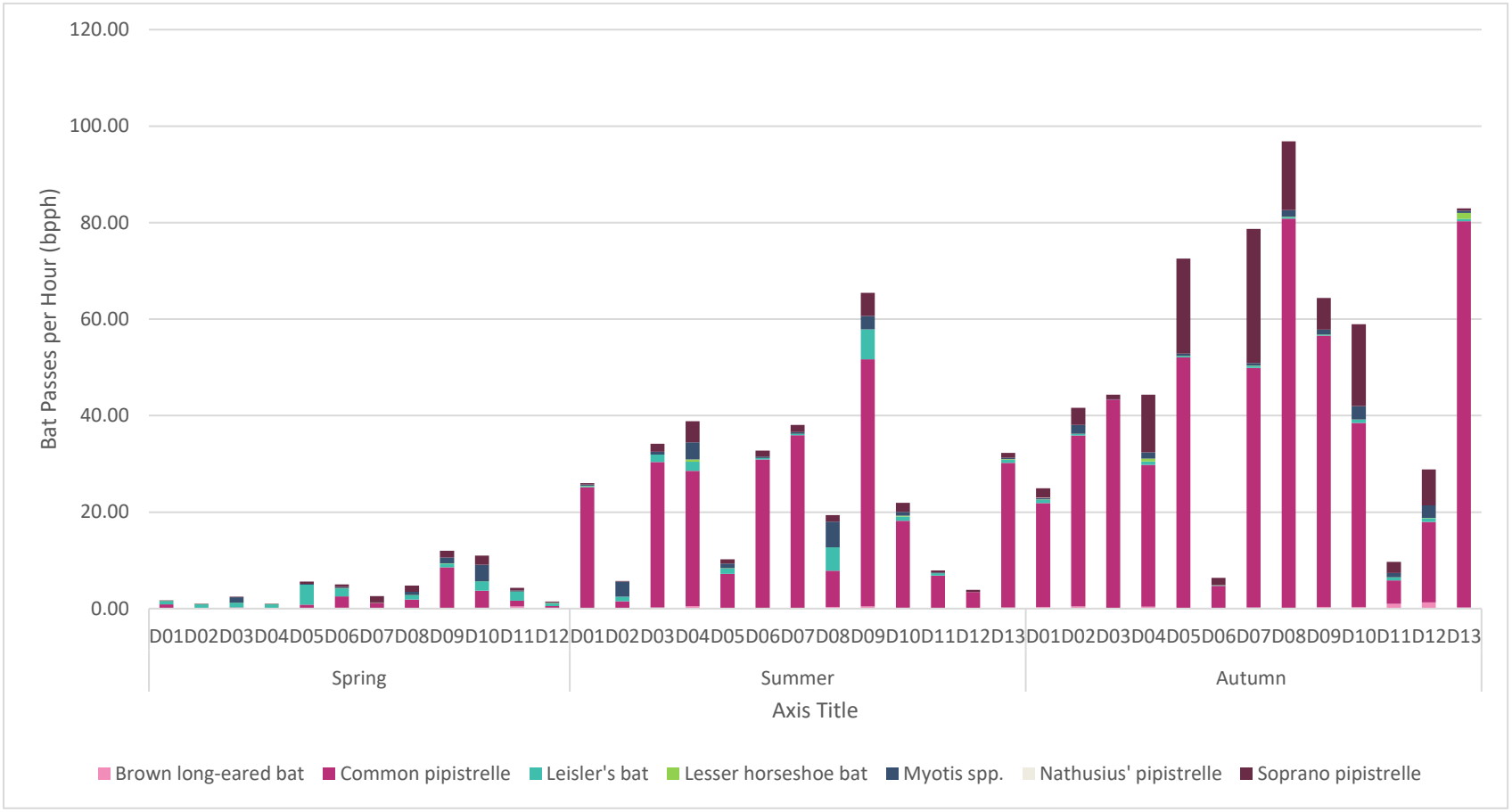

Plate 3-5 2021 Static Detector Surveys: Total Bat Passes per Hour (bpph), per Detector, per Season

4. OVERALL SUMMARY OF RESULTS

Bat surveys in 2021 were designed in accordance with survey standards for medium risk sites, in accordance with the SNH guidelines for wind turbine developments (SNH, 2019). Surveys took place between April and October 2021, and included a desktop study, habitat and landscape assessments, roost inspections, manual activity surveys and static detector surveys at ground level.

The Site is largely suitable for foraging and commuting bats, with a network of linear features present which provide connectivity with the wider landscape. The Site is comprised predominantly of commercial coniferous forestry. The majority of trees within the Site were assessed as not providing suitable roosting habitat for bats due to the lack of PRFs, size or age to contain potential roost features. However, areas of mature deciduous trees contain features of roosting potential.

Four structures identified within the Site were subject to roost assessments. No roosts were identified during the surveys carried out in 2021; however, the site does present a number of potential roost features. It is not intended that any structures will be impacted by the Proposed Development. Further details on bat habitat appraisal and potential roost features can be found in the main baseline report.

Static detector surveys identified similar species compositions across the Site with varied levels of activity between detectors. Pipistrelle bats comprised the vast majority of activity recorded, with common pipistrelles being the most recorded species at all detectors. Leisler's activity peaked in Spring and activity levels were lower in Summer and Autumn. All other species recorded higher activity levels in Summer and Autumn.

The 2021 survey results provide supplementary data to the core 2022 surveys. These surveys will be used to inform the impact assessment of the proposed Knockshanvo Wind Farm and to provide appropriate mitigations for the protection of bats.